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In the Supreme Court of the United States

OCTOBER TERM, 1929

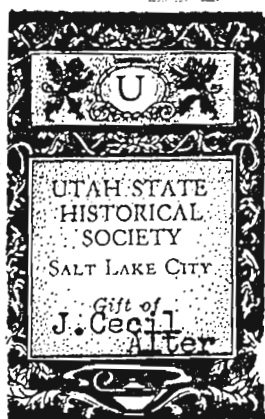
THE UNITED STATES OF AMERICA, PLAINTIFF

v.

THE STATE OF UTAH, DEFENDANT

BRIEF FOR THE UNITED STATES

BEFORE HON. CHARLES WARREN, SPECIAL MASTER



UTAH STATE ARCHIVES

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In the Supreme Court of the United States

OCTOBER TERM, 1929

No. 15, ORIGINAL

THE UNITED STATES OF AMERICA, PLAINTIFF

v.

THE STATE OF UTAH, DEFENDANT

BRIEF FOR THE UNITED STATES

I

STATEMENT

This suit was commenced on the 9th day of April, 1928, by the filing of the bill of complaint, by leave of court, in the Supreme Court of the United States. After due issuance and service of process, the defendant, the State of Utah, filed its answer to the bill of complaint on the 10th day of October, 1928.

The purpose of this suit is to quiet the title of the United States to certain portions of the river beds of the Green, Colorado, and San Juan rivers within the State of Utah, as follows:

Green River, from a point where the river crosses the township line between townships 23 and

24, S., R. 17 East (approximately the mouth of the San Rafael), to its confluence with the Colorado River), 95 miles.

Colorado River, from the mouth of Castle Creek to the Utah-Arizona boundary line, 296 miles.

San Juan River, from the mouth of Chinle Creek to its confluence with the Colorado River, 133 miles.

The United States is the riparian owner of all the lands (except those which have been disposed of which are shown on said Exhibit A attached to the bill of complaint), and its claim to the river beds is based upon that ownership. The ownership of the United States of the beds of these rivers depends on whether or not the rivers are navigable in Utah. The State asserts title to the river beds on the theory that the rivers are navigable. The United States asserts the rivers are not navigable. The evidence, both oral and documentary, is voluminous, and such evidence as is pertinent to a decision of the law and facts will be set forth in the different subheads of the brief. No question of the navigability of the rivers outside of Utah is involved in this case.

II

THE PLEADINGS

The bill of complaint

The Bill of Complaint alleges that the United States acquired by the Treaty of Guadalupe Hidalgo (9 Stat. 922) all of the river beds and riparian lands in the State of Utah; that the United States is now seized in fee of the riparian lands, more par-

ticularly described in subdivision 2 of the Bill, on the sections of the San Juan, Green, and Colorado Rivers set forth in the bill; that the lands have not been surveyed but the beds of the rivers are plainly traceable by the water marks; that said rivers throughout their courses travel a barren, desolate, broken country; except at a few isolated places the riparian lands are so high above the canyon streams as to preclude access to man or beast to the streams; that the region is uninhabited and substantially uninhabitable; that the region has not produced and does not produce commodities for water transportation; that the country is not susceptible of sustaining a population served by water; that the rivers carry large quantities of silt and sand; that the volume of water is variable; the flow rapid; the channels filled with fixed and shifting boulders producing rapids; the channels filled with shifting sand and gravel bars; that sand waves are found on the San Juan; that the Colorado, Green, and San Juan Rivers in Utah are not and have never been navigable in fact; that neither trade nor travel can move over the portions of the rivers in Utah, in their natural conditions; that they are not used and have not been used as permanent highways of useful commerce within the State, between States, or with any foreign State; that the Green River enters the State through a rock-walled, practically inaccessible mountain gorge; that the Colorado enters the State through an open canyon and passes

from Utah into Arizona through a vertical, practically inaccessible canyon; that because of the conditions use of the rivers as highways of commerce either intrastate or interstate is impracticable; that deposits of minerals exist under the river beds and the riparian lands; that the United States has granted permits to drill on said river beds and the riparian lands for oil and gas; that the permittees have entered into possession thereof under said permits and have spent large sums of money in exploring for oil and gas; that Utah claims an interest in said river beds adverse to that of the United States and asserts ownership thereto; that through its Board of Land Commissioners, without authority from the United States, is executing and delivering leases to said river beds granting to the lessees the right to drill for oil and gas in and under said river beds; that Utah's actions constitute a cloud upon the title of the United States; that the United States has no plain, speedy, and adequate remedy at law; that unless its title is quieted the United States will suffer irreparable damage.

The bill prays (a) that Utah answer the bill of complaint and set up its title; (b) that the title of the United States be quieted in the United States; (c) that the full and exclusive fee simple title in and to the riparian and river bed lands and the minerals thereunder, except those shown in Exhibit A attached to the bill, be adjudged vested in the United States; (d) that the State of Utah be en-

joined from asserting any estate, right, title, or interest in said river beds and the minerals thereunder adverse to the United States and be enjoined from in any manner disturbing or interfering with the possession, use, and enjoyment thereof by the United States; (e) for further relief to which the United States may be entitled.

Answer

The answer admits the source of the title under which the United States claims; admits United States owns lands riparian to the rivers but denies knowledge of the precise amount; admits lands are unsurveyed and that the beds of the rivers are marked plainly on the sides thereof; denies the United States is the owner, or has been since the admission of Utah as a State, of the beds of the Colorado, Green, and San Juan Rivers; admits lands traversed by rivers are arid, barren, desolate, and broken and high above the streams and that certain areas do not produce nor have produced commodities which are transported on water; denies that the streams are inaccessible to man or beast so as to make said regions uninhabitable or to make impractical or impossible the sustaining a population served by water; alleges that vast areas along said streams are susceptible to the production of crops and other uses; alleges that the character or conditions of the lands traversed by the streams in no manner affects or destroys their navigability within the State of Utah; denies that the course of

said streams is tortuous; denies the rivers are laden with sand and silt; denies the flow is variable in depth or volume or that the channels are beset with fixed or shifting boulders or with rapids or cataracts; admits that at widely separated points boulders are present and rapids exist; that sand and silt are at times present and that there are at times sand bars which shift to some degree as a result of floods, current, and gradient, but denies that these conditions or any other destroy the navigability of the rivers in Utah; alleges that said streams now and always have been navigable in the State of Utah; denies that the floods or any other characteristics affect the navigability of the San Juan; admits the existence of deposits of oil and gas in the lands under the river beds, but denies ownership therein by the United States since Utah became a State; admits United States has executed and delivered numerous prospecting permits to the river beds purporting to grant the right to explore for oil and gas but denies that under the terms of said permits, the permittees were granted such right; that said permits expressly provide that valid rights existing at the date thereof should not be affected; admits that permittees are in possession and have drilled at various points but denies any drilling in the river beds and alleges that if such possession has been assumed it is unlawful; admits State publicly asserts title to river beds;

asserts ownership since statehood; denies title of United States and asserts navigability of the rivers.

Admits granting of oil leases by the State to the river beds and asserts the right to do so as the owner thereof in fee simple; denies the United States will suffer injury if refused the relief prayed, because United States has no title to the river beds; alleges that Utah was admitted to the Union January 14, 1896, on an equal footing with the original States and upon admission became the owner of the beds of the Green, Colorado, and San Juan Rivers; that said rivers are navigable throughout the State of Utah and are well adapted for carrying freight and passengers in boats and other water craft; that at and prior to Utah becoming a State said rivers were susceptible to navigation and had been actually navigated frequently and regularly by boats carrying freight and passengers; the answer prays for a dismissal of the bill and for further relief.

III

SOURCE OF THE TITLE OF THE UNITED STATES

The territory, now comprising the States of Utah, Arizona, and New Mexico, was acquired from Mexico at the conclusion of the war with Mexico. See the following treaties:

Guadalupe Hidalgo, February 2d, 1848 (9 Stat. 922).

Gadsden Purchase, December 30th, 1853 (10 Stat. 1031).

Article 5 of the Treaty of 1848 recognizes the navigability of the Colorado River below its confluence with the Gila River. This article was modified by Article 4 of the Treaty of 1853, but the article as modified in no way contributes to the solution of the problem of navigation above the Gila River.

IV

ON THE QUESTION OF NAVIGABILITY, THE FEDERAL LAW IS CONTROLLING

The question of navigability of the rivers must be determined in this case under the Federal rule, as announced by the Supreme Court of the United States. It is quite apparent that the application of any other rule would result in a lack of uniformity of construction.

In *United States v. Holt State Bank*, 270 U. S. 49, at pages 55 and 56, it was said:

Both courts below found that the lake was navigable. But they treated the question of navigability as one of local law to be determined by applying the rule adopted in Minnesota. We think they applied a wrong standard. Navigability, when asserted as the basis of a right arising under the Constitution of the United States, is necessarily a question of federal law to be determined according to the general rule recognized and applied in the federal courts. *Brewer-Elliott Oil & Gas Co. v. United States*, *supra*, p. 87. To treat the question as turning on

the varying local rules would give the Constitution a diversified operation where uniformity was intended. But notwithstanding the error below in accepting a wrong standard of navigability, the findings must stand if the record shows that according to the right standard the lake was navigable.

The same result is reached in the case of *Economy Light Co. v. United States*, 256 U. S., 113, where a decision of the Supreme Court of Illinois determining a stream nonnavigable was rejected. The Federal rule was applied.

In *Brewer-Elliott Oil Co. v. United States*, 260 U. S. 77, it was said, at page 87:

But it is said that the navigability of the Arkansas River is a local question to be settled by the legislature and the courts of Oklahoma, and that the Supreme Court of the State has held that at the very point here in dispute, the river is navigable. *State v. Nolegs*, 40 Okla., 479. A similar argument was made for the same purpose in *Oklahoma v. Texas*, *supra*, based on a decision by the Supreme Court of Oklahoma as to the Red River. *Hale v. Record*, 44 Okla. 803. The controlling effect of the state court decision was there denied because the United States had not been there, as it was not here, a party to the case in the state court. *Economy Light & Power Co. v. United States*, 256 U. S., 113, 123. In such a case as this the navigability of the stream is not a local question for the state tribunals to settle.

THE TITLE TO THE RIVER BEDS IS DETERMINED AS OF
THE DATE OF STATEHOOD

The State of Utah was admitted into the Union on January 4, 1896 (29 Stat. 876). In conformity with the constitutional principle of equality under which new states are admitted to the Union, the title to the beds of the Colorado, Green, and San Juan rivers within the State passed to the State, if the rivers were navigable, as of that date, provided the beds had not already been disposed of by the United States. If the rivers were not then navigable, the title to the beds remains in the United States.

United States v. Holt State Bank, 270 U. S. 49.

Goodtitle v. Kibbe, 9 How. 470.

Pollard v. Hagan, 3 How. 212.

It was said in the case of *United States v. Holt State Bank*, supra, at page 55:

The State of Minnesota was admitted into the Union in 1858, c. 31, 11 Stat. 235, and under the constitutional principle of equality among the several States the title to the bed of Mud Lake then passed to the State, if the lake was navigable, and if the bed had not already been disposed of by the United States.

In *Oklahoma v. Texas*, 258 U. S. 574, 583, it was stated, at page 583:

Oklahoma claims complete ownership of the entire bed of the river within that State, and in support of its claim contends that the river throughout its course in the State is navigable, and therefore that on the admission of the State into the Union, on November 16, 1907, the title to the river bed passed from the United States to the State in virtue of the constitutional rule of equality among the States whereby each new State becomes, as was each of the original States, the owner of the soil underlying the navigable waters within its borders. If that section of the river be navigable, its bed undoubtedly became the property of the State under that rule. Those who oppose the State's claim recognize that this is so; and the State concedes that its claim is not tenable, if that section of the river be not navigable. So the real question in this connection is whether the river is navigable in Oklahoma.

And in *Brewer-Elliott Oil Company v. United States*, 260 U. S. 77, it was said, at page 88:

It is not for a State by courts or legislature, in dealing with the general subject of beds of streams, to adopt a retroactive rule for determining navigability which would destroy a title already accrued under federal law and grant or would enlarge what actually passed to the State, at the time of her admission, under the constitutional rule of equality here invoked.

The title of the United States to the beds of the rivers and the title of the State of Utah must be determined as of the date of statehood. In this case there had been a complete exploration and scientific examination of the rivers prior to statehood, and the effect of that evidence will be discussed later in this brief. Should the evidence, and it is the contention of the Government that it does, demonstrate the nonnavigability in fact of the rivers prior to statehood, then the title in the river beds remains vested in the United States. Evidence of navigability and nonnavigability since statehood becomes competent only in so far as it serves to explain matters prior to statehood.

VI

PHYSICAL CHARACTERISTICS

- (A) Navigability of a river in law, is predicated upon navigability in fact, and, in order to determine navigability in fact, the physical characteristics of the river must be considered
- (B) The physical characteristics of the Green, Colorado, and San Juan Rivers within the State of Utah are such that in their natural and ordinary condition they have never in the past been and will never in the future be used as highways of commerce

The navigability of a river in law must have its foundation upon navigability in fact. Navigability in fact must be tested by the use or the susceptibility of use of the river as a highway of commerce. This was ably and clearly stated by Mr. Justice

Field in the case of *The Daniel Ball*, 10 Wall. 557, 563.

Those rivers must be regarded as public navigable rivers in law which are navigable in fact. And they are navigable in fact when they are used, or are susceptible of being used, in their ordinary condition, as highways for commerce, over which trade and travel are or may be conducted in the customary modes of trade and travel on water.

Other cases which adhere to the statement of the law of navigability as declared in *The Daniel Ball* case are *The Montello*, 20 Wall. 430; 441, 443; *United States v. Rio Grande Dam & Irrigation Co.*, 174 U. S., 690; 699; *Leovy v. United States* 177 U. S. 621, 632.

All of these cases limit navigability in fact and hence navigability in law to those streams which in their ordinary condition may be termed highways of commerce over which trade and travel are or may be conducted in the customary modes of trade and travel on water. All of the cases limit the trade and travel to customary modes. This limitation excludes unusual or exceptional modes of trade and travel. If, therefore, the physical characteristics of a river are such that these requirements can not be met, the river is not navigable. Some of the common, natural obstructions which may interfere with navigation and prevent a river

from being used as a highway of commerce as defined in the cases cited, are an erratic or undependable stream flow; an excessive quantity of sand and silt and other materials in suspension; a steep gradient which produces high velocities of stream flow; many rapids; shifting sand bars; instability of channel; marked sinuosity of the channel; and terrain immediately adjacent to the river of a character which permits a rapid run-off from rains and thereby subjects the river to sudden and unusual floods.

As will be pointed out in more detail in this brief, all of these natural conditions offering obstructions and interference to navigation are present to a marked degree on the Green, Colorado, and San Juan rivers.

Some of the obstructions of the character mentioned have been the subject of comment by the Supreme Court of the United States, and considered by that Court to create sufficient interference with the operation of boats to render the river non-navigable. By a parity of reasoning, those obstructions to the operation of boats which have not already been commented on by the Supreme Court of the United States and which are present in the rivers in question are of such a character that they have in the past, do now, and will in the future prevent any use of the rivers in their natural and ordinary condition as highways of commerce over which trade and travel may pass in the ordinary and customary modes.

In considering the navigability of the Red River, in the case of *Oklahoma v. Texas*, 258 U. S. 574, the Supreme Court, with reference to the western part of the river, states, at page 587, as follows:

The river has its source in the Staked Plains of northwestern Texas and from there until it gets well into Oklahoma is within a region where the rainfall is light, is confined to a relatively short period in each year and quickly finds its way into the river. Because of this the river in the western half of the State does not have a continuous or dependable volume of water. It has a fall of three feet or more per mile and for long intervals the greater part of its extensive bed is dry sand interspersed with irregular ribbons of shallow water and occasional deeper pools. Only for short intervals, when the rainfall is running off, are the volume and depth of the water such that even very small boats could be operated therein. During these rises the water is swift and turbulent and in rare instances overflows the adjacent land. The rises usually last from one to seven days and in the aggregate seldom cover as much as forty days in a year.

And with reference to the eastern part of the river, the Court states, at page 589, as follows:

Of course, the conditions along that part of the river greatly affect the part in the eastern half of the State. But the latter received additional waters from the Washita and other tributaries and has a practically continuous flow of varying volume, the ex-

treme variation between high and low water being about thirty feet. When the water rises it does so very rapidly and it falls in the same way. The river bed has a fall of more than one foot to the mile and consists of light sand which is easily washed about and is carried downstream in great quantities at every rise of the water. At all times there is an almost continuous succession of shifting and extensive sand bars. Ordinarily the depth of water over the sand bars is from six to eighteen inches and elsewhere from three to six feet. There is no permanent or stable channel. Such as there is shifts irregularly from one side of the bed to the other and not infrequently separates into two or three parts. Boats with a sufficient draft to be of any service can ascend and descend only during periods of high water. These periods are intermittent, of irregular and short duration, and confined to a few months in the year.

At page 591 the Court states:

Its characteristics are such that its use for transportation has been and must be exceptional, and confined to the irregular and short periods of temporary high water. A greater capacity for practical and beneficial use in commerce is essential to establish navigability.

In the case of *North American Dredging Co. of Nevada et al. v. Mintzer et al.*, 245 Fed. 297, the physical characteristics of the San Pablo Canal,

the waterway which was under discussion, were taken into consideration by the court in arriving at its conclusion of nonnavigability and are set out at length in the opinion on page 299.

In the opinion sustaining the nonnavigability of the Arkansas River (*Brewer-Elliott Oil & Gas Co. v. United States*, 260 U. S. 77), on the issue of navigability, the Supreme Court, at page 86, rests upon the finding of the Circuit Court of Appeals, and of the District Court. See 270 Fed. 100 and 249 Fed. 609. In the latter report, at page 619, the District Judge sets forth in detail the evidence with reference to the physical characteristics of the river. The river contained many shoals. It had a winding course, a broad channel, and a shifting, sandy bed and these characteristics were important factors by which the court reached the conclusion of nonnavigability.

In the case of the Fox River, considered in *The Montello* (20 Wall. 430), the question of the rapids as an obstruction to navigation was discussed. The rapids, in that case, were held not to render the river nonnavigable, but in that case it appeared affirmatively that the river was used constantly as a highway of travel. This situation did not exist on the Red River, nor does it exist, nor has it ever existed upon the Green, Colorado, and San Juan rivers.

The total mileage of the Fox River used for navigation is 17½ miles; in 28 miles it has a fall of

170 feet, 88 of which are in two falls; the portage around both falls is less than one mile (See *United States v. Economy Light & Power Co.*, 256 U. S. 113) (Record 3035, 3040).

In the case now before the court, both expert and lay witnesses testified as to the physical characteristics of the rivers in question, and, in the light of the principles of law set out in the above cases, we proceed to a discussion of the evidence.

Brief description of Colorado, Green, and San Juan Rivers

Colorado River.—Colorado River has its source among the high peaks of the Rocky Mountains in north central Colorado and flows generally southwest across western Colorado, southeastern Utah, north and northwestern Arizona, and southward, as the boundary between Arizona, Nevada, and California, into Mexico where it enters the Gulf of California, a short distance below the international boundary. With Green River, it drains 244,000 square miles, of which 44,000 square miles are in Utah and the remainder is located in six other States.

Physiographically, the Colorado River from its source to the lower end of Black Canyon (between Arizona and Nevada) flows in a canyon. That portion in Colorado is in a mountain valley of varying width, and that portion in Utah and below is in a canyon formed by erosion in the Colorado River plateau, a region of flat-lying or tilted rocks cut by canyons and surmounted by mesas and

buttes. (Exhibit 58, page 12.) (Water Supply Paper 617, page 6.)

Loper (Vol. 13, page 2397), Kolb (Vol. 5, page 856), Seitz (Vol. 22, pages 3996, 4012), and others who have been through all or portions of the stretch of the river between Grand Junction and Castle Creek in boats state that the river has the characteristics of a steep mountain stream with many rocky rapids. The largest rapid is in Westwater Canyon, located in Utah, just below the Utah-Colorado State line, where the river drops 27 feet in a short distance. (Sheet 23, Exhibit 10.) This rapid (Kolb, Vol. 5, page 856) has been run about once or twice.

The mean flow of Colorado River at Moab as determined from the measurements at the Geological Survey gaging station near Cisco is 9,660 second-feet, with a minimum daily of 866 second-feet and a maximum daily of 73,200 second-feet. The average mean monthly flow, August to March, is between 2,550 second-feet and 5,870 second-feet, and during the months of April to July is between 10,000 and 34,300 second-feet. (Exhibit 88, page 32.)

From Castle Creek to Nigger Bill Creek about 8 miles below Castle Creek and 4 miles above Moab, the slope is somewhat lower averaging only 4.4 feet to the mile, much of which is concentrated at rapids resulting from debris brought in by side drainage. (Exhibit 75, pages 75 and 76.) From

Nigger Bill Creek downstream through Moab Valley $3\frac{1}{2}$ miles and in the $62\frac{1}{2}$ miles canyon section from Moab Valley to the mouth of Green River, the slope is unbroken by rapids (except at The Slide near the mouth (Exhibit 75, page 70), and averages about 1.14 feet to the mile (Exhibit 80, page 10). In the canyon section below Moab the sandstone walls vary from 1,000 to 2,000 feet in height.

About 4 miles below the mouth of Green River, the Colorado River enters Cataract Canyon, where for 40 miles it flows nearly straight southwest. Powell (Exhibit 51, page 79), gives the height of the canyon walls in Cataract Canyon as 1,300 feet at the head and foot, and 2,700 feet high in the central portion (Photographs Nos. 39, 40, Exhibit 11B). Based upon the river survey and profile (Exhibit 10, sheets 17-19, 58-59, and Exhibit 80, pages 10, 11) the average slope through Cataract Canyon is somewhat over 11 feet to the mile. Average downstream progress by both of Powell's parties and by Stanton was between $2\frac{1}{2}$ and $5\frac{1}{2}$ miles a day. (Summary of Exhibits 51, 176, and 628.)

From the foot of Cataract Canyon to Lees Ferry the Colorado River flows generally westward for 6 miles in Narrow Canyon and 170 miles in Glen Canyon. Powell (Exhibit 51, page 79) describes the height of canyon in Narrow Canyon as 1,300 feet at the head, coming down to the water at its

foot. The walls in Glen Canyon vary from two or three hundred to sixteen hundred feet. (Exhibit 251, Phot. No. 29.) Jones, topographer, with the second Powell expedition (summary of Exhibit 628), notes 31 rapids in Glen Canyon, at one of which party waded and eased boats. Stanton, with his railroad survey (summary of Exhibit 176), notes 20 rapids, at one of which boats were lined and goods portaged. The average slope of the water through Glen Canyon as shown by Exhibit 10, plan and profile surveys, sheets 1-12 and 52-54 and Exhibit 80, is practically 2 feet to the mile.

The mean flow of Colorado River at Lees Ferry, based on official records 1922 to 1928 (Exhibit 88, page 39), is 19,500 second-feet with a minimum daily of 1,000 second-feet and a maximum daily of 119,000 second-feet. The average mean monthly flow August to May is between 5,680 second-feet and 21,900 second-feet, and during the months of May, June, and July, between 27,800 second-feet and 62,400 second-feet. During the latter three months 60.8 per cent of the total yearly run-off occurs.

From Lees Ferry the Colorado River continues generally westward through canyon section, the first $61\frac{1}{2}$ miles being designated by Powell as Marble Canyon and the next 223 miles as Grand Canyon.

Callville is located about 65 miles below the lower end of the Grand Canyon. From Callville the river continues generally southward 333 miles to Yuma, flowing through a wide desert valley. (U. S. Geological Survey River Survey maps.)

Green River.—Green River and its tributaries drain an area comprising a large part of western Wyoming, northwestern Colorado, and eastern Utah, bounded on the north and east by the Wind River Mountains and the range forming the Continental Divide, on the south and east by White River Plateau and the Book Cliffs; and on the north and west by the Gros Ventre and Wyoming Mountains and the Great Wasatch Range. The area is roughly triangular in shape; its greatest length north and south is 370 miles and its greatest width 240 miles. The total area is approximately 45,000 square miles. (Page 3, Exhibit 85.)

The river heads on the western slope of the Wind River Mountains and flows generally southward across western Wyoming. (Page 3, Exhibit 85.) At Green River, Wyo., its mean flow is 2,040 second-feet, its minimum about 220 second-feet, and its maximum 21,800 second-feet. From September to February the average mean monthly flow varies from 401 to 973 second-feet and from March to August varies from 1,110 to 7,680 second-feet. (Pages 61-69, Exhibit 88.)

Powell (Exhibit 51, page 12) describes the stretch between Green River, Wyo., and Flaming Gorge (just south of the Utah-Wyoming line) as follows:

The river runs between bluffs in some places standing so close to each other that no flood plain is seen. At such a point the river might properly be said to run through a canyon. The bad lands on either side are interrupted here and there by patches of sagebrush. Where there is a flood plain along either side of the river a few cottonwood may be seen. (Photographs 1 to 5, Exhibit 11A.)

Average downstream progress of 23½ miles a day was made by Powell's first expedition and 14½ miles a day by the second. (Digest of Exhibit 51.)

Immediately below the Wyoming-Utah line the Green River flows through a series of canyons named by Powell *Flaming Gorge*, length 2 miles; *Horseshoe Canyon*, 3 miles; *Kingfisher Canyon*, 1½ miles; *Red Canyon*, 34 miles, and then into and through *Browns Park* for 31 miles to the head of *Lodore Canyon*. (Exhibit 55, page 3.) Powell (Exhibit 51, page 21), describing these canyon sections, says:

Besides passing through the gorge (Flaming), the river runs through Horseshoe and Kingfisher Canyons, separated by short valleys. The highest point on the walls at Flaming Gorge is 1,300 feet above the river. The

east wall at the apex of Horseshoe Canyon is about 1,600 feet above the water's edge and from this point the walls slope both to the head and foot of the canyon. Kingfisher Canyon, starting at the water's edge above, steadily increases in altitude to 1,200 feet at the foot. Red Canyon, the highest walls are about 2,500 feet. Browns Park is a valley bounded on either side by a mountain range, really an expansion of the canyon. (Photographs 6 to 19, Exhibit 11A.)

From Browns Park the river flows southward through Lodore Canyon, a distance of 19 miles to the mouth of the Yampa River. Powell, Exhibit 51, page 30, describes the canyon starting "abruptly at what we have called the Gate of Lodore, with walls nearly 2,000 feet high and they are never lower than this until we reach Alcege Brook, about 3 miles above the foot. They are very irregular, standing in vertical or overhanging cliffs in places, terraced in others, or receding in steep slopes and are broken by many side gulches and canyons. The highest point on the wall is at Dunn's Cliff, near Triplet Falls, where the rocks reach an altitude of 2,700 feet, but the peaks a little way back rise nearly a 1,000 feet higher." With further reference to Lodore Canyon, Powell says (Exhibit 51, page 30):

This has been a chapter of disasters and toil, notwithstanding which the canyon of

Lodore was not devoid of scenic interest, even beyond the power of pen to tell. The roar of the water was heard unceasingly from the hour we entered it until we landed here (mouth of Yampa). No quiet all that time. But its walls and cliffs, its peaks and crags, its amphi theatres and alcoves, tell a story of beauty and grandeur that I hear yet and shall hear. (Photographs 20 to 30, Exhibit 11A).

Below the mouth of the Yampa, Green River immediately enters *Whirlpool Canyon*, 11 miles long, and *Split Mountain Canyon*, 10 miles long, separated by *Island Park*, 5 miles long. From the lower end of Split Mountain Canyon the river flows southward 108 miles through *Uintah Valley* to the mouth of the Duchesne. Powell (Exhibit 51, page 43) states that the walls of Whirlpool Canyon vary from 1,800 feet to 2,400 feet in height and Split Mountain Canyon walls from 2,500 to 2,700 feet high. (Photographs 32 to 44, Exhibit 11A.)

Southward from the mouth of the Duchesne, Green River flows through *Desolation Canyon*, 54 miles; *Gray Canyon*, 21 miles; and across the Green River valley 12 miles to Green River, Utah. Powell, in Exhibit 51, page 56, states that the highest canyon wall in Desolation Canyon is 2,400 feet, the walls in Gray Canyon 2,000 feet. (Photographs 49 to 62, Exhibit 11A.)

The larger tributaries of the Green include the Yampa River, mean flow about 1,860 second-feet; the White River, with mean of about 672 second-feet; the Duchesne River, with mean flow of about 872 second-feet; the Price River, with mean of about 165 second-feet; and the San Rafael River, with a mean of about 270 second-feet. (U. S. Geological Survey records.)

The mean flow of Green River at Green River, Utah, is 7,600 second-feet with minimum daily of 510 second-feet and maximum daily of 67,300 second-feet. The average mean monthly flow from September to February varies from 1,770 to 3,420 second-feet and during the months March to August, between 4,560 and 26,200 second-feet. (Exhibit 88, page 71.)

Below Green River, Utah, the river continues to flow in a comparatively open valley for 20 miles, then enters Labyrinth and Stillwater Canyons, through which it flows for about 95 miles to its junction with the Colorado River. Powell (Exhibit 51) gives the height of the Canyon walls in both Labyrinth and Stillwater canyons as 1,300 feet (Exhibit 228, photograph No. 7).

San Juan River.—San Juan River rises in San Juan Mountains in southwestern Colorado, and flows southwesterly into New Mexico, then turns west and northwest across the extreme southwest

corner of Colorado into San Juan County, Utah, thence generally southwesterly and flows into Colorado River 78 miles upstream from Lees Ferry. The drainage area is about 25,800 square miles and includes parts of four States. (Page 10, Exhibit 85.) In its course above Chinle Creek, 133 miles above the mouth, it flows in general through valleys of varying widths alternating with short canyons, having relatively low walls. From Chinle Creek to its mouth it flows in a canyon with close precipitous walls as much as half a mile high which is continuous except for a short distance where the river flows through open country. (Page 1, Exhibit 56.) The region trenced by the canyon is a rough arid country which forms part of the broad Colorado River Plateau. (Photograph No. 31, Exhibit 145.)

The mean annual flow of San Juan River as determined from the measurements at the Geological Survey gaging station near Bluff (Exhibit 88, page 89) is about 4,070 second-feet and according to the record its range is from zero to probably 150,000 second-feet (Water Supply Paper 309, Exhibit 86). The average mean monthly flow August to March is between 824 and 3,990 second-feet, and between April and July, during which four months 62.9 per cent of the total run-off occurs, is between 5,610 second-feet and 9,960 second-feet. (Exhibit 88, page 89.)

Topographic features of area adjacent to rivers

Exhibit No. 99, introduced by Deeds, based upon the precipitation records of the U. S. Weather Bureau, shows that the rivers in the stretches under consideration flow through a region receiving less than 10 inches of precipitation annually. The U. S. Weather Bureau records at points near the river being as follows:

Location:	Mean annual inches
Green River, Utah.....	5.30
Thompson.....	6.97
Chico.....	5.94
Moab.....	9.26
Hanksville.....	5.58
Bluff.....	6.44
Average.....	6.69

Based upon this exhibit, official Weather Bureau records, precipitation map by Powell (Exhibit 53) and report on Arid Lands of the West by Powell (Exhibit 52) it is evident that the region is distinctly arid. The vegetation is necessarily of the desert type with shadscale and sagebrush or other desert types predominating (Photo. No. 184, Exhibit 11B), (Photo. 34, Exhibit 77). Baker, in Exhibit 55, "The Colorado River Plateau," states that most of the surface is either bare rock (Exhibit 145, Photo. No. 2) or covered with sand. Grass grows in a limited quantity (Photo. 33, Exhibit 145). Large areas are so broken up that they support no vegetative cover.

Briefly, the principal topographic features are a broad plateau, dissected by the Colorado and Green Rivers (photograph 34, Exhibit 11C) and their tributaries, which, for the most of their courses, flow through canyons which, as has been described by Powell (Exhibit 51), vary in depth from a few hundred feet to more than 2,500 feet. The canyons frequently have inner gorges, with the higher walls rising in gigantic steps to a flat divide. (Photograph 34, Exhibit 11B.) Isolated mountain masses which rise above the plateau are the LaSalle Mountains, lying 15 to 20 miles east of the Colorado River, slightly southeast of Moab; the Blue or Abajo Mountains, 25 miles southeast of Cataract Canyon and 40 miles north of the San Juan River; and the Henry Mountains, from 12 to 25 miles northwest of Upper Glen Canyon.

Although topographically a plateau, each wash and stream tributary to the main river has eroded deep canyons, which finally find their way to the river. Various geologic strata composed of sandstone and shales of various degrees of hardness have been eroded by the elements into walls, benches, and terraces, creating a terrain that baffles description. (Photograph No. 17, Exhibit 11B.) (No. 26, Exhibit 11B.) The minor stream channels are generally without water, but enormous accumulations of coarse alluvium, the product of

floods, are to be seen on all sides. (Photograph 212, Exhibit 11A.) Geological Survey photographs Nos. 1 to 41, which are part of Exhibit 55, clearly show that for thousands of square miles the region is arid, barren, and desolate (also photographs 127 to 140, Exhibit 55). This fact is also clearly shown in all of the photographs produced by Aurand, Exhibit 145, and many others, as well as general statements, as follows:

Gregory.—"The Navajo Country," U. S. Geological Survey Water Supply Paper No. 380 (Exhibit 63, page 21), in describing the area through which the San Juan River flows, broadly characterizes the region as "a plateau in which the depth of the canyons about equals the height of the mountains, * * * Mesas of the second and third order and innumerable buttes of both igneous and sedimentary origin, are characteristic features of the country. Mesa, butte, volcanic neck, canyon, wash, repeated indefinitely, are elements of the Navajo landscape. Alcoves, recesses, and miniature erosion forms of great variety and rare beauty stand as ornamental carvings on the larger architectural features, and over all is spread an unevenly developed sheet of wind-blown sand."

Ives, in his report upon the Colorado River of the West (Exhibit 72)—

So numerous and interlaced are the canyons in some portions of this singular region

that they have displaced all but the scattered remnants of the original plateau, leaving narrow walls, isolated ridges, and spires so slender that they seem to totter upon their bases, shooting up to an enormous height from the vaults below. (Photo 7, Ex. 145.)

LaRue.—The Colorado River and its Utilization, U. S. Geological Survey Water Supply Paper No. 395 (Exhibit No. 58):

For more than a thousand miles along its course the Colorado has cut for itself a deep narrow gorge or canyon, but at some points where lateral streams join it the canyon is broken, and these narrow transverse valleys divide it into a series of canyons. Virgin, Kanab, Paria, Escalante, Fremont, San Rafael, and San Juan * * * have also cut for themselves narrow winding gorges or deep canyons. Every river entering these has cut another canyon, every lateral creek has cut a canyon, every brook runs in a canyon so that much of the basin of the Colorado is traversed by a labyrinth of these deep gorges. * * * The streams run at depths almost inaccessible. Low plateaus dry and treeless stretch back from the brink of the canyon. * * * (Photo. No. 275, Ex. 11D.) These canyons, obstructing cliffs, and desert waste long prevented travelers from penetrating the country.

Powell, in his diary of July 17, 1869, in his report on the exploration of the Colorado River of the West (Exhibit 51), in describing the Stillwater Canyon section of Green River, states, "Landscape everywhere, rocks; no vegetation, no soil, no sand."

Other testimony in the record shows most conclusively that the roughness of the region, combined with the meager rainfall, the almost total absence of soil, and the scantiness of grass, sage, pine, pinon, and cedar, make the plateau section, through which these rivers flow, a desert waste. Prommel (Vol. 5, page 992); Dobbin (Vol. 7, pages 1311, 1317); Aurand (Vol. 7, page 1339); Dellenbaugh (Vol. 9, page 1556).

Locations at which the rivers are accessible

As Baker shows in Exhibit 55, page 4, the region does not permit free travel by automobile, horseback, or on foot. Testimony as noted hereafter, however, of many old-timers, explorers, prospectors, engineers, geologists, and others shows that there are certain fairly well-defined routes over which considerable travel has occurred and that in connection with exploration work there were few localities that could not be reached either on horseback or on foot.

Area west of Green River and Colorado River.—Within reasonable limits, the testimony shows that the plateau section lying to the west of Green River

and to the west and north of Colorado River is generally accessible, and routes of travel generally on foot, horseback, or wagon have been used at various times as follows:

Points north and west of Green and Colorado Rivers to points along Green River between Green River, Utah, and the mouth of San Rafael: Hoyt (Vol. 2, page 178); Edwards (Vol. 10, page 1933); Reeside (Vol. 22, page 3943); Wolverton (Vol. 31, page 5416).

Mouth of Barrier Creek (59 miles above mouth of the river). Rust (Vol. 12, page 2277).

Fort Bottom (39.5 miles above mouth of the river). Rust (Vol. 12, page 2279).

Valentine Bottom (33 miles above mouth of the river). Anderson (Vol. 30, page 5232; Tasker, Vol. 31, page 5436).

Mouth of Green River, on foot from relatively near trail. Dobbin (Vol. 7, page 1309).

Various points in Cataract Canyon from north and west only, on foot. Kane (Vol. 11, page 2010); Loper (Vol. 13, page 2382).

North Wash (Crescent Creek) (Mile 167.5).
North Wash, Dandy Crossing.—Galloway (Vol. 6, page 1062); Nims (Vol. 7, pages 1401, 1411); Stone (Vol. 10, page 1764); Edwards (Vol. 10, page 1897); McDonald (Vol. 12, pages 2164, 2190); Rust (Vol. 12, page 2269); Loper (Vol. 13, page 2400); Weber (Vol. 15, page 2627).

Hite (White Canyon) (Mile 162.5).—Galloway (Vol. 6, page 1132); Wetherill (Vol. 9, page 1604); Edwards (Vol. 11, page 1977); Kane (Vol. 11, pages 1995, 2023); Rust (Vol. 12, page 2258); Loper (Vol. 13, pages 2353, 2439); Harshberger (Vol. 13, pages 2509, 2517); Weber (Vol. 15, page 2642); Hite (Vol. 20, page 3561).

Red Canyon (Loper Ranch) (Mile 150).—Wetherill (Vol. 9, page 1648); Loper (Vol. 13, pages 2363, 2392).

Good Hope (Mile 145), Tickaboo Creek (Mile 145.8).—Edwards (Vol. 11, page 1977); Rust (Vol. 12, page 2262); Loper (Vol. 13, page 2447); Sumner (Vol. 17, page 3124).

Stanton Dredge, New Year Bar; Moki Bar, California Bar; Olympia Bar, Hanson Creek (Mile 122-132).—McDonald (Vol. 12, page 2202); Weber (Vol. 15, page 2630); Bennett (Vol. 17, page 3177); Chaffin (Vol. 17, page 3271); Gibbons (Vol. 29, page 5146); Chaffin (Vol. 28, page 4961).

Halls Crossing, Bullfrog Creek (Mile 118-120).—Lint (Vol. 9, page 1564); Thomas (Vol. 13, page 2487); Bennett (Vol. 17, page 3131); Stabler (Vol. 22, page 4054).

Hole-in-Rock (Mile 84.3).—Jones (Vol. 3, page 364); Butts (Vol. 3, page 547); Hyde (Vol. 4, page 593); Wetherill (Vol. 9, page 1616); Hyde (Vol. 9, page 1679); Loper (Vol. 13, page 2409);

Chaffin (Vol. 17, page 3291); Fotheringham (Vol. 28, p. 4976).

Bridge Canyon, Aztec Creek (Mile 68.7).—Wetherill (Vol. 9, page 1606).

Crossing of Fathers (Mile 40.5).—Dellenbaugh (Vol. 9, page 1538; Vol. 9, page 1547); Wetherill (Vol. 9, pages 1606, 1649); Fowler (Vol. 22, page 3964).

Warm Creek (Mile 27.8).—Rosenfelt (Vol. 16, page 3009).

Lees Ferry (Mile 0).—Jones (Vol. 3, page 363); Dellenbaugh (Vol. 9, page 1542); Kane (Vol. 11, pages 1999, 2019); McDonald (Vol. 12, page 2184).

Travel on the plateau north and west of Green and Colorado Rivers is made over a rocky, sandy road which roughly parallels the Green River to a point opposite its mouth and connects with road to Hanksville and Escalante. From these points roads or trails extend toward the river. (Wolverton, Vol. 31, page 5397.)

Area between Green and Colorado Rivers.—Above the mouth of the San Rafael the country has been shown to be generally accessible, see Dobbin (vol. 7, page 1310). According to Baker (Exhibit 55, page 7) it is possible to take an automobile from the Thompson-Moab road southwest to the Dubinky Spring near the southwest corner of T. 24 S., R. 19 E., and from there (although there is no road) he states that an automobile can be driven to a point near head of Taylor Canyon which enters Green

River 43 miles above the mouth. There is also a road branching south from the Green River-Thompson road, which extends to a point near Green River opposite the mouth of the San Rafael. According to testimony by Wimmer (vol. 27, page 4748), this road at one time continued farther south. Baker states (Exhibit 55, page 7) that trails extend to the Green River at the mouth of Spring Canyon (66 miles above the mouth of the river): Hell Roaring Canyon (53.8 miles above the mouth), and Taylor Canyon (Mile 43). Cliff Dwellers ruins in lower 41 miles of river also indicate access to the surrounding plateau. Bishop, in diary of second Powell expedition (Exhibit 629) for September 11, 1871, while in Stillwater Canyon states, "Prof. (Thompson) and Maj. (Powell) have found the way where the Shinemous (cliff dwellers) got out—on stone steps and poles." According to Baker the Colorado River may be reached by the Shafer trail which comes to the river in the canyon section about 30 miles below Moab and again by a rough trail just below the canyon entrance in the southwest corner of T. 25 S., R. 21 E. Powell (July 20, 1869) climbed to the plateau section between the Colorado and the Green at their junction. (Exhibit 51, page 59.) No evidence was introduced to show the accessibility of the Colorado River from the west between the Shafer trail and the mouth of Green River.

Area on east and south sides of Colorado River.—
A well-traveled road extends southeastward from

Moab through Moab and Spanish Valley to Monticello, Blanding, and Bluff. Above Moab a road follows the river in Castle Creek Valley. Baker (Exhibit 55, pages 7, 8) states that a road leaves the Monticello road in the northern part of T. 29 S., R. 23 E., by which it is possible to take an auto westward to Hatch Point, a broad divide between Cane and Indian Creeks. Hatch Point is 2,000 feet above the Colorado River and separated from it by an impassible cliff. Another road leaves the Monticello Road and follows Indian Creek to the head of a box canyon in T. 30 S., R. 20 E., where it leaves Indian Creek and follows the bend around the southwest corner of Hatch Point, then down the bed of Lockhart Canyon (Baldwin, vol. 29, p. 5038) to the Colorado River, 27 miles above the mouth of Green River.

Baker (Exhibit 55) reports trails which have also been described by various witnesses, from Moab southward to Lockhart Canyon. From this trail other trails leading to the upland follow the bed of Cane Creek and two others climb the walls of Lockhart Canyon. No trails are known to lead to the Colorado River from the east between Indian Creek and Dandy Crossing near White Canyon, a distance of about 70 miles. Below Cataract Canyon there was considerable testimony showing travel routes crossing Colorado River at Dandy Crossing, Halls Crossing, and Hole-in-the-Rock connecting with trails leading eastward to

the country north of San Juan River. Below the mouth of the San Juan testimony indicates that ardent explorers use trails from the south leading to the Natural Bridge Monument near the mouth of Aztec Creek and to the Crossing of the Fathers.

Area adjacent to the San Juan River.—According to Baker (Exhibit 55, page 10) the road from Bluff continues westward roughly parallel to San Juan River to the Goodridge Bridge at Mexican Hat from which it leads southwestward to points in Arizona. Miser in Exhibit 56, pages 26 to 33, and testimony Vols. 20 and 21, pages 3728, 3790, describe a road from Mexican Hat which follows a bench high above the river on the north side to Johns Canyon and Slickhorn Gulch. A trail leads up Johns Canyon to the upland north of the river. On the south side of the river a poor road leads westward to Moonlight and Copper Creeks. From Copper Creek a road is passable at times to the mouth of Nokai Creek and at one time to Zahns Camp and Spencer Camp. Trail leads to the river at other points between the mouth of Moonlight Creek and points near the mouth of the river. Between Moonlight Creek and Mexican Hat the only trail to the river is the old Honaker trail. Testimony indicates that the old road between Hole-in-the-Rock and Bluff is practically abandoned as a route of trade and travel but that it is occasionally used by explorers.

Testimony in the records shows accessibility of the following locations:

Goodridge (Mile 113.5 above mouth).—Trimble (Vol. 21, page 3868); Miser (Vol. 21, page 3784).

Mendenhall Trail (Mile 110).—Mendenhall (Vol. 19, page 3463).

Honaker Trail (Mile 96.5).—Hyde (Vol. 9, page 1687); Loper (Vol. 12, page 2308); Miser (Vol. 21, page 3784).

Johns Canyon (Mile 82.5).—Wetherill (Vol. 9, page 1599).

Slickhorn Canyon (Mile 74.8).—Miser (Vol. 21, page 3784).

Moonlight Creek (Mile 65.5).—Miser (Vol. 21, page 3784).

Clay Hill Crossing (Mile 57).—Wetherill (Vol. 9, page 1616); Trimble (Vol. 21, page 3868).

Piute Farms (Mile 54).—Loper (Vol. 12, page 2330); Miser (Vol. 21, page 3784).

Clay Gulch (Mile 50).—Hyde (Vol. 9, page 1687); Miser (Vol. 21, page 3784).

Copper Canyon (Mile 46.8).—Spencer (Vol. 4, page 709); Wetherill (Vol. 9, page 1633); Gerdine (Vol. 10, page 1858); Miser (Vol. 21, page 3784).

Nokai Canyon (Mile 44).—Harshberger (Vol. 13, page 2501).

Zahns Camp (Mile 41.5).—Hyde (Vol. 9, page 1687); Zahn (Vol. 11, pages 2037, 2075).

Spencer Camp (Mile 38.0).—Nielsen (Vol. 3, page 444); Barnes (Vol. 13, page 2548); Miser (Vol. 21, page 3784).

Area adjacent to the rivers uninhabited and substantially uninhabitable

Testimony shows that at the present time only one person is living in the area extending from Green River, Utah, to Lees Ferry, a distance of 330 miles. (Johnson, Vol. 26, page 4582.)

According to the testimony of Baker (Vol. 1) and others, outside of two or three families at Valley City on the road between Moab and Green River there is no one living permanently in the vast pie-shaped area between the Green and Colorado Rivers (Dobbin, Vol. 7, page 1310). Between Moab and the mouth of the Green River there are no inhabitants within 10 miles of the river, and between the mouth of Green River and Lees Ferry on the east and south, no one for even a greater distance back from the river. (Pronmel, Vol. 6, page 1022.)

In the country bordering the San Juan River, according to Miser (Exhibit 56, page 22) and Gregory (Exhibit 63, page 76), Nielsen (Vol. 3, page 459) inhabitants are no more numerous than along the Colorado and Green Rivers. West of Mexican Hat to the north of the river there are no inhabitants and according to Baker there are only four permanent habitations between the San Juan and Colorado Rivers and the Utah-Arizona State line. The total number of people living in these four habitations in 1928 was 14. Within this last-described area there are a few more or less migratory families of Navajo and Piute Indians but no per-

manent settlements. For all practical purposes, a region which does not average much more than one person per thousand square miles, may clearly be classified as uninhabited.

Testimony by Bennett (Vol. 17, page 3241), Loper (Vol. 12), and others shows that during the boom of 1892 upwards of several hundred were attracted to the Glen Canyon section of the Colorado River and the San Juan River below Bluff. The boom, however, was short lived and apparently the only so-called permanent homes on a river frontage of nearly a thousand miles, were those of Wimmer, Halverson, Wolverton, and Valentine, on the Green River; the Hites and Bert Loper, in Glen Canyon, on the Colorado; and the Spencers and Zahns, on San Juan River. (Kolb, Vol. 4, pages 791, 799.)

From an agricultural standpoint.—Practically all of the evidence shows clearly that the only land being tilled at the present time is on irrigated tracts in the vicinity of Green River, Moab, and Bluff, Utah, and on dry-farming land in the vicinity of Monticello and Blanding. With the exception of possibly a thousand acres of scattered bottom lands along Green River, any increase in the area of tillable land would be in the vicinity of the localities mentioned. According to Exhibit 507, a press release of two detailed Government reports, the additional area which could be irrigated amounts to about 28,000 acres in the vicinity of Green River, Utah, 1,000 acres in the vicinity of Moab, and possibly 25,000 in the vicinity of Blanding and Mon-

ticello by diversions from the Dolores River. The probable increase is seen to be very small and only half of the probable increase is contiguous to the river. (Exhibits 505, 506.)

Considering all of the area in southeastern Utah embraced within the 28,000 square miles covered by Grand, San Juan, Emery, Wayne, Garfield, and Kane Counties, Government records of the U. S. Geol. Survey as summarized in a report prepared for the Secretary of the Interior on the grazing resources of Utah show that 98.6 per cent are grazing lands or in national forest (national forests are 12 per cent of the total) and the remaining 244,800 acres, or 1.4 per cent, is tillable land. Additional evidence showing rough, arid country is contained in field notes, General Land Office, Exhibits 419 to 459.

From an industrial standpoint.—Witnesses for the State testified that the development of the natural and scenic resources of the country would result in an increased population. To what extent development as outlined will take place is problematical. Government witnesses (Cleary, Vol. 16, page 2895) testified that upward of \$2,000,000 had been expended in "wild-catting" but to date there are no producing wells in the territory adjacent to the river in the stretches under consideration, nor have any substantial quantities of oil been produced. Whether the region is underlain with oil deposits is entirely problematical.

Placer-mining activities have decreased until evidence indicates that probably there are less than five men working bars along the 540-mile stretch between Green River, Utah, Moab, Chinle Creek, and Lees Ferry. Witnesses for the State showed mineralization and some attempt to develop coal, copper, uranium, vanadium, and manganese in the La Salle, Abajo, and Henry Mountains and in the region between Green and Colorado Rivers. With one or two exceptions, especially in the La Salle Mountain region, testimony showed that operations were of an exploratory nature and that little actual development had taken place.

Government Exhibit No. 638, pages 608 to 640, U. S. Geological Survey Bulletin No. 111, entitled "Ore Deposits of Utah," discusses authoritatively the mineralization of the region. With respect to the La Salle Mountains area the report states that between date of first mineral locations in 1888 and 1917 when the Big Indian mine was opened, probably \$5,000 would cover the entire output of quartz and placer mining. In discussing the copper deposits at the Big Indian properties the report (page 615, Exhibit 638) states "Some good ore has been found but the richer grade is in small bodies and would be difficult to mine without mixing with poor ore or waste. The great bulk of the mineralized rock carries a rather low percentage of copper and much of the low-grade ore occurs in thin lenses and is difficult to extract without breaking barren

rock." Uranium-vanadium deposits are stated to occur in the La Salle Mountain region and northward but the report indicates that deposits have not been actively worked for several years.

Manganese deposits are discussed (Exhibit 638, page 617) at considerable length. The report states that under ordinary conditions existing before the war mining of manganese was not profitable. During the war operations were running as high as 600 tons a month. There was no evidence that any manganese is being mined at the present time.

Abajo (Blue) Mountains.—Some gold has been discovered in these mountains, but the report says that but little gold was extracted and the placers were soon abandoned. With respect to lode deposits the report states that much money and labor have been expended but that little metal has been recovered and no mineral deposit has paid the expense of operation. State evidence showed possible coal in the Abajo region but it was shown by witnesses (Woods, Vol. 25, page 4431; Baldwin, Vol. 29, page 5061) that all present coal demands of Monticello and surrounding region were met by coal hauled overland from points on the railroad. Some copper deposits are stated to occur in the White River region southwest of the Abajo Mountains and near Hite, but no development has been shown to have taken place. (Exhibit 638, page 618.)

Henry Mountains region.—The report states that the metal production of this region is not known

but has not been large. One mine is reported to have produced \$15,000 in 1892 and a little more since. Uranium and vanadium ores were shipped from the district in 1913 and 1914 but there has been little shipped since the World War. (Ex. 638, page 622.)

Carrizo Mountains region.—Gregory in Water Supply Paper No. 380 (Exhibit 63, page 30) states "Search for mineral wealth on Carrizo has resulted in failure, and the Navajo tends his sheep undisturbed by other interests."

Wolverton (Vol. 30, page 5345) showed some prospecting for copper west of Green River and south of the San Rafael and stated that he used river transportation of small quantities of copper ore shipped out for testing purposes. Testimony showed, however, that the actual quantity carried on the river amounted to but a few tons. Wimmer (Vol. 27, page 4748) on the other hand, testified to the overland transportation of manganese ore by team to the railroad. Witnesses (Wolverton, Vol. 30, page 5363) for the State showed presence of large quantities of building stone. The presence of a soft sandstone in practically unlimited quantities is admitted. No evidence was introduced, however, to show that the stone, when quarried, could be transported economically by water and it is questionable if rock in a region where its presence is in almost unlimited quantities can be considered a natural resource, and the same is true with respect to the scenery.

Taking the region as a whole into consideration, there is no evidence to show that it will ever become a substantially habitable country nor will it produce commodities which can be transported by water. (Baldwin, Vol. 29, page 5061.)

CHARACTERISTICS OF THE RIVERS

Tortuous course

Exhibit 10, sheets 1 to 74.—Official river survey maps clearly show the tortuousness of the rivers under consideration. Measurements show the following characteristics:

Green River:

Green River, Utah, to mouth of San Rafael—

Distance by river.....	22.3 miles.
Air-line distance.....	14.5 do.
Ratio, river mileage to straight line.....	1.54

Mouth of San Rafael to mouth of river—

Distance by river.....	95.0 miles.
Air-line distance.....	42.8 do.
Ratio, river mileage to straight line.....	2.22

Colorado River:

Castle Creek to mouth of Green River—

Distance by river.....	79.2 miles.
Air-line distance.....	42.4 do.
Ratio, river mileage to straight line.....	1.87

Colorado River, mouth of Green to North Wash—

Distance by river.....	49.0 miles.
Air-line distance.....	35.4 do.
Ratio, river mileage to straight line.....	1.38

Colorado River, mouth of North Wash to Utah-Arizona line—

Distance by river.....	139.7 miles.
Air-line distance.....	82.0 do.
Ratio between river mileage and straight line.....	1.70

Colorado River, Utah-Arizona line to Lees Ferry—

Distance by river.....	27.8 miles.
Air-line distance.....	14.0 do.
Ratio between river mileage and straight line.....	1.99

San Juan River:

Chinle Creek to Mouth—

Distance by river.....	132.5 miles.
Air-line distance.....	64.0 do.
Ratio between river mileage and straight line.....	2.08

Logs and débris.—LaRue, in Water Supply Paper 556 (Exhibit 62, page 15) states—

During flood periods Colorado River carries a large amount of driftwood. In the flood of September, 1923, hundreds of logs 20 to 30 feet long and 2 to 3 feet in diameter passed through Grand Canyon.

Photograph No. 123, Exhibit 77, shows the large amount of drift being carried by the Green River on October 12, 1928, during a small flood of 12,000 second-feet (page 6, Exhibit 75). Miser, in Water Supply Paper No. 538 (page 55, Exhibit 56), in speaking of the San Juan River, says: "The floods during rising stage carry so much driftwood, including logs, as to make boating precarious," and again on page 71:

In fact the drift is so abundant that the river picks up enough fine trash, logs, and stumps to cover much of the surface of the stream during rising stages. The drift contains some green trees, but consists mostly of seasoned wood, including pine, pinon, cedar, and cottonwood. Some drift accumulations are 15 to 20 feet in length, some were noted as far as 35 feet above the water surface, and some occupy areas of several acres.

Eddy, Vol. 1, page 47, testified to huge accumulations of drift in Cataract Canyon as high as 50 feet above the water.

Specific instances of the presence or accumulation of logs and débris are contained in the record, as follows:

Eddy (Vol. 1, page 47); Blake (Vol. 5, page 923); Sawyer (Vol. 11, page 2104); Loper (Vol. 13, page 2376); Johnson (Vol. 17, page 3097).

Ice.—As is usual in localities where temperatures are below freezing for considerable periods in the winter, ice forms on the river. As shown by the Geological Survey records of daily discharge (Exhibit 94) for Green River at Green River, Utah, ice is present on the river in sufficient quantities to affect the relation between stage and discharge usually from the latter part of December to the middle of February; Colorado River near Cisco (Exhibit 89), for slightly longer periods, generally from the middle of December to the latter part of February; Colorado River at Lees Ferry, for much shorter periods, ranging from only a few days during 1922 to over a month (December 24, 1924, to February 6, 1925, Exhibit 90), during the winter season 1924–25. Conditions on the San Juan are similar to those at Lees Ferry.

LaRue, Water Supply Paper 556 (Exhibit 62, pages 12–13), notes minimum temperatures of -32° F. at Green River, Utah, $+7^{\circ}$ F. at Hite and

an average of 102 days with temperatures below freezing.

During January, 1878, LaRue records (Exhibit 62, pages 12–13) the crossing of the Colorado River at Lees Ferry of loaded wagons and during January, 1886, the crossing of stock. On January 15, 1925, the ice at Lees Ferry was sufficiently thick to support loaded animals.

Reference is made to ice conditions in the record, as follows:

Baldwin (Vol. 6, pages 1192, 1213); Hyde (Vol. 9, page 1700); Zahn (Vol. 11, page 2028); Bennett (Vol. 17, page 3192); Chaffin Vol. 17 (page 3292); Hyde (Vol. 18, page 3357); Howland (Vol. 26, page 4624).

Rapids, riffles, and cataracts

The various witnesses have given their own definitions of "rapids." The great majority have made no differentiation between little rapids, referred to by some as riffles, and the large rapids or cataracts. In general they have been described as obstructions to the flow of the water of sufficient size to either raise the water or contract the width of the channel causing waves and high velocities. Certain portions of the river have few, if any, rapids while in other stretches rapids predominate. For the purpose of clearness the rivers are divided into outstanding stretches as follows: (Sections where rapids predominate are shown on Exhibit 5, and tabulation in Exhibit 80.)

Green River

Green River, Wyoming, to Utah-Wyoming line.—Based upon Exhibit 10, sheets 45 and 46, the distance from Green River, Wyoming, to the Utah-Wyoming line is 65½ miles and the total drop 214 feet at a rate of 3.3 feet to the mile. Neither Powell (first expedition), Exhibit 51, pages 8-12; Jones (topographer, Powell, second expedition), Exhibit 628; nor oral testimony of Kolb (Vol. 4, page 770); Stone (Vol. 10, page 1776), or any of the other witnesses note any rapids in this stretch.

Flaming Gorge, Horseshoe Canyon, Kingfisher Canyon, Red Canyon, Browns Park.—Powell, on his first expedition (Exhibit 51), notes many rapids, three of which required the boats to be either lined or portaged and an average progress of 13 miles per day. Jones, topographer with the second Powell expedition (Exhibit 628), notes 14 rapids all in the canyon section above Browns Park, at four of which the boats were either lined or portaged. Their downstream progress was 8½ miles a day.

Lodore Canyon.—Powell's first expedition (Exhibit 51) records a downstream progress of 2½ miles a day with many rapids run, lined, or portaged, and boats capsized many times. Jones, topographer (Powell's second expedition), reports downstream progress of 2¾ miles a day with 16 rapids, of which only 4 were run and the remainder either lined or portaged. (Summary Exhibit 628; Photographs 262 to 265, Exhibit 11-B.)

Whirlpool Canyon, Island Park, Split Mountain Canyon, Uintah Valley.—Jones, topographer (Powell second expedition), reports 19 rapids in this stretch, all in the canyon section, at 8 of which the boats were lined. Their average downstream progress was 8¾ miles a day in the canyon section and 26½ miles a day in the valley section (summary, Exhibit 628). Powell on the first expedition reports many rapids in the canyon section at which boats were lined (Exhibit 51; Photograph 272, Exhibit 11B).

Desolation Canyon, Gray Canyon.—Jones notes 118 rapids in Desolation and Gray Canyons at which it was necessary to line the boats 32 times. Their average downstream progress was 7½ miles a day. Powell notes many rapids and many times the boats were either lined or portaged. (Summary Exhibits 51 and 628; Photographs 293 and 294, Exhibit 11B.)

Based upon the river-survey map of the U. S. Geological Survey (Exhibit 10, sheets 31 to 46) and the computations based thereon (Exhibit 80, pages 14 to 19), the Green River in the 439-mile stretch from its mouth to the Utah-Wyoming line, has 126 stretches where the average fall is at a rate of 33 feet to the mile and classified in Exhibit 80 as rapids; 67 stretches totaling 40½ miles where the average slope is 10.1 feet to the mile classified in Exhibit 80 as rapid water, and the remaining stretches having average slopes of between 1.4 and 3.0 feet to the mile, classified as quiet water. Jones

(Exhibit 628) notes a total of 172 stretches which he characterizes as rapids with a total of 54 times when the boats were lined or portaged. (Photographs, Exhibit 116 to 120.)

Green River, Utah, to mouth of San Rafael.—In the 22-mile stretch testimony regarding the number of rapids or riffles has varied between 14 as found by W. G. Hoyt (Exhibits 14 and 75) after field examination, and 12 by the Army Engineers' examination (maps shown on Exhibits 481 to 491 and in State Exhibit 18). Field notes of Stanton (Exhibit 176) notes two, at one of which three holes were stove in one of the boats. Diary of the second Powell expedition, by Jones (Exhibit No. 628), notes but one. There is no question but that since 1909 at least, there have been between 12 and 14 small rapids or riffles depending somewhat on the stage of the water. It is also evident that with the exception of about three the obstructions were not of sufficient size to be defined as rapids by explorers such as Powell and Stanton.

The characteristics of the river at these rapids or riffles are described in the record as follows:

Eddy (Vol. 1, page 45); Hoyt (Vol. 1, pages 159 to 173); Anderson (Vol. 4, page 726); Kolb (Vol. 4, page 787); Blake (Vol. 5, page 912); Nims (Vol. 7, page 1397); Dellenbaugh (Vol. 9, page 1525); Clark (Vol. 9, page 1710); Kane (Vol. 11, page 2304), and photographs 13 to 32 and 103 to 113, Exhibit 77.

Green River below Mouth of San Rafael River.—In this 95-mile stretch of the river, the slope is 1.17 feet to the mile and there are no rapids or riffles (Exhibit 80, page 12; photographs 116 to 140, Exhibit 77).

Colorado River

Grand Junction, Colo., to Castle Creek.—In this 94½-mile stretch, as shown by Exhibit 10 and Exhibit 80, the river has an average slope of 5.8 feet to the mile with 21 stretches where the slope exceeds 15 feet to the mile, which have been characterized as rapids.

Castle Creek to Moab.—In this 14-mile stretch, but more especially the upper 12-mile stretch between Castle Creek and Nigger Bill Creek, rapids are numerous. The average slope is considerably greater than the slope below Moab and in at least three places (See Exhibit 10, sheets 19 to 21, and Exhibit 80, pages 10, 11) the rate of fall per mile exceeds 10 feet. (Photographs 170, 171, Exhibit 77.)

Moab to mouth of Green.—In this 65-mile stretch there is only one place where the channel has been contracted sufficiently to cause an increase in the velocity comparable with a rapid, and this occurs at "The Slide" located on the Colorado 1.8 miles above the mouth of Green River. This slide has been described by various witnesses and the descriptions conform to that contained in Exhibit 75, page 70, and mapped in Exhibit 76; also in Exhibit 491, and State Exhibit 490.

Mouth of Green River to Mille Crag Bend (Cataract Canyon).—In the 40-mile stretch occurs a series of rapids which were defined by Powell as cataracts. These rapids often occur so frequently that there is no open space between them; consequently, there is a somewhat wide range in the testimony as to the actual number. Hoyt, in Exhibit 80, page 3, shows 49 rapids at which the total drop is 302 feet and having an average fall at the rate of 33 feet to the mile. This exhibit is based on the river-survey profiles and number and location are confirmed by the topographic engineer (Chenoweth) who made the map and so testified. (Vol. 21, page 3887.)

R. B. Stanton, at the time of his survey for a railroad, noted 78 rapids, 36 of which were of such size that portage or lining of boats was required. (Summary Exhibit 176.)

Jones and Dellenbaugh (Exhibits 176 and 14), with the second Powell expedition, noted 62 rapids, of which 29 were of sufficient size to require lining or portage. The oral testimony of Kolb, Eddy, Lint, and others in the record, as follows, confirms the number of rapids and their magnitude:

Eddy (Vol. 1, page 58); Kolb (Vol. 4, page 792) (Vol. 5, page 829); Galloway (Vol. 6, pages 1112, 1128); Nims (Vol. 7, page 1400); Lint (Vol. 8, page 148); Dellenbaugh (Vol. 9, page 1529); Clark (Vol. 9, page 1714); Stone (Vol. 10, page 1786);

Rodin (Vol. 10, page 1804); Edwards (Vol. 10, page 1909); Edwards (Vol. 11, page 1969); Kane (Vol. 11, page 2006); McDonald (Vol. 12, page 2175); Loper (Vol. 13, pages 2351, 2377); Chaffin (Vol. 18, page 3317); Chenoweth (Vol. 21, page 3905). Photographs as follows: (Exhibit 239, No. 17), (Exhibit 241, No. 36), (Nos. 56 to 121, Exhibit 11B), (Photographs Exhibits 27 to 44), (Photographs Exhibits 105 to 114).

Mille Crag Bend to Lees Ferry (Narrow Canyon and Glen Canyon).—In the 176-mile stretch between the foot of Cataract Canyon at Mille Crag Bend and Lees Ferry there are stretches as shown by Exhibit 80, pages 7 and 8, totaling 21.31 miles, which have been characterized as rapid-water stretches, and it is in these stretches that rapids as noted in the diaries of Jones and Dellenbaugh, field notes of Stanton, and the testimony of Loper, Rust, Stabler, Dent, Freeman, Kolb, John and Homer Hite, and others, occur. The diary of Jones (Exhibit 628) second Powell expedition, notes 30 rapids, one of which required that the boats be eased through by hand; numerous groundings occurred. Dellenbaugh (Exhibit 14) of the same party, reports rapids and particular trouble at the bedrock section. Stanton (Exhibit 176) notes 15 rapids, at three of which the boats had to be lined or otherwise portaged. Oral testimony, as follows, indicates that outstanding rapids occur as follows, listed in downstream order from North Wash:

Kolb (Vol. 5, pages 804, 853); Galloway (Vol. 6, page 1113); Nims (Vol. 7, page 1402); Dellenbaugh (Vol. 9, page 1532); Clark (Vol. 9, page 1718); Stone (Vol. 10, page 1769); Woodbury (Vol. 10, page 1820); Kane (Vol. 11, pages 1993, 2015); McDonald (Vol. 12, pages 2181, 2217); Rust (Vol. 12, page 2273); Loper (Vol. 13, pages 2356, 2401); Thomas (Vol. 13, page 2488); Johnson (Vol. 16, page 3049); Bennetts (Vol. 17, pages 3136, 3147, 3198); Chaffin (Vol. 17, page 3274); Cheneweth (Vol. 22, page 3937); Stabler (Vol. 22, page 4055).

	Above Lees Ferry
	Mile 161
Trachyte Creek Rapid.....	159.5
Two-mile Creek Rapid.....	158
Four-mile Creek Rapid.....	148.5
Tickaboo Creek Rapid No. 1.....	148.5
Tickaboo Creek Rapid No. 2.....	136.5
Warm Springs Creek Rapid.....	132
Smith Rapid.....	129.8
Hanson Creek Rapid.....	120.5
Bullfrog Rapid.....	116.8
Unnamed rapid.....	113.2
Lake Canyon Rapid.....	112
Bed Rock Rapid.....	111
Shock Rapid.....	104.6
Whirlpool Rapid.....	71.5
Oak Creek Rapid.....	68.7
Aztec Creek or Bridge Creek Rapid.....	49.4
Last Chance.....	

Col. Dent, Vol. 7, p. 1257, records the following rapids and obstructions in Colorado River through Glen Canyon, based on observations made by him during early October, 1929:

Mile 160-161.....	Rapids.
159½.....	Do.
158½.....	Do.
158.....	Do.
157.....	Swift and rough water.
150.....	Rapids with boulders and cobbles.
148½.....	Rapids with boulders.
132.....	Smith Rapids with cobbles and small boulders.
129½.....	Rapids.
113½.....	Do.
113.....	Do.
112½.....	Rapids with bad rocks.
109.....	Rapids.
108½.....	Do.
107½.....	Do.
105½.....	Do.
104.....	Do.
103½.....	Do.
74-78.....	Sand waves.
68½.....	Rapids.
63.....	Sand waves.
54.....	Do.
53.....	Do.
31½.....	Do.
25.....	Do.
22-25.....	Do.

San Juan River

Chinle Creek to the mouth.—In the 133 miles between Chinle Creek and the mouth, Hoyt, in Exhibit 80, page 21, indicates that the entire stretch may be classified as either rapids or rapid water and the statement is verified by Miser in his San Juan report (Exhibit 56) which states that there are no quiet water stretches. Hoyt, based on the river survey and profile, notes 16 rapids having a total fall of 117 feet and an average rate of fall of 29.2 feet to the mile. Miser (Exhibit 56) notes the locations of 30 rapids based on observations made at the time the river surveys were made. In his

report and oral testimony, in shooting the worst rapid, Miser states that only the boatman stayed with the boat and at several the boats were lined through by hand and at one a portage of both the boats and the supplies was made.

Miser (Vol. 20, page 3743) states rapids occur at the following locations on San Juan River:

Above mouth Mile 124	Above mouth Mile 78
122.5	77.5
121.0	76.0
121.6	74.6
118.2	71
113.7	70.4
98.5	21.5
95.2	21.4
94.7	21
93	20
92.7	19.9
89.1	18.6
88.7	16.8
84.6	15.8
83.3	14.9
82.7	11.4
82.4	10.9
80	10.6
78.4	

Additional testimony as follows describes location and magnitude of rapids in San Juan River below Chinle Creek:

Jones (Vol. 3, page 376); Blake (Vol. 5, page 888); Allen (Vol. 12, page 2243); Loper (Vol. 12, page 2314); Mendenhall (Vol. 19, page 3473); Trimble (Vol. 21, page 3871).

Velocity

Testimony relating to stream velocity is very apt to indicate wide differences. This is due to the fact

that not only is there a very wide range in velocities throughout any cross section at any particular moment and a difference in velocity at every change in cross section and slope, even though the stream discharge remains constant, but also a change in velocity with every variation in flow. In other words, each change in volume of flow, slope of river, size or character of bed channel is accompanied by a change in velocity. Velocity characteristics can therefore be shown clearly only at sections where actual measurements of velocity have been made. These sections on the Colorado, Green, and San Juan are limited to localities where stream gaging stations have been maintained by the U. S. Geological Survey, and for the rivers in question are located at:

Green River, near Green River, Utah.
Colorado River, near Cisco, Utah.
Colorado River, at Lees Ferry, Arizona.
San Juan River at Goodridge bridge, near Bluff, Utah.

The velocity characteristics at these stations, based on measurements by the U. S. Geological Survey, are shown in Exhibits 82 and 82-A by Hoyt. As stated in the report and oral testimony, gaging stations are, of necessity, located where river-bed conditions are as favorable as possible, and where, considering the river, velocities are low and uni-

form. The exhibits represent minimum or fair conditions and do not apply to any section where rapids, riffles, or contraction in the channel occur. It was pointed out in oral testimony by Hoyt (Vol. 23, page 4154) that the velocities as shown for the Green River station near Green River, Utah, might be fairly indicative of velocities in the reasonably straight stretches of Green River located between the mouth of the San Rafael River and the mouth; that the velocities as shown for the Colorado River near Cisco, Utah, might be fairly indicative of the Colorado River between Moab and the mouth of the Green, with the exception of the section at The Slide; that the velocities as shown at the Lees Ferry gaging station might be fairly indicative of velocities through the Glen Canyon section except at those stretches which, on account of excessive slopes or contraction resulting from bedrock or gravel and boulder obstructions at the mouths of streams or washes have been characterized as rapids or rapid water stretches; and that the velocity records at the Bluff station might be fairly indicative of stretches on the San Juan other than those on which rapids occur.

Green River near Green River, Utah.—As shown on plate 2, Exhibit 82-A, the velocity in the thread of the current ranges from less than 2 miles an hour

at extreme low-water period when the flow is 1,500 second-feet or less, to 8 miles an hour at flood stage. The approximate number of days in each year when velocities occur between these two extremes are shown on Plate 7, Exhibit 82-A and indicate that for half the time the velocity exceeds 2.85 miles an hour and for half the time less. As heretofore pointed out these velocities would obtain approximately between the mouth of the San Rafael and the mouth of the river.

At the various riffles or rapids above the mouth of the San Rafael the velocities were estimated by Hoyt (Exhibit 75) to be about 6 or 7 miles an hour during a period having a volume of flow equivalent to about 2 miles an hour at the gaging station. Using the same ratio velocities at the rapids during flood stage would approximate and possibly exceed 20 miles an hour. The Army Engineers in State Exhibit 18 estimate velocities of 6 miles an hour during periods of fairly low flow.

Colorado River near Cisco, Utah.—As shown on Plate 2, Exhibit 82-A, the velocity in the thread of the current ranges from less than 1 mile an hour at extreme low-water period when the flow is about 1,500 second-feet, to 7 miles an hour at flood stage. As shown on Plate 7, Exhibit 82-A, the velocity exceeds 1.8 miles an hour for half of the time and

is between 1.0 and 1.8 miles an hour for half the time. As heretofore stated these velocities may obtain approximately in the stretch from Moab to the mouth of the Green except at The Slide. Above Moab, they will not apply between Castle Creek and Nigger Bill Creek where the slope is much greater. Velocities at The Slide were sufficient, as brought out in oral testimony, to almost entirely retard the upstream progress of a boat propelled by a 14-horsepower engine (Blake Vol. 30, page 5208) and at flood stage the velocity was such as to effectually prevent the City of Moab from going upstream. (Testimony of Lumsden, Vol. 4, page 670, and Anderson, Vol. 4, page 731.)

Colorado River at Lees Ferry, Arizona.—As shown on Plate 5, Exhibit 82-A, the velocity in the thread of the current ranges from 3 miles an hour during extreme low-water stage to $9\frac{1}{2}$ miles an hour at flood stage. As shown on Plate 7, Exhibit 82-A, for half the time the velocities exceed $4\frac{1}{2}$ miles an hour and for half the time range from 3 miles to $4\frac{1}{2}$ miles an hour.

These velocities are fairly indicative of the velocities in the so-called quiet water stretches which are shown on page 7 of Exhibit 80 and located between Miles 0 and 67.52, Miles 68.72 and 100.17, Miles 114.15 and 119.45, and Miles 120 and 147.92, above Lees Ferry. Elsewhere the slopes are

greater, the sections more contracted, and, under the laws of hydraulics, higher velocities must obtain. How much higher the velocities are can not be determined except by deduction. Almost without exception witnesses for the Government testified that rowing upstream in any stretch was practically impossible. If the average rate of rowing is 4 miles an hour, data already given show the slow progress that could be made upstream. Witnesses for the State testified that upstream progress was made by rowing and towing, an indication that velocities were probably in excess of 4 miles. Testimony by operators of motor boats showed slow upstream progress (Photograph 249, Exhibit 11D), but it was not always possible to differentiate between retardation due to shoals and bars and retardation resulting from velocities alone. As shown in the testimony of Freeman, Vol. 14, page 2571, Marrs, Vol. 13, page 2458, and other power-boat operators, they could make little or no progress through rapids and rapid water stretches; and the testimony of Johnson, Vol. 16, pages 3017, 3027, regarding the operation of the steamer Chas. H. Spencer, shows that a brake in the form of a 100-foot chain was used while going downstream in order to make steering possible. Other indications of high velocities are shown by the testimony of State witness Fotheringham, Vol. 28, page 4984,

relative to the inability to stop the dredge much short of Lees Ferry while they were making a move from one bar to another near the mouth of the San Juan River, and of the second Powell expedition as related by Jones (Exhibit 628, diary for October 4, 1871), when in the bedrock section during low water one boat hit bottom with sufficient force to break it. All evidence seems to indicate that for considerable portion of the river higher velocities than are shown at Lees Ferry for corresponding stages obtained. Col. Dent (Vol. 7, page 1285) testifies that in his judgment the only way a rowboat could have been taken upstream at the 19 rapids he noted in Glen Canyon, would be by dragging the boat by hand. Homer Hite (Vol. 20, page 3612) states how 13 men took 26 days bringing launch and rowboats up through Glen Canyon.

Considerable evidence (Chaffin, Vol. 30, p. 5313) was introduced by the State to the effect that rowboats have sailed up the Colorado River through portions of the canyon, including the stretch of river in which rapids are located. Since the prevailing wind is from the southwest in this region and at times blows through the canyon section with terrific force, it is possible that a sail might provide sufficient force to counteract the downstream velocity under such storm conditions (Photo. 40a, Ex. 77) even in the rapids.

Additional testimony showing velocities in Glen Canyon sufficient to retard upstream progress of boats is shown by the record as follows:

Aurand (Vol. 7, page 1373); Clark (Vol. 9, pages 1720, 1723); Clark (Vol. 10, page 1731); Gerdine (Vol. 10, page 1852); Edwards (Vol. 11, page 1978); McDonald (Vol. 12, page 2182); Marrs (Vol. 13, page 2462); Freeman (Vol. 14, page 2575); Johnson (Vol. 16, pages 3017, 3042); Bennett (Vol. 17, page 3182); Chaffin (Vol. 17, page 3270, Vol. 18, pages 3302, 3328).

San Juan River near Bluff, Utah.—As shown on Plate 4, Exhibit 82-A, the velocity in the thread of the current ranges from 2 miles an hour at the low-water stage to nearly 9 miles an hour at flood stage. Plate 7, Exhibit 82-A, shows that velocities exceed 5½ miles an hour for more than half the time. Miser, in his San Juan report, Exhibit 56, states that the velocity is fairly swift between the rapids and that during flood stage is so swift that experienced boatmen do not venture thereon during such periods. The average slope of its flattest section is 50 per cent greater (page 4, Exhibit 80) than the rapid water stretches of the Colorado River through Glen Canyon.

Variations of flow

Roughly speaking, over 35,000 observations of daily flow have been made by the Geological Sur-

vey from 1895 to date on Green, Colorado, and San Juan Rivers, at Lees Ferry and above. The results of these observations are shown on Exhibits 89 to 98. The actual daily variation in flow is shown graphically on plates making up Exhibit 79 and in tabular form in Exhibit 88.

It is obvious that in the brief only the high spots can be touched:

Green River at Green River, Utah (1895-1897, 1905-1928)

	Second-foot
Mean annual discharge.....	7,600
Minimum daily discharge.....	510
Maximum daily discharge.....	67,300
Ratio, maximum to minimum.....	132
Minimum mean month (November and December).....	1,770
Maximum mean month (June).....	26,250

Number of days in the year on the average the flow is below the mean discharge of 7,600 second-feet

January.....	31	July.....	13
February.....	27	August.....	27
March.....	26	September.....	28
April.....	16	October.....	30
May.....	1	November.....	30
June.....	1	December.....	31

Occurrence of floods—Average number of days in year flow exceeds

	10,000 second-feet	20,000 second-feet	30,000 second-feet
January.....	0	0	0
February.....	0	0	0
March.....	3	-1	-1
April.....	9	-1	0
May.....	27	14	5
June.....	28	18	11
July.....	14	3	1
August.....	-1	0	0
September.....	1	-1	0
October.....	-1	0	0
November.....	0	0	0
December.....	0	0	0

These records clearly demonstrate an extremely wide variation in flow, with low water occurring in all months except May, June, and July, during which three months 63.8 per cent of the total run-off occurs and with floods occurring in all the months except November, December, January, and February.

Colorado River near Cisco (1914-1917, 1923-1928)

	Second-foot
Mean annual discharge.....	9,660
Minimum daily discharge.....	866
Maximum daily discharge.....	73,200
Ratio, maximum to minimum.....	84
Minimum mean month (January).....	2,550
Maximum mean month (June).....	34,300

Average number of days in the year the flow is less than the mean discharge of 9,660 second-feet

January.....	31	July.....	9
February.....	28	August.....	26
March.....	30	September.....	28
April.....	15	October.....	29
May.....	-1	November.....	30
June.....	0	December.....	31

Occurrence of floods—Average number of days in year flow exceeds

	10,000 second-feet	20,000 second-feet	30,000 second-feet
January.....	0	0	0
February.....	0	0	0
March.....	-1	0	0
April.....	13	2	-1
May.....	30	22	13
June.....	30	27	16
July.....	13	3	1
August.....	4	0	0
September.....	+1	-1	0
October.....	+1	0	0
November.....	0	0	0
December.....	0	0	0

Sixty-five and three-tenths per cent of the total run-off occurs during the three months of May,

June, and July. Floods are common during all months except November, December, January, and February, and periods of low water in all months except April to July.

Colorado River at Lees Ferry (1922-1928)

	Second-feet
Mean annual discharge.....	19,500
Minimum daily discharge.....	1,000
Maximum daily discharge.....	119,000
Ratio, maximum to minimum.....	119
Minimum mean month (January).....	5,680
Maximum mean month (June).....	62,400

Average number of days in year the flow is less than the mean discharge of 19,500 second-feet

January.....	31	July.....	10
February.....	28	August.....	26
March.....	28	September.....	24
April.....	15	October.....	29
May.....	0	November.....	29
June.....	0	December.....	31

Floods of 30,000 second-feet and over have occurred in all months except November, December, January, and February, and 60.8 per cent of the total run-off occurs in the three months, May, June, and July. Low-water flows of less than 6,000 second-feet have occurred in all months except March to July.

San Juan River near Bluff (based on U. S. Geol. Survey records 1915, 1916, 1917; 1927 and 1928)

	Second-feet
Mean annual discharge about.....	4,070
Minimum daily discharge ¹	199
Maximum daily discharge ¹	51,100
Ratio, maximum to minimum about.....	257
Minimum mean month (December).....	824
Maximum mean month (June).....	9,960

¹According to testimony of many witnesses the San Juan has been entirely dry and, according to Water Supply Paper No. 309 (see page 27 of Exhibit 86) the flood of October 6, 1911, was estimated to be 150,000 second-feet.

Average number of days in year the flow is less than the mean discharge of 4,070 second-feet

January.....	30	July.....	12
February.....	27	August.....	25
March.....	25	September.....	24
April.....	9	October.....	24
May.....	1	November.....	30
June.....	3	December.....	31

Floods of 10,000 second-feet and more have occurred in all months except November, December, January, and February, and low-water periods of less than 1,000 second-feet occur in all months except April, May, and June; 62.9 per cent of the total run-off occurs in the four-month period, April to July.

Richardson (Vol. 20, page 3708) following observations extending over a year says, "during that period, I observed that the stream (Green River) was one of erratic and irregular regimen."

Rapidity of change in flow

The Colorado, Green, and San Juan Rivers, in common with all rivers draining an arid or semi-arid region, are subject to very sudden floods. The hydrographs of daily discharge (Exhibit 79) show vividly the rapidity with which the flow conditions change. A few of the more outstanding changes are noted on various exhibits as follows:

Green River at Green River, Utah

(Exhibits 97 and 94)

From 7,830 second-feet May 25, 1896, to 43,500 on June 3.

From 10,100 second-feet April 28, 1897, to 67,300 on May 29.

From 2,990 second-feet March 21, 1906, to 21,800 on March 28.

From 3,510 second-feet March 18, 1909, to 33,000 on March 24.

From 66,700 second-feet June 27, 1917, to 10,800 on July 30.

From 64,100 second-feet June 17, 1917, to 8,080 on July 15.

(Exhibits 79 and 94)

From 8,630 second-feet September 10, 1927, to 27,700 on September 14.

(Exhibit 75, page 6)

From 1,680 second-feet September 26, 1928, to 19,800 at 9.00 p. m., September 27.

Colorado River near Cisco, Utah

(Exhibits 79 and 89)

From 7,040 second-feet April 26, 1923, to 34,100 on May 12.

From 49,900 second-feet June 16, 1924, to 9,820 on July 7.

From 13,400 second-feet May 16, 1926, to 47,500 on May 27.

From 4,430 second-feet September 8, 1927, to 21,900 on September 13.

Colorado River at Lees Ferry, Arizona

(Exhibits 79 and 90)

From 181,000 second-feet June 18, 1921, to 28,100 on July 14.

From 16,000 second-feet August 17, 1921, to 64,100 on August 25.

From 12,500 second-feet April 22, 1922, to 119,000 on May 30.

From 9,310 second-feet September 18, 1923, to 47,800 on September 20.

From 119,000 second-feet July 1, 1927, to 17,700 on July 24.

From 14,400 second-feet September 9, 1927, to 110,000 on September 15.

San Juan River near Bluff, Utah

(Exhibit 96)

From 6,170 second-feet July 25, 1915, to 21,900 on July 28.

From 380 second-feet September 24, 1915, to 5,830 on September 27.

(Exhibits 96 and 79)

From 6,130 second-feet June 27, 1927, to 52,000 on June 30.

From 1,040 second-feet September 6, 1927, to 32,900 on September 10.

Love (Vol. 21, page 3824) records from actual observation 18.2 feet rise in 20 hours.

General.—Fortier and Blaney, Technical Bulletin No. 67, Department of Agriculture (Exhibit 68, page 5):

The greater part of the basin and more particularly that part just below the mouth of Green River, is subject to sudden violent rainstorms and resulting floods erode and carry off the unprotected surface soils. Most of the storms deluge small areas and their erosive action is proportionally limited but occasionally extensive areas receive downpours causing floods in several streams which transport large quantities of débris.

Miser, in "The San Juan River," Water Supply Paper No. 538 (Exhibit 56, page 55):

Floods in San Juan Canyon are numerous and disastrous. They are known to have reached stages as high as 50 feet in the narrower parts of the canyon. * * * Swept away practically all trees and shrubs from the bottom of the canyon. The floods rush down the canyon with such speed and rise so rapidly that all canyon voyagers * * * seek high ground for every camp site. * * * High waves and great speed that make boating in open rowboats impossible.

Gregory, "The Navajo Country," Water Supply Paper No. 380 (Exhibit 63, pages 101 and 102):

The amount and quality of rainfall and evaporation, the nature of the soil and of vegetation, the effect of recent erosion, and the work of the wind combine to produce

great and sudden fluctuations in the volume of water carried by the streams of the Navajo country. * * * On July 17, 1909, the San Juan River was three inches deep at Four Corners, and July 23 the water at Mexican Hat was 3 feet deep. Following rains of July 24 the river rose 8 feet. * * * In narrow, deep canyons the rise of water supplied by some insignificant tributary is sufficient to render the canyon impassable, a change which may come without warning. * * * The San Juan in January, 1905, discharged a minimum of 40 second-feet; in June of same year a maximum flow of 24,000 second-feet was recorded. * * * Those who are acquainted with the region retain vivid impressions of the rapid and unpredictable fluctuations of stream volume—impressions based on experiences which involve both hardships and danger. * * *

Quoting from Water Supply Paper No. 309 (Exhibit 86, page 248):

At Shiprock, New Mexico, * * * the maximum gage height was over 22 feet * * * and the maximum discharge was probably 150,000 second-feet. (Flood of October, 1911.)

La Rue, Water Supply Paper No. 556 (Exhibit 62, page 14):

The stream flow records which extend back about 30 years indicate that the maximum flood in Cataract Canyon has been about 150,000 second-feet, and at Lees Ferry about

200,000 second-feet. * * * Gage readings and traditional evidence * * *. It may be reasonable to assume that at this time (July, 1884) Green River was discharging 100,000 second-feet. This would indicate that the flood of 1884 reached a stage of 225,000 second-feet in Cataract Canyon. * * * By extending a well-defined rating curve for the Lees Ferry gaging station it was found that the flood of 1884 may have reached a stage of about 250,000 second-feet.

Variation in depth

To a limited extent the variations in flow are an index to the variations in depths. The observations at the various gaging stations are the best evidence of variations in depth, and detailed studies are contained in Exhibit 82 and Exhibit 82-A from which the following conclusions are drawn:

Green River at Green River, Utah.—On Plate 2, Exhibit 82-A, it is shown that the mean depth at the gaging station varies from less than 3 feet with discharge of 2,000 second-feet to a mean depth of somewhat over 12 feet at flood stage of between 30,000 and 40,000 second-feet. As shown on Plate 9 the mean depth at the gaging station for half of the time is less than 4.2 feet and less than 3 feet for 53 days on the average each year.

Depths in channel of Green River below Green River, Utah.—The detailed study of the physical characteristics of Green River (Exhibit 75) shows that during the periods of low and medium flow

shallow depths were invariably encountered across the head of the various riffles above the mouth of the San Rafael and across shoals or bars which exist in straight stretches between bends below the mouth of the San Rafael River.

Jones, second Powell expedition (Exhibit 628), in diary for September 9, 1871, makes the following observation on conditions in Green River below the mouth of the San Rafael:

Stopped raining, and we started again at 2.15 p. m. The river wide, still and very shallow * * * all the boats ran onto a sand bar. All were obliged to get out, the two boats in the rear were easily backed off. * * * The water grew more shallow until at last it was not more than 2 or 3 inches deep.

September 11, 1871:

The water of the river so thick with sand and mud we could scarcely drink it. * * * Got fast on sand bars several times during the day.

September 14, 1871:

We ran the entire length of Labyrinth Canyon and so far in this (Stillwater Canyon) finding nothing to stop us but *sand bars*.

September 15, 1871:

We were obliged to wade over a sand bar to get our boats into the water of the latter stream (Green to Colorado).

Stanton records in Field Notes (Exhibit 176).
May 25, 1889:

3.00 p. m. we started again. At 4 came to our first small rapid (may be Auger, Mile 112 above mouth WGH). Water shallow. rocks. *Denver* stuck on rocks and stove three holes in her bottom. All hands jumped into river and carried rest of fleet over safely.

May 26, 1889:

Floated down river without incident except several very small rapids, all easy. Brown ran the *Ward* against gravel bottom in one shallow place; no damage.

Dent (Vol. 7, page 1240) notes depths and groundings of a boat drawing about 2½ feet of water as follows in Stillwater Canyon near the mouth during investigations of September, 1929:

Depth	Depth
Miles above mouth:	Miles above mouth:
0----- 4 feet.	3----- 7 feet.
¼----- Heavy grounding.	3½----- Grounding.
1¼----- 5 feet.	3¾----- 4 feet.
1¾----- Grounding.	4½----- 4 feet.
2¼----- 6 feet.	4¾----- Grounding.
2½----- +8 feet.	5----- 8 feet.
2¾----- 3 feet.	

Took four hours to go the above 5 miles and waded around on bars looking for deep enough place to float the boat.

Additional testimony indicating shallow depths in Green River is contained in the record, as follows:

Hoyt (Vol. 1, page 159; Vol. 2, pages 184, 200); Lunsden (Vol. 4, page 667); Anderson

(Vol. 4, pages 726, 737); Kolb (Vol. 4, page 790; Vol. 5, page 821); Blake (Vol. 5, page 912); Galloways (Vol. 6, pages 112, 1126, 1144); Baldwin (Vol. 6, page 1189); Aurand (Vol. 7, page 1354, bars mile 2, 4, 14, 18, 20, 23, 24, 25, 27, 30, 31); Lint (Vol. 8, page 1480); Dellenbaugh (Vol. 9, page 1528); Clark (Vol. 9, page 1710); Stone (Vol. 10, page 1782); Rodin (Vol. 10, page 1802); Woodbury (Vol. 10, page 1816); Edwards (Vol. 10, page 1907); Kane (Vol. 11, page 2003); Sawyer (Vol. 11, pages 2099, 2113); McDonald (Vol. 12, page 2173); Loper (Vol. 13, page 2347); Bennett (Vol. 17, page 3225); Newby (Vol. 17, page 3244); Yokey (Vol. 18, pages 3425, 3440); Reeside (Vol. 21, page 3925); Nye (Vol. 24, page 4183); Ross (Vol. 24, page 4198); (Photographs as follows: Ex. 77, Nos. 22, 23, 26, 31, 32, 111).

Colorado River near Cisco, Utah.—On Plate 3, Exhibit 82-A, it is shown that the mean depth at the gaging station varies from less than 3 feet when the discharge is about 2,000 second-feet to mean depths of 20 feet with flood flows of 60,000 to 70,000 second-feet. As shown on Plate 9, Exhibit 82-A, the mean depth for half the time is less than 3.8 feet.

Depth in channel

Mouab to mouth.—Testimony by W. G. Hoyt (Vols. 1 and 2), based on observations described on pages 73 and 74, Exhibit 75, indicates that the deepest part in cross section at the following locations was, in general less than 2.5 feet during the period,

October 18 to 23, 1928: Miles 3.5, 4, 4.9, 7.8, 10, 11.8, 14, 16.5, 19.5, 21, 21.5, 22, 28, 29.5, 31.8, 33.8, 36.5, 39, 40, 43, 46.5, 48.5, 49.5, 50, 50.6, 53.9, 54.2, 54.4, 55.5, 56, 57, 59, 61, 62.8, 64.4, and 64.8 above the mouth of the Green River.

Testimony by Col. Dent (Vol. 7, pages 1234 to 1238) indicates that when he made his examination beginning August 25, 1929, depths were such that boats drawing about 2½ feet grounded at the following locations when the flow was about 6,000 second-feet (according to page 37, exhibit 88, on the average there are 228 days in the year when the flow is less than 6,000 second-feet): Miles 64¾, 64, 63, 57¾, 57¼, 57, 56½, 55½, 54½, 53¾, 53, 49½, 46, 43½, 43, 41½, 41, 40¾, 40, 35, 34, 32½, 28½, 27, 25, 24½, 23, 22¼, 21½, 21, 19¾, 19½, 19, 17½, 16½, 15¾, 14¾, 14½, 13¾, 12, 11½, 10¾, 9¾, 8¾, 8, 7½, 4, 1¾, 1½ above the mouth of the Green River.

Shaw (Vol. 20, page 3658) notes frequent groundings with boat drawing between 6 inches and 8 inches of water.

Testimony by Virgil Baldwin (Vol. 6, pages 1163, 1174, 1182) and numerous others, as listed below, indicates that the depths are so shallow that boats drawing less than 2½ feet frequently ground.

The detailed study of physical characteristics as contained in Exhibit 75 shows that the most common depths at the bends and between the bars is between 3 and 5 feet, while the depths across the

shoals and bars which extend across the river between the bends are between 1 and 2 feet:

Baker (Vol. 1, page 111); Blake (Vol. 5, page 925); Clark (Vol. 5, page 966); Gallows (Vol. 6, pages 1049, 1134); Baldwin (Vol. 6, pages 1163, 1174, 1182); Dobbin (Vol. 7, pages 1319, 1333); Aurand (Vol. 7, page 1349, bars at miles 64, 63, 56, 46, 44, 33, 32, 30, 28, 26, 2); Cleary (Vol. 16, page 2898); Edwards (Vol. 16, page 2961); Dugan (Vol. 16, page 2990); Reeside (Vol. 21, page 3924); Nye (Vol. 24, page 4185.)

Channel depths in Cataract Canyon.—There has been no direct testimony with regard to depths in Cataract Canyon. The rowboats which have gone downstream through this stretch of water had drafts of between 6 inches and 18 inches. There was no evidence that these boats grounded between the rapids and it may therefore be assumed that channel depths between the rapids generally exceeded 18 inches. Evidence shows that the majority of rapids in Cataract Canyon have been formed by an accumulation of boulders and large rocks in the channel over and around which the water passes. It is evident that under such conditions depths may range from zero where the boulders stick out of the water to several feet between them. The velocity of the water is so great that the sand and gravel bars which predominate behind the riffles on the Green River are not formed in Cataract Canyon. The river is narrower and depths are

therefore greater than in sections of the river upstream and downstream.

Channel depths in Glen Canyon.—Stanton's field notes (Exhibit 176) records the following indications of channel depths:

December 10, 1889:

* * * At about 2.15 we came to Trachyte rapid (161 miles above Lees Ferry WGH) * * * McDonald was entirely undecided which channel to take. * * * Started down the center channel. We had not gone more than 200 feet when we commenced bumping on the rocks, and in a few moments we were stranded. Boats 2 and 3 were close behind us and went bumping over the rocks, but did not stick.

December 13, 1889:

Just above California Bar going over riffle (Mile 130 WGH) our boat and No. 2 swamped on the rocks.

December 14, 1889:

Today the water was so low we got through with great difficulty. No. 1 went through without touching, but No. 2 struck several times, and No. 3 stuck on the rocks. We then found a mess of shallow water formed by flat shelves of rock running across the river and downstream for half a mile. (Mile 112.) We found the water so shallow that we could not get our boats through loaded—made portage of 800 feet. Mac and Gibson run the boats through light. * * *

December 15, 1889:

* * * They found we could not get our boats through loaded over the half-mile shoal below.

December 16, 1889:

* * * commenced our portage at 7 a. m. * * * distance of portage 2,475 feet—started 10.45, at 12 M. came to head of long shoal which on last summer's trip (July, 1889) was simply swift water. We started our boats with only three men in to make them lighter. No. 1 went through the first three-fourths mile without grounding, but No. 2 and No. 3 both grounded on gravel and worked for some time to get off. Succeeding at last all hands got aboard, and we started down the remaining three-fourths mile. In about 1,200 feet all boats got stuck on flat shelf of rock and after various efforts with two men in the water we got under way again at 3 p. m. Below this, 1½ miles of shoal. This work is very hard and fatiguing. These shoals seem to occur now where we had simply swift water before * * *.

Jones, with the second Powell expedition, notes in his diary (Exhibit 628):

October 2, 1871:

Started again at 1 p. m. and ran 11 miles. Ran five shallow rapids, on one of which the Emma stuck, the Nellie twice. (Mile 158 to 168 above Lees Ferry.)

October 3, 1871:

Ran nine small rapids, most of them long with small waves and some quite shallow, * * * ran three long shallow rapids, getting aground once. (Mile 124 to 152 above Lees Ferry.)

October 4, 1871:

Broke camp at 7.50 a. m. and pulled out steadily for about 8½ miles, when we came to a long shallow; wound slowly along among the rocks, striking occasionally, until at last the Emma Dean hung on the bottom, and soon the Nellie Powell was fast. All hands in the water most of the time for an hour, making little more than a mile. * * * Continued to find shoals with rock bottom; current usually slow, but sometimes quite swift. In one of these places the Nellie struck with such force as to break a board in the center cabin.

October 5, 1871:

running 5 rapids, 2 big ones at the head of one Nellie got aground.

Dellenbaugh in "A Canyon Voyage" (Exhibit 14) describes similar shallow depths.

Exhibit 619, page 119, Annual Report U. S. Coast and Geodetic Survey, 1922.—Kolb (Vol. 4, page 796), (Vol. 5, pages 807, 841, 850); Galloway (Vol. 6, page 1147); Nims (Vol. 7, page 1414); Lint (Vol. 8, page 1487); Clark (Vol. 9, page 1717) (Vol. 10, page 1731); Stone (Vol. 10, page 1789); Rodin (Vol. 10, page 1808); Gerdine (Vol. 10, page 1852);

Edwards (Vol. 10, page 1889); Kane (Vol. 11, pages 1993, 2016); McDonald (Vol. 12, page 2179); Allen (Vol. 12, page 2245); Rust (Vol. 12, page 2287); Loper (Vol. 13, page 2343); Mars (Vol. 13, page 2453); Thomas (Vol. 13, page 2489); Barnes (Vol. 13, page 2535); Freeman (Vol. 14, page 2580); Johnson (Vol. 17, page 3075); Palmer (Vol. 17, page 3105); Miser (Vol. 21, page 3773); Stabler (Vol. 22, page 4054), all describe the shallow conditions at rapids and shoals. Testimony of both Dent and Hoyt showed that in silt-laden rivers, such as the Colorado, Green, and San Juan, bars or shoals would form in straight stretches between the bends, across which there might be no channel. That this is true of the rivers in question was amply shown by many competent witnesses.

Dent (Vol. 7, page 1256) noted frequent groundings a part of which were recorded as follows: Between North Wash and Lees Ferry in early September, 1929, the boat he was using ran smoothly where depths were 1½ feet and greater and dragged at lower depths—134¼, 126, 124, 108½, 46¼, 36.

San Juan River near Bluff.—On Plate 4, Exhibit 82-A, it is shown that the mean depth at the gaging station varies from less than 1 foot when the discharge is about 300 second-feet or less to between 10 and 11 feet with flood flows of 20,000 second-feet. As shown on Plate 9 of Exhibit 82-A the mean depth is less than 2 feet on the average of 165 days in each year.

Testimony in the record as follows shows clearly that the greater part of the time the San Juan River is extremely shallow:

Jones (Vol. 3, page 371); Adams (Vol. 3, page 432); Nielsen (Vol. 3, page 445); Raplee (Vol. 3, page 468); Blake (Vol. 5, page 890); Newkirk (Vol. 4, page 582); Hyde (Vol. 4, page 615); Weatherills (Vol. 9, pages 1601, 1655, 1665); Hyde (Vol. 9, page 1689); Rust (Vol. 10, page 1837); Zahns (Vol. 11, pages 2042, 2077); Allen (Vol. 12, page 2239); Loper (Vol. 12, pages 2313, 2332); Bennett (Vol. 17, page 3223); Miser (Vol. 21, pages 3764, 3767, 3790).

Silt and sediment

In discussing the formation and transportation of silt and sediment in the Colorado, Green, and San Juan Rivers, consideration must be given to the climatic and topographic conditions existing in their basins. The region is distinctly arid and therefore there is little plant life to act as a protective blanket to the surface. Consequently, the precipitation, which often occurs in the form of heavy downpour, runs off rapidly and carries with it soil which later appears in the rivers as sediment. Love states (San Juan, Vol. 21, p. 3824) that the amount of silt varied from less than 1 per cent on September 20, 1929, to over 40 per cent by weight on September 21, 1929, following a rain of over $\frac{1}{2}$ inch on the 20th with no rain for 8 days prior. (U. S. Weather Bureau, September, 1929.)

The extent of the erosive action of the water is evidenced by the fact that only remnants of the Colorado River plateau remain. Each gully, wash, and canyon, is mute evidence of erosion and topographic features of all grades show the influence of aridity.

Besides the material brought into the river by side tributaries or blown in by the wind (Photo Exhibit 20), the river's own powers of erosion are a source of sediment supply caused by gradually wearing away their rock walls or undermining their banks.

As a result of these conditions the Colorado River system carries more suspended matter per square mile of drainage area than any other river in the United States. (Denudation by R. B. Doyle and H. Stabler, pages 78 to 93, U. S. Water Supply Paper No. 234, Government Printing Office, 1909.)

The following testimony all based on actual observations made since 1909 when Water Supply Paper No. 234 was prepared is a partial indication of the actual amount of suspended matter carried by these streams.

Green River.—According to Fortier and Blaney (Exhibit 68, page 17) as digested by Hoyt (Exhibit 75, pages 76, 77), the amount of silt carried past Green River in *suspension* during the 12-month period August, 1914, to July, 1915, was 8,332,900 tons. This is exclusive of sediment brought in by Saleratus Wash and San Rafael River and includes *no bed load*.

C. S. Howard (Vol. 21, page 3802), based on much more complete basic information than was available to Fortier and Blaney, estimates that during the period October 1, 1928, to September 30, 1929, the Green River carried 50,700,000 tons of sediment in suspension.

Colorado River near Moab.—According to Fortier and Blaney (Exhibit 68, page 17), as digested by Hoyt (Exhibit 75, page 77), the amount of silt carried past the gaging station on Colorado River near Cisco in *suspension* during the *nine-month* period November, 1914, to July, 1915, was 9,110,000 tons. This is exclusive of sediment carried by Court House Wash, Mill Creek, and other washes and includes *no bed load*.

C. S. Howard (Vol. 21, page 3805), based on much more complete basic information than was available to Fortier and Blaney, estimates that during the 12 months ending September 30, 1929, the Colorado River carried 25,000,000 tons of suspended matter.

At Lees Ferry.—C. S. Howard (Vol. 21, page 3805) estimates that during the 12 months ending September 30, 1929, 131,000,000 tons of suspended matter was carried in Colorado River past Lees Ferry.

San Juan River

At Goodridge Bridge near Bluff.—According to Fortier and Blaney (Exhibit 68, page 17) as

digested by Hoyt (Exhibit 86, pages 15, 16), the amount of silt carried past the Goodridge Bridge in *suspension* during the period November, 1914, to August, 1915, amounted to 16,638,000 tons. It is estimated by Hoyt (Exhibit 86) that the total amount of silt carried by the San Juan in *suspension* and as *bed load* during the course of a year is between 16,000,000 and 100,000,000 cubic yards, and in all probability nearer the greater of the two estimates.

Howard (Vol. 21, page 3805) estimates that during the 12-month period ending September 30, 1929, 60,200,000 tons of suspended matter passed the Goodridge bridge. Love (Vol. 21, page 3840), based on actual measurement made to determine silt content, estimates that between July 10 and October 1, 1929, alone 150,000,000 tons passed the gaging station in suspension, and that at times as much as 40 per cent by weight of the water was sediment (Vol. 21, page 3825). During one day, September 21, 1921, Love estimates that 20,000,000 tons were carried by the San Juan River. (Vol. 21, page 3826.)

Silt, General.—The estimates by Howard and Love (Vol. 21) being based on actual measurements made by the U. S. Geological Survey for the purpose of determining the actual quantities of sediment, are as accurate as any that can be made.

Although to date the laws governing the habits of silt-laden streams have not been well established, their characteristics are fairly well known. It has been established quite definitely that the higher the velocities in the stream the more sediment will be carried in the channel, and vice versa, and also that the amount of sediment transported has a relation to the size and character of the sediment and the shape of the channel. As pointed out by Howard, Vol. 21, page 3810, there is no uniformity in the rate of movement of the sediment or in its distribution in the cross section. As a result of these conditions there is a variation in the amount carried past any particular point ranging from a few thousand tons per day to as much as 20,000,000 tons a day. (Love, Vol. 21, page 3826.) This is the natural result of the wide range in channel velocities shown to exist and which result in a continual process of scour and fill; a building up of bars in one place and tearing down in another; a sorting and redistributing of the millions of tons of sediment; a movement at times in the form of sand waves of the entire bed of the stream. These conditions account for the instability of the beds of the Colorado, Green, and San Juan Rivers.

Unstable channel

Evidence shows that with respect to sand bars and gravel bars the rivers divide into fairly definite

sections where one or the other predominates. On the Green River above the mouth of San Rafael, the bars are gravel almost without exception. Below the mouth of the San Rafael the river bed is in sand and silt without exception. On the Colorado River gravel bars occur in the short stretch between Castle Creek and Nigger Bill Creek and frequently at the mouths of creeks, drains, and washes in the Glen Canyon section. Elsewhere, excluding the Cataract Canyon section and the section where bed-rock is near the surface, the bed of the river is sand and sediment. As Howard points out (Vol. 21, page 3811), there is a continuous change taking place in the beds of rivers having sandy beds.

In the cataract section of the Colorado velocities are apparently such that the only sediment in the river bed consists of large boulders.

On the San Juan River (Exhibit 56), where the gradient of the river is high, that is, exceeds 5 feet to the mile, at the mouth of tributaries and washes, the *débris* consists chiefly of heavy gravel and boulders. Elsewhere sand is prevalent; some of which is in the form of exposed bars which may rise above the water in islands or submerged from a fraction of an inch to greater depths. The profile prepared by Miser (Plate XXII of Exhibit 56) shows that well over 90 per cent of the bed of the San Juan is in sand.

It is a well-known scientific fact that flowing water is capable of moving sediment ranging in size from the finest débris to large boulders. The method of movement varies; fine material is carried in suspension; medium-sized material slides or makes short skips, the larger rocks and boulders roll. (Howard and Love, Vol. 21.) On the Colorado and San Juan Rivers the movement of sediment may take place in the form of waves. The character and amount of material which will move depend primarily upon the velocity, the size, and amount of the sediment, and, to a limited extent, upon the shape of the channel. (Howard, Vol. 21, page 3810.)

It is clearly evident that the Green, Colorado, and San Juan Rivers can not have stable or permanent channels since their beds are composed of sand, silt, and sediment of varying degrees of fineness and channel velocities range from 1 or 2 miles an hour to over 10 miles an hour. Scientific deduction leads to this conclusion. The conclusion is supported by actual observations, technical and otherwise, as follows:

Green River

Green River, Utah, to mouth of San Rafael.—The unstability of the bed at the Green River gaging station is shown on Plate IV, Exhibit 76.

A few cross sections show change over half the width of the river averaging 8 inches to over 1 foot and in the other half of the section changes of 4 feet and averaging 2 feet.

The text of Exhibit 75 and plates of Exhibit 76, when taken in connection with the Army Engineers' surveys, Exhibits 480 to 489 and 490A show radical changes have taken place between 1909 and 1928 in channel conditions at the various bars and riffles and also that there has been a decided increase in the flood channel of the river. See also testimony relative to changing condition of Green River, by Dent. (Vol. 7, p. 1251.) For evidence of unstable conditions of bank see photographs in Exhibit 77, as follows: 1, 4, 5, 6, 7, 8, 9, 14, 16, 17, 19, 21, 22, 27, 33, 33A, 101, 102, 108, 109. In other words, except where the channel abuts against rock or rock talus, there is little or no permanency in either bed or banks of Green River between Green River, Utah, and the mouth of the San Rafael.

Oral testimony by State witnesses tended to show that the only changeability in channel occurred at bars formed at the mouths of side streams and washes and at these localities conditions soon become normal when the river has washed the débris away. In connection with this testimony it should be noted that according to exhibit 75 only

the following bars and riffles are the result of debris washed in by side drainage:

Name:	Location (miles from mouth)
Browns Bar.....	117.1
Auger.....	112.5
Halverson.....	108.5
San Rafael.....	94.9

Surveys and comparisons show that not only are these bars not permanent (except as to general location) but that the other bars, namely, Mohre, Two-mile, Butterfly, Farrer, Cable, Crossing, Mile 109, Mile 106.7, Gimlet, Sunaba, Second Anvil, and First Anvil, which have not been formed by side washes, are not permanent except as to general location. As an indication of the magnitude of bars which may temporarily be formed by side drainage, Wolvertson (Vol. 51, page 5393) testified for the State that at the mouth of Indian Creek on the Colorado a bar was formed by side drainage which backed the water up 5 or 6 miles. The slope of the river at this point is such that a dam 6 feet high must have been thrown up extending across the river.

Green River: Mouth of San Rafael to mouth.

Colorado River: Moab to Lees Ferry.

Throughout the oral testimony the word bar was used loosely and in general without definition. The attention of the court is called to the following discussion of bars from Exhibit 75, pages 63 to 76, which describes actual conditions in Green and Colorado Rivers and scientific reasons therefor. (See also Dent Vol. VII, p. 1219.)

Bars—General.—As indicated by the large-scale surveys (Exhibit 76) the principal permanent features of the Green River are its rock walls. These walls, however, are rarely closer than 1,500 to 2,000 feet; therefore, the river although in canyon has considerable freedom of action and meanders in an alluvial channel, cutting the banks where they are exposed to the thrust of the current and building up bars where the velocities diminish. The river is constantly shifting, sorting, and redistributing the enormous volumes of silt and sediment brought into it in suspension and bed load.

The bed of the Green River between the San Rafael River and its mouth and the Colorado River from the mouth of the Green River to Moab was found to be sand of various degrees of fineness. As is to be expected in a river flowing in a bed composed of fine material, the bed, although most irregular, had characteristics which are common to channels in unstable material. Within the limits of the rock walls the river is flowing in a channel unstable as to bed and banks, but at the same time having certain prominent features, such as side bars and crossing bars, which are common to all rivers flowing in alluvial material. The crossing bars are probably the most troublesome as far as depth and permanency of channel are concerned. Since these crossing bars are for the most part submerged, it is practically impossible to map them.

Although all rivers naturally seek meandering courses, with resultant swifter current and well-defined channels next to the concave shore, if they are to arrive finally at a destination, reverse curves are necessary. With few exceptions crossing bars are coincident with all such reversals.

It is apparent that the reversal of the current from one bank to the other is the primary cause of crossing bars. (Photo 5, Exhibit 145.) These bars extend across the river diagonally and average in length from 1,000 feet to more than 3,000 feet. It is evident that when the river is at flood stage the channel is full from bank to bank. Velocities in the cross sections are, however, known to vary within wide limits, even where the cross section is regular and the channel straight. Each change in the cross section or direction of the river is attended by a redistribution of velocities in the cross section and a change in the direction of the thread of maximum velocities. These changes in velocity give rise to the formation of whirlpools, eddies, and backwater, with the resultant decrease in the velocity and a partial or complete deposition of sediment carried in suspension or as bed load. When the direction of current is changed as a result of a reversal of curvature of the channel, there is change in the distribution of velocities. The thread of maximum velocity which, as a result of centrifugal force, follows the concave bank is diverted diagonally across the channel and downstream. The reduction in the velocities parallel to the thread of

the current is apparently sufficient to cause a complete or partial deposition of load resulting in the building up of long diagonal bars (Photo No. 16, Exhibit 145), paralleling approximately the thread of the velocity (Dent, Vol. VII, p. 1219). The assumption that these crossing bars, more especially those composed of the finer materials, are continually changing their size, shape, and location is logical when it is considered that not only does the position of the thread of the current change appreciably with each change in flow, but also during low stages when changes in flow are minor, the material cut from the lower side bars drifts along to be deposited in the wider cross sections at the crossing bars. Dent (Vol. 7, p. 1222) says:

This bar (crossing) would ordinarily be built up during any freshet. It will occupy the same general position each year, but its form may be entirely different from year to year.

The bars which form along the inside of the bends, the general character of which has been shown by large-scale surveys (Exhibit 76), fall in three general types. *First*, the bars that are partially awash during low-water periods; *second*, extensive sand bars having an average height of 4 to 6 feet above the water; and *third*, the willow-covered bars and benches ranging 12 to 15 feet in height.

The bars that are practically awash at the lower stages are the result of the lowering of the velocity

in the cross section next to the inside of the bends resulting from eddies and backwater. The material making up these bars is so fine that their surfaces can be seen to be in constant motion. The particles shift and move around with the smallest disturbances in the water. The material in these bars is so fine that the pressure of the little finger was frequently sufficient to sink out of sight the 8-foot sounding rod which was one-half inch in diameter. It is clearly evident that these portions of the river bed are, accurately speaking, in a constant state of change caused by all changes in velocity due either to change in stage or ripples and waves caused by wind.

The sand bars which lie between 4 and 6 feet above the water are apparently formed during ordinary floods. Between such floods they are subject to minor changes as a result of the gradual washing away of their edges where exposed to the current, the gradual building along their downstream slopes, and surface changes resulting from wind movement. It is Hoyt's conclusion that (Exhibit 75, page 67) many of the changes occurring at the crossing bars during low and medium stages are a result of the gradual wearing away of these low bars. The formation of the higher willow-covered bars or benches is not so easily analyzed. These bars or benches, which extend probably for one-half the distance through the canyon, form the flood channel limits for all except the most extraordinary floods. It is evident that they are composed

of sediment brought into the canyon section, and their height above the normal water surface indicates that such deposits could have been laid down only during the most extreme floods. All ordinary floods cut these banks rather than add to their height. It seems evident, therefore, that these enormous flats or, in reality, bars, many of which contain from 1 to 5 million cubic yards, are the result of extreme floods and that except for side cutting and surface erosion they are fairly permanent for long periods of time. Their presence may also be explained as a result of a change in flow conditions resulting from changes in climate. In the canyon sections we therefore have three degrees of permanency:

First, the bed of the low-flow channel of which the crossing bars are a part which, to speak accurately, is constantly shifting as the result of a rearrangement of the finer materials of which it is made up and of the constant addition of material brought into the section both in suspension and as bed load.

Second, the sand bars which lie from 1 to 5 feet above the water at low-flow stages and which are fairly permanent for periods between ordinary high-water stages. Such minor changes as take place consist of the gradual cutting and sloughing off along the edges and changes in surface configuration due to wind.

Third, the large willow-covered flats which are permanent for long periods between exceptionally high floods except for spasmodic cutting along their

edges during ordinary flood periods and by surface erosion.

It is roughly estimated that the amount of canyon fill in these bars, including only that part lying above the bed of the river, ranges from about 1,200 acre-feet to the mile in stretches where small bars predominate to 3,000 acre-feet to the mile in stretches where bars similar to the Tuxedo Bar, mile 23 (Plate 33, Exhibit 76), predominate. An estimate of 1,000 acre-feet to the mile for the 95-mile stretch would be conservative, or a total of 95,000 acre-feet which does not include an undetermined amount which may be over 100 feet deep. This amount represents very roughly the canyon fill between the San Rafael River and the mouth of the Green River, which is now subject to change. Enormous amounts of sediment which may easily exceed 25,000,000 cubic yards per year are being carried into the canyon as the result of erosion in the whole area tributary to the Green River. Whether the Green River is now transporting to its mouth all the material brought in is a matter of speculation. It is doubtful if information is available that would demonstrate conclusively whether in the long run the channel is aggrading or degrading. The Green River, through the greater part of its course between the town of Green River, Utah, and the mouth of the San Rafael River and in all its course below the mouth of the San Rafael River, is flowing in a channel of unconsolidated

material which, within the limits of the rock walls, is unstable.

Photographs as follows show the nature of the exposed bed, bars, and banks from which it can be seen that conditions can not be permanent:

Exhibit 77, photos. Nos. 37, 38, 42, 48, 49, 54, 55, 58, 61, 62, 64, 116, 118, 119, 120, 121, 122, 123, 124, 125, 127, 128, 129, 130, 131, 132, 134, 135, 137, 138, 139, 140.

Exhibit No. 10, the plan and profile show that in this stretch the average slope is only 1.17 feet to the mile.

It is evident that at times the velocities are so low that large quantities of sediment shown to be carried by Green River past Green River, Utah, are temporarily deposited in the river bed. Scientific and other testimony shows that such deposits occur primarily along the insides of bends and in the straight stretches between bends. The reason for this has already been described, based on studies by Hoyt, in Exhibit 75, and by oral testimony of Col. Dent and others, and is a subject on which most students of river hydraulics agree. Testimony offered by the State attempted to prove that with frequent operation of boats a channel could be maintained through these bars. Such a contention is contrary to scientific observations. Sawyer states (Vol. 20, page 3693) it looked to him as if the entire bottom of Green River was moving out.

Additional testimony showing the shifting character of the bed of Green River is contained in the

record, as follows: Hoyt (Vol. 1, page 159 to 173, Vol. 2, pages 184-200); Lumnsden (Vol. 4, page 672); Kolb (Vol. 5, page 827); Blake (Vol. 5, page 954); Galloway (Vol. 6, page 1058); Edwards (Vol. 11, page 1953); Sawyer (Vol. 11, page 2119); McDonald (Vol. 12, page 2195); Loper (Vol. 13, page 2408); Newby (Vol. 17, page 3259); Yokey (Vol. 18, page 3425); Richardson (Vol. 20, page 3692); Hoyt (Vol. 23, page 4124); Ross (Vol. 24, page 4233).

Colorado River from the mouth of the Green to Moab.—Except at The Slide and perhaps one or two isolated localities, the Colorado River between Moab and the mouth of the Green River flows in a canyon fill of unconsolidated shifting sand and silt. (Exhibit 75.) The limits of horizontal shift are fixed by the adjacent rock walls and talus slopes, but between these limits the river meanders similarly to the Green. Any one of the bars shown on Plates 30 to 33 (Exhibit 76) could, with a few changes in general dimensions, be used to illustrate bars along the Colorado. Roughly, there are about 2.7 acres of low exposed sand bars to the mile along the Colorado compared to about 1.4 acres to the mile along the Green below the San Rafael. This ratio would probably hold true for the submerged crossing bars. All side and crossing bars are noted with appropriate symbols on the river-survey maps, Plates 44, 45, and 46. (Exhibit 78.) Outstanding bars with shallow depths were observed at Mile 3.5, 4, 4.9, 7.8, 10, 11.8, 14, 16.5, 19.5, 21, 21.5, 22, 28,

29.5, 31.8, 33.8, 36.5, 39, 40, 43, 46.5, 48.5, 49.5, 50, 50.6, 53.9, 54.2, 54.4, 55.5, 56, 57, 59, 61, 62, 62.8, 64.4, and 64.8. Most of these bars are in straight stretches of the river and there is every reason to believe that under the same flow conditions they maintain about their same relative position. However, long periods of uniform flow are unusual and with variable flow the unstable condition of crossing bars previously discussed will prevail. Without exception the channel depths across these bars are shallow. The most common channel depths at the bends and between the bars ranged from 3 to 5 feet.

The drainage area tributary to the Colorado River below Moab is approximately twice as large as the area contributing to the Green below the mouth of the San Rafael. Courthouse Wash and Mill Creek, discharging into the Colorado River in the vicinity of Moab, and Kane Spring Wash, Lockhart Creek, Indian Creek, Salt Creek, and Red Lake Canyon coming in below Moab, all drain extensive areas subject to erosion. The load carried by these tributaries during floods may have produced a considerable amount of the canyon fill, because there is indication that during such periods they may fill channels 100 feet wide and 10 feet or more deep with a velocity sufficient to roll and otherwise move large boulders. About 40,000,000 cubic yards of sediment may pass Cisco during a year.

Photographs as follows show the nature of the exposed bed, bars, and banks between Moab and the mouth of the Green River:

Exhibit 77, Photographs Nos. 70, 71, 75, 77, 84, 86, 150, 151, 153, 155, 156, 158, 160, 163, 165, 167, 168. A complete description of the temporary nature of the typical side sand bar is described on page 71. Exhibit 75, and plate 36 of Exhibit 76.

Testimony of Virgil Baldwin, who has made more boat trips on Colorado River below Moab than all the rest of the witnesses put together, proves conclusively that conditions on the Colorado River are similar to that already described on the Green River and that the river throughout, except at The Slide, flows over unstable, shifting, unconsolidated mass of sand and silt so spread out that the channel, if any, is obscured.

Dent (Vol. 7, page 1227) describes the Colorado River as very changeable between its rock walls.

Richardson (Vol. 20, page 3692) describes shifting character of the bed of Colorado River at its junction with the Green River.

Additional testimony with reference to the shifting character of the bed of the Colorado River downstream from Moab is contained in the record as follows: Hoyt (Vol. 2, page 210); Prommel (Vol. 6, page 1034); Baldwin (Vol. 6, pages 1166, 1180, 1184); Galloway (Vol. 6, page 1055); Cleary (Vol. 16, page 2926); Edwards (Vol. 10, page 1909); Dugan (Vol. 16, page 2992); Ross (Vol. 24, page 4307); Baldwin (Vol. 29, p. 5074).

Colorado River

Through Cataract Canyon.—No evidence has been introduced to show that there is decided shifting of river bed in this stretch. Kolb, who has been through this stretch twice, testified to always looking each rapid over before running it the second time, since there is often a rearrangement of the boulders and rocks in the rapids. No one person had made a sufficient number of trips or observations in Cataract Canyon to be in a position to testify conclusively that changes of great magnitude occur in the cataract section.

Glen Canyon Section.—The most exact information relative to the shifting character of the bed of Colorado River in the Glen Canyon section, except at those sections where gravel bars or bedrock occur, is contained on Plate II-A and Plate III-A of Exhibit 82A. These cross sections are based on actual observations of depth made by engineers of the U. S. Geological Survey in connection with their determination of daily discharge. They show conclusively that scour and fill amounting to as much as 17 feet has occurred in the river bed and that the average scour and fill across the entire cross section has amounted to 12 feet. Plate III-A especially shows the rapidity with which the river has scoured as shown by a change of 5 feet in two days.

Col. Dent, Loper, Rust, Stanton, and others have also described the sand waves on the Colorado

River especially below the mouth of the San Juan River. Their description by Stanton following observation made below Lees Ferry, February 25, 1890 (Exhibit 176), is especially illuminating.

February 25, 1890, 2.30 p. m. Look ahead thinking we saw a rapid. We start at 2.38 and again stop at 2.41 to see great rapid ahead, and when we get to it find only rolling waves. When we stopped to look ahead at 2.30 p. m. we thought we saw a bad rapid ahead on left side. When we got ahead a little on shore there was nothing in sight but swift smooth water.

We started ahead again and ran 5 minutes when all three of us, Hislop, Travers, and myself, saw again a heavy rapid with breaking waves ahead. We land with great difficulty and walk down the talus, but there is no rapid. We walk ahead $\frac{1}{2}$ mile to where the waves are breaking, and, after studying them for some time, find that it is an immense body of water moving down the river from what we suppose to be a great cloudburst above. We watch them carefully and the waves rise up gradually as they move down the river to 12 to 15 feet high, and the whole width of the river (150 to 200 feet wide), and then break upstream just as a huge breaker at sea. A half dozen of these rise and roll, break with a great roar, and then they subside and the water settles down. The same movement is repeated a little distance down and then further and further. Now they

begin again opposite us and the whole operation is gone through with again. This occurs at regular intervals, and as these waves are of such force the bends in the river so sharp, and the current so swift on account of the rise, it is difficult to land to see the rapids ahead. I fear we may be drawn into one of these swells just as we approach a rapid, and, unable to get out of it, be carried over the rapid with it. This, I believe, would be utter destruction to the boat and the men's lives. Hence, I conclude to stop where we are till morning believing that the "tidal wave" will subside and not thinking it right to run such a risk without more thought.

It is hard to imagine the force and grandeur of this phenomena. The greatness of the stream, the height and width of the waves, the narrow canyon, the towering walls, our perfect helplessness on the water, our boats like little chips tossed from one side to the other, turned round and round and perfectly unmanageable, and it is something to inspire awe and caution. We go into camp 91 on the right bank.

Hite (Vol. 20, page 3574) describes the building up and washing away of bars in a few hours by the rising and falling water.

Chenoweth (Vol. 21, page 3895), in oral testimony, showed where a bar at the mouth of Halls Creek sufficient to form a rapid with a 5-foot drop, had disappeared entirely between July and September, 1921. Oral testimony by Loper and others in

the record as follows, who are most familiar with the character of the river bed, shows that changes of large magnitude frequently occur:

Blake (Vol. 5, page 907); Clark (Vol. 10, page 1732); Stone (Vol. 10, page 1768); Edwards (Vol. 10, page 1923); McDonald (Vol. 12, pages 2174, 2196); Rust (Vol. 12, page 2266, sand waves, page 2272); Loper (Vol. 13, pages 2365, 2370, 2405, sand waves, pages 2403, 2436); Freeman (Vol. 14, page 2590, sand waves, page 2590); Johnson (Vol. 17, page 3070); Bennett (Vol. 17, pages 3204, 3218); Chaffin (Vol. 17, page 3278, Vol. 18, page 3304); Chenoweth (Vol. 21, page 3895); Fowler (Vol. 22, page 3967).

San Juan River

Chinle Creek to mouth.—Plate V-A of Exhibit 82-A and cross section introduced by Love (Exhibits 495 and 496) show the unstable character of the bed of the San Juan River and the rapidity with which such changes take place. Miser, in the published San Juan report (Exhibit 56, page 58) shows that the river flows on unconsolidated material that may be 50 feet deep. Love (Vol. 21, page 3829) shows by Exhibits 495 and 496, cross sections based on actual soundings, scour and fill amounting to 6 feet.

Miser (Exhibit 56, page 58):

Perhaps no great amount of material is permanently deposited, for the highest floods, such as that of October, 1911, when

the river is said to have reached a stage of 50 feet in the narrower parts of the canyon, may pick up and move all the material down to bedrock at many if not most places. The impinging and grinding of the transported material against the bedrock floor wears away the solid rock. In consequence of this wearing away process the canyon is deepened at times of high floods. During the recession of such floods much of the debris load is deposited and thus partly fills the canyon. Between such floods much debris is added from time to time by the river and other contributing sources.

According to Hoyt (Exhibit 86, page 12) as much as a million cubic yards of bed may be moved in a mile stretch of San Juan River during a flood period.

Miser (page 60, Exhibit 56):

San Juan River, being confined between closely spaced cliffs in most parts of its canyon, does not have alluvial plains in such parts. Whatever alluvial material is present occurs beneath the bed of the river and as short, unsubmerged bars. Alluvial plains of small extent occur only in the open stretches like those near Clay Hill Crossing, Piute Farms, and Zahn's Camp. There the river has wide braided channels and narrow alluvial stretches over which the main channel frequently shifts position, especially during floods.

Miser (page 61, Exhibit 56):

Much of the sand that is present along the river is being continually moved downstream. It is piled up in shifting ripple and rill-marked bars. Some of the bars are exposed as small and large areas adjacent to the river, and some rise above the water as islands, but others are submerged for depths ranging from a small fraction of an inch to perhaps many feet. Sand underlies the bed of the river for long distances. For example, Loper and I, in towing a boat upstream from the mouth of Piute Creek to Spencer Camp, a distance of 16 miles, waded the river with bare feet the entire distance and encountered gravel and boulders at only two or three places; only a few shoals were so deep that they could not be waded.

The sand, on account of its fine grain, is generally firm and compact enough for a person to walk on its surface; though in doing so he causes wavelike movements in the sand around him and is likely to sink into it if he retraces his steps. Quicksand is usually confined to the lower ends of the sand bars where it is being piled continually by the river and where it has not yet had time to become compact. The deepest quicksand encountered by members of the party was not more than waist deep.

Miser (page 63, Exhibit 56):

The boulder bars at the mouths of Piute Creek and some other creeks extend entirely across the river channel, suggesting that the

rushing flood-swollen, and boulder-laden waters of such tributaries dashed completely across the channel and filled it with boulders. For the river to be so powerless under such circumstances, its velocity and also probably its volume must have been far exceeded by the velocity and volume of the tributary.

Testimony in the record as follows shows the extreme instability of the bed of the San Juan River

Jones (Vol. 3, page 375); Adams (Vol. 3, page 424); Nielsen (Vol. 3, page 447); Butts (Vol. 3, page 552); Hyde (Vol. 4, pages 598, 621); Spencer (Vol. 4, page 704); Wetherill (Vol. 9, page 1609); Zahns (Vol. 11, pages 2058, 2079, 2080); Allen (Vol. 12, pages 2241, 2254); Loper (Vol. 12, pages 2315, 2323); Harshberger (Vol. 13, page 2508); Mendenhall (Vol. 19, page 3508); Miser (Vol. 21, pages 3760, 3768).

In addition to the shifting described, the movement of the bed of the river in sand waves is shown to be of common occurrence. These waves have been described by Loper, Miser, Hite (Vol. 20, page 3627), and others, as ranging in height from 3 to 7 feet (Photo, Ex. 314 to 318) often so close together that the ordinary rowboat would cut across two of them at the same time. They are associated only with streams which are heavily laden with silt. Pierce in Water Supply Paper No. 400 (Exhibit 59) describes their appearance on the San Juan as follows:

At one moment the stream is running smoothly for a distance of perhaps several hundred yards. Then suddenly a number of waves, usually from six to ten, will appear. They reach their full size in a few seconds, flow for about two or three minutes, then suddenly disappear. Often, for perhaps half a minute before disappearing, the crest of the waves goes through a combing movement, accompanied by a roaring sound.

Miser, in Exhibit 56, reports the occurrence of sand waves whenever the river was 2 feet or more above normal and states that during such periods the party stayed off the river.

CONCLUSION

The characteristics of these rivers in Utah are such that neither Richardson nor Col. Dent, who are shown to be familiar with river systems throughout the United States (Vol. 20, p. 3098 and Vol. 7, p. 1246), know of any other comparable rivers. The characteristics are plainly such that the use, in Utah, in the past for purposes of navigation has been exceptional, unusual, and confined to irregular periods. Those same characteristics will prevent future navigation. "A greater capacity for practical and beneficial use in commerce is essential to establish navigability." *Oklahoma v. Texas*, 256 U. S. 574, 591.

VII

ANCIENT AND EARLY NAVIGATION

The Colorado River above Lees Ferry, Arizona, the Green River, and the San Juan River have no history of early navigation

In determining the question of the navigability of a river, ancient and early navigation is entitled to great weight. This is necessarily so, because, in the early history of this country there were few overland routes. Explorers, fur traders, merchants, and immigrants were forced whenever possible to use rivers as highways for trade and travel. Early navigation was given serious consideration in the case of "*The Montello*" (20, Wall. 430) wherein it is said at page 440:

It is true, without the improvements by locks, canals, and dams, Fox River, through its entire length, could not be navigated by steamboats or sail vessels, but it is equally true that it formed, in connection with the Wisconsin, one of the earliest and most important channels of communication between the Upper Mississippi and the lakes. It was this route which Marquette and Joliet took in 1673 on their voyage to discover the Mississippi; and the immense fur trade of the Northwest was carried over it for more than a century.

The court also quotes at page 440, from Smith in his *History of Wisconsin* (Vol. 1, page 81) as follows:

At this time (1718) the three great avenues from the St. Lawrence to the Mississippi were, one by the way of the Fox and Wisconsin Rivers, one by the way of Chicago, and one by the way of the Miami of the Lakes, when, after crossing the portage of three leagues over the summit level, a shallow stream led into the Wabash and Ohio.

In the case of *Economy Light & Power Company v. United States*, 256 U. S., 113, navigability of the Desplaines River was under consideration. In the course of its opinion the Supreme Court points out that as early as 1675 there was the use of the rivers by fur traders (page 117):

But both courts found that in its natural state the river was navigable in fact, and that it was actually used for the purposes of navigation and trading in the customary way, and with the kinds of craft ordinarily in use for that purpose on rivers of the United States, from early fur-trading days (about 1675) down to the end of the first quarter of the nineteenth century. * * * During the period mentioned the fur trade was a leading branch of commerce in the western territory, and it was regularly conducted upon the Desplaines River. Supplies in large quantity and variety, needed by the early settlers, also were transported over this route between Chicago and St. Louis, and other points. Canoes and other boats of various kinds were employed, hav-

ing light draft but capable of carrying several tons each, and manned by crews of six or eight men. The route was navigated by the American Fur Company regularly during a period of years down to about 1825, after which it was disused because the trade had receded to interior portions of Illinois that could be reached more conveniently with horses.

In each of the above cases, early navigation was one of the principal points upon which the court based its opinion.

The opinion of the United States Circuit Court of Appeals for the Seventh Circuit in the same case, discusses in more detail the early navigation of the Desplaines. See *Economy Light & Power Co. v. United States*, 256 Fed. 792. At page 798, the court said:

No doubt other instances of its use may properly be inferred. It was employed by the American Fur Company down to 1825, and then abandoned for other routes. The trial judge found, as the record shows, that there is no evidence of actual navigation within the memory of living men, and therefore there would be no present interference with navigation by the building of the proposed dam. But it was held that the evidence shows the Desplaines a navigable water of the United States, preserved as such by the legislation of Congress.

In the early days the fur trade was a leading branch of commerce in the Western

world, and this trade was one of the characteristics of the Desplaines River. Large quantities of supplies of various kinds needed by the settlers in a new country were also transported over the Desplaines during the same period in boats of the size and character then commonly used in river commerce; this transportation being carried on between Chicago, St. Louis, and other points. Canoes of several tons burden were used: some were 35 feet long by 6 feet wide, some 33 feet long by 4½ feet wide, worked by paddles and occasionally a sail, and had a crew of eight men, carrying as much as 6,000 pounds of freight as well as 1,000 pounds of provisions. The pirogues were manned by six or seven oars; the bateaux were larger than the pirogues; the Durham boats were heavy freight craft, 60 feet long, 8 feet wide, 2 feet deep, with a capacity of 15 tons, drawing 20 inches of water.

In contradistinction to the above-mentioned cases, no such extensive early use appears in the *Red River case, Oklahoma v. Texas*, 258 U. S. 574; or in *Brewer-Elliott Oil & Gas Company et al. v. United States et al.*, 260 U. S. 77.

An inquiry, therefore, into the ancient and early uses of the Green, Colorado, and San Juan rivers becomes pertinent.

Indians and cliff dwellers

Practically every river in the United States which is navigable has a history of early naviga-

tion which antedates the coming of the white man. This is true of the Hudson, the Ohio, the Missouri, the Columbia, and many others.

The history of the world demonstrates that wherever rivers are suitable for the operation of boats, primitive man has used them for that purpose. (Lewis R. Freeman, Vol. 14, p. 2570.)

Historical writings indicate that no Indians ever used the San Juan River as a highway of travel. None of the early settlers ever saw or heard of the Indians traveling this river in boats. (Vol. 3, pp. 365, 428, 445.)

The method of navigation used by the Indians in the United States ranged from the birch bark canoe used by the northern Indians to the log dug-outs used by the Indians of the southern states. (Bureau of American Ethnology, Bulletin No. 30, Vol. 1 p. 156.)

The inhabitants of the lower regions of the Colorado River used a crude reed boat or raft for the purpose of crossing the river. (See "The Colorado River," page 13, by Freeman, Exhibit S1; "The Romance of the Colorado River," page 30, by Dellenbaugh, Exhibit 13.)

It seems certain that no Indian ever attempted to operate a boat on the section of the Colorado River in Utah, or upon the Green River. No relics have been found which indicated the use of boats by the Indians. When Major Powell entered upon his first expedition in 1869 and his second expedi-

tion in 1871, no Indian guides were available who knew anything about the river. (Freeman, Vol. 14, p. 2570.)

The Navajo Indians inhabited that part of Utah bordering on the San Juan and Colorado rivers. The Navajos were skilful artisans. They were masters of design, weavers, and workers in silver. (Bureau of American Ethnology, Bulletin No. 30, Vol. 2, p. 40.) They made no boats and used none. Susceptibility to navigation must to a degree be measured by the wants of man. The Indians' desire for travel never at any time placed a boat on any of the rivers in question. Their modes of travel were overland. The necessity of travel existed. The creative ability was present, because Indians in other parts of the United States far less advanced than the Navajos made and used boats for travel when living near rivers susceptible to navigation. Nonnavigation by the Indians of the rivers in question, when considered in the light of the scientific evidence as to the character and habits of the rivers, leads to the conclusion that such non-use was from lack of susceptibility to navigation. (Vol. 9, p. 1557.)

Early history

The mouth of the Colorado River was discovered in the year 1539 by Francisco de Ulloa. ("The Colorado River," by Freeman, Ex. 81, page 4; "The Romance of the Colorado River," by Dellenbaugh, Ex. 13, page 7.)

The exploration of the Colorado River, however, was not complete until the first Powell expedition in 1869. Other explorers had seen the Colorado River, but none had attempted its exploration above the Grand Canyon to any great extent.

The early events in connection with the Colorado River are found in Dellenbaugh's "The Romance of the Colorado River." Chapters 1 to 5, inclusive; "The Colorado River," by Freeman, chapters 1 and 2, and are, briefly, as follows:

1540: Hernando de Alarcon proceeded up the Colorado, probably to a point 100 miles above the mouth of the Gila River.

1540: Melchior Diaz explored the Colorado River and surrounding country in the vicinity of the Chocolate Mountains.

1542: Cardenas discovered the Grand Canyon.

1605: Onate, Governor of New Mexico, journeyed from the mouth of the Williams River to the Gulf.

1618: Zalvidar reached the Colorado River at a point near Marble Canyon.

1680 to 1711: Padre Kino touched the Colorado River at numerous points in the southern half of Arizona.

1744: Sedelmair crossed the Colorado River at the mouth of the Williams River.

1768 to 1776: Garces made several expeditions to the Colorado River from the mouth of the Little Colorado to the Gila River.

1776: Padre Escalante explored the country in the neighborhood of the San Juan

River. Setting out from Santa Fe, New Mexico, he explored a large portion of the State of Utah and on his return journey to Santa Fe, New Mexico, crossed the Colorado River at the Crossing of the Fathers (about 40½ miles north of Lees Ferry, Arizona). This expedition has an important bearing upon navigation and will be referred to later.

1779 to 1781: Several explorations were made by Garces in the neighborhood of Yuma, Arizona. (Water Supply Paper, 395, p. 16, Ex. 58.)

Expedition of Padre Francisco Escalante and the Old Spanish Trail

In the year 1776 Escalante set out from Santa Fe, New Mexico, to seek a route to Monterey, California. (Freeman, *The Colorado River*, p. 29, Exhibit 81.)

Santa Fe was the most important Spanish town north of the Rio Grande River. Monterey was the most important Spanish town in California. It was highly desirable to connect these two towns in order that trade and travel might pass easily between them.

Escalante crossed the San Juan River near the point where, at the present time, it first meets the north line of New Mexico. From this point the expedition proceeded northward and crossed the Grand or the Colorado River near the mouth of the Dolores; thence northwesterly and crossed

the Green River near the foot of Split Mountain Canyon, Utah. From there it moved southwesterly to a point in the neighborhood of the Virgin River, then turned easterly and eventually crossed the Colorado River, at a point designated as the Crossing of the Fathers, and returned to Santa Fe, New Mexico. (Vol. 9, p. 1560.)

This expedition is extremely important on account of its bearing upon the susceptibility of the rivers in question to navigation.

The prime object of the expedition was to establish a line of communication between Santa Fe, New Mexico, and the California Spanish towns. The Spaniards were experienced explorers and were builders of empires. They were skilled in the operation of boats. They never used any boats on the Green, Colorado, or San Juan Rivers. Later an overland trade route from Santa Fe to California was established, known as the Old Spanish Trail.

Between the point where the Old Spanish Trail crosses the San Juan River and the mouth of the Virgin River there were 700 miles of continuous river and the Spaniards discarded the river route as unsuitable for travel. The trail crossed the Grand River near the present town of Moab. From the point where it crossed to the mouth of the Virgin River, there were 600 miles of continuous river and this river also was discarded as a means of travel. The trail crossed the Green River at the present town of Greenriver, Utah, and from

this point to the mouth of the Virgin River there were 660 miles of continuous river and the river route was again discarded.

From the crossing of the Green River, the trail proceeded overland to a point near the mouth of the Virgin River through a country which was rough, broken, and barren and offered obstacles to overland travel unequalled in any section of the United States. (See Exhibit 221, Vol. 9, pp. 1567-8.)

Subsequent to Escalante's explorations, Wolfskill, Jedediah Smith, and others used the overland route from Santa Fe, New Mexico, to Monterey and the other Spanish towns in California. History does not disclose that any person ever attempted to operate boats upon any of the three rivers for the purpose of traveling or transporting goods from Santa Fe, New Mexico, to California.

The Old Spanish Trail appears upon all of the old maps. (See Exhibit 54; Dellenbaugh, Exhibit 14, page 95; Vol. 9, p. 1561.)

Hispanic American Historical Review, Vol. IV, No. 3, August, 1921.

The fur traders in Utah

The fur trade was the "big business" of the West. The fur trader played an important part in the exploration and the civilization of the western country.

The fur-trading business necessarily carried the trader into the wildest parts of the United States. The success of the fur trade depended largely upon

transportation. It was necessary for the fur trader to bring in his articles of trade and as exchanges were made, to transport his furs out of the wilderness.

In every section of the country, each large river played its part in the fur trade. The history of this country discloses that the fur traders, by Durham boats, by flat boats, and by canoes, traversed the Mississippi, the Missouri, the Ohio, the Fox, the Wisconsin, the Desplaines, and the Columbia Rivers. Each of those rivers was recognized as an important link in transportation between civilization and the fur-producing wilderness. The Colorado, the San Juan, and the Green rivers were never so used.

As early as 1825 General Henry Ashley established fur-trading posts at several points on the Green River above Greenriver, Utah. Ashley was at the head of one of the largest fur companies in North America. His operations were comparable with those of the Hudson Bay Company.

Ashley attempted an expedition upon the Green River for a few miles and his boat was wrecked. Had the Green-Colorado River been a navigable stream, Ashley would undoubtedly have transported his furs by way of the Green-Colorado River to the Gulf of Lower California and from there by ships to the New York or the London markets.

Ashley and the other fur traders discarded the Green-Colorado River as a means of travel and chose in preference to transport their furs across

the Rocky Mountains to convenient points upon the Missouri River and from there to the City of St. Louis, from which point their furs eventually reached the eastern markets. (Vol. 9, p. 1670.)

These men were experts upon the subject of western transportation and their nonuse of the Green and Colorado Rivers for trade and travel must be counted against the navigable capacity of the rivers. See Dellenbaugh, Exhibit 13, page 108; Freeman, Exhibit 81, page 82.

Chittenden says in *The American Fur Trade of the Far West* (Francis P. Harper, N. Y., 1902):

It was the trader and trapper who first explored and established the routes of travel which are now and always will be, the avenues of commerce in that region. (P. 9, Preface.)

Expedition of John C. Fremont

General John C. Fremont occupies a peculiar position in the history of the West. He was known as the "Pathfinder"; he was an Army officer and a man of education.

The purpose of his expedition was to discover, investigate, and report what was in the country. General Fremont, by reason of his education and his profession, knew the importance of transportation for trade, travel, and military expeditions.

He saw the Green River at various points. He undoubtedly knew of the existence of the Colorado River, and yet at no place does any commentator

upon his expeditions suggest that General Fremont ever thought of using the Green or Colorado Rivers as highways of travel to California. (Fremont and '49, from "The Romance of the Colorado River," by Dellenbaugh, Chapter 6, Exhibit 13.)

Expedition of W. L. Manly

In the year 1849, W. L. Manly and some companions set out from a point near Green River, Wyoming, in an old scow ferryboat, twelve feet long and six feet wide, in an attempt to reach California. The expedition was abandoned near the mouth of the Uinta River and from that point Manly and some of the party continued overland to California. ("The Romance of the Colorado River," page 132, by Dellenbaugh, Exhibit 13; "The Colorado River," Chapter 6, by Freeman, Exhibit 81.)

This expedition is important on the question of navigation for two reasons.

1. Because it came at a time when the gold rush was on for California and when any route to California which lessened the labor of the overland journey across the Great Basin was eagerly sought.

2. Because it gave to the world definite knowledge of the sections of the Green River actually traveled by Manly.

The Mormons

In the year 1847 the Mormons settled in the vicinity of the Great Salt Lake. Almost immediately the church leaders commenced the establishment of the towns, known technically in church history as "stakes," in southern Utah in the vicinity of the Colorado River.

The Mormon settlements in Utah were separated from the outposts of civilization on the Missouri River by fifteen hundred miles of hard, tedious travel over plains, deserts, and mountains. During the early years of the Mormon settlements it was necessary for them to obtain their supplies by this overland route. Their numbers were constantly being increased by converts made in the eastern part of the United States and in many of the European countries. Under the plan of the church, it was contemplated that all of these converts should eventually come to Utah for the purpose of becoming permanent residents.

To the Mormon, therefore, the problem of transportation was of vast importance.

The gold rush was on in California. Ships left the European ports and the eastern ports of the United States for California practically daily. Many boats carried their freight and passengers to the Isthmus of Panama, where they passed overland to the Pacific coast and then proceeded by boats to the California towns.

Had the Colorado River any possibilities as a navigable stream, most certainly it would have been so used by the Mormon church.

The history of the Mormon church indicates that as early as 1847 the Spanish trail was known to the Mormons and used by them as a travel route to California for the purpose of obtaining seeds, seedling trees, and other necessities of a pioneer country. (Exhibit 626, page 1.)

Subsequent to the year 1847, the records of the church disclose that there was considerable travel between Salt Lake City, Utah, and California. The road to California started at Salt Lake City, Utah, and went down through central Utah and swung west and passed out of Utah near the Virgin River. The road was a long, hard trip, which was attended by considerable difficulty on account of the rough, barren, uneven country through which it passed.

Several roads led from Salt Lake City to various points on the Green River. A road led from Salt Lake City across the Green River at Gummison's Crossing, which is the present site of Greenriver, Utah. There was another road which led from Salt Lake City to the mouth of the Uinta River. It was at that point that Major Powell, on his second expedition, left his party and went to Salt Lake City. (Dellenbaugh, Exhibit 14, pp. 66 and 67.) The road from Salt Lake City, which crossed at

Gunnison's Crossing, was traveled by the Mormons in their settlement of Moab in the year 1855. (See Exhibit 625.)

The road leading from Salt Lake City to California was not only used by the Mormons for the purpose of bringing in supplies, but was used as a Government post road and also by immigrants and gold seekers.

The most authentic history of the use of this road is found in the records of the Mormon Church. The pertinent excerpts were collected by Mr. Dellenbaugh and are found in Exhibits 621, 622, 623, 624, and 626.

In addition to the through travel between Salt Lake City and California, it was necessary for the Mormons to maintain communications with their settlements in southern Utah. The aforementioned exhibits disclose that the Mormon Church never at any time used the Green or the Colorado Rivers in Utah for the purpose of trade and travel.

The Union Pacific Railroad was completed in 1869 and at that time the Colorado River ceased to interest the people of Utah further as a highway of commerce.

While it is true that no complete exploration of the Green and the Colorado rivers had been made prior to the time of the Powell Expedition of 1869, yet the exploration of the Mormons in that part of

Utah which lies east of the Green and Colorado Rivers below the town of Greenriver, Utah, gave them a familiarity with the lands adjacent to the river. No Church record discloses that any of these sections of the river were ever used by the Mormons as highways of travel.

As early as 1853 a trading expedition proceeded from Santa Fe, New Mexico, to Salt Lake City. The record of this expedition shows that it crossed the Grand River (now the Colorado River) about twenty-five miles below the mouth of the Dolores. They proceeded from this point and crossed the Green River near the present town of Greenriver, Utah. (See pages 6 and 7, Exhibit 622.)

In 1854, at the direction of Governor Young, a party left Springville, Utah, to explore the southeastern part of Utah. The travels of this expedition necessitated the crossing of the Green, Grand (now the Colorado), and San Juan rivers. The object of the expedition was to ascertain if southeastern Utah contained any lands suitable for settlement.

Elder W. D. Huntington, in charge of the trip, reports upon the character of the land, the condition of the roads, cliff dwellings, and other items of interest. (See pages 7 to 10, Exhibit 622.) At no place does he suggest navigation of any of the rivers.

The following year the Mormon Church sent out a mission to settle the country in and about the present site of Moab. The leaders in charge of this expedition left Great Salt Lake City for Manti in the spring of 1855. Manti was the place selected for the assembly of the expedition.

This expedition started at Manti and proceeded in an eastward direction to the Green River, apparently traveling the Old Spanish Trail. The whole expedition was ferried across the Green River in the early part of June, during the usual period of high water. The Grand River (now the Colorado River) was apparently crossed near the present site of Moab. The expedition was driven out by the Indians in September of the same year and returned to Manti by the same route. (See Exhibit 625.)

Between the years 1865 and 1874, a Mormon missionary by the name of Jacob Hamblin, conducted various missions to the Indians from the town of Kanab.

It is recorded that the Ferryboat at Lees Ferry was used by the Mormon missionaries for crossing at various times subsequent to the year 1871. (See page 26, Exhibit 621.)

Jacob Hamblin was also at the Crossing of the Fathers in 1875. (See page 27, Exhibit 621.) It is also recorded that Hamblin crossed at Lees Ferry as early as 1864. (Page 28, Exhibit 621.)

The Mormon settlements on the San Juan River in the vicinity of Bluff in 1879 have an important bearing upon the question of the navigation in the San Juan River. The settlements in the vicinity of Bluff were preceded by the comprehensive exploration of the surrounding country, the year previous to the settlement. The entire country was critically examined by the exploring party for the purpose of ascertaining the nature and extent of the land which might be susceptible to farming purposes. The exploring party also examined the country for the purpose of finding a suitable route to bring in the settlers. (See Kumen Jones, Tr. Vol. 3, p. 363.)

A settlement expedition was organized at Cedar City and an appropriation secured from the Legislature of \$5,000 to build a road into the San Juan country. The church also made an appropriation for the same purpose. (Page 5, Exhibit 620.)

The expedition had a boat which was launched on the Colorado River in the neighborhood of Hole-in-the-Rock. It is recorded that the boat was stuck in some shallow rapids and it was neither possible to float down nor to row up the river and the boat was abandoned. (Page 6, Exhibit 620.)

The difficulties encountered in building the road, the character of the country traveled and the length of time it took to complete the journey are all re-

corded in the records of the Church and are set forth in Exhibit 620.

After the advance expedition had reached the vicinity of Bluff, several of the members started back to Hole-in-the-Rock on New Year's day, 1880. (Exhibit 620, page 12.) The return to Hole-in-the-Rock was entirely overland.

During the succeeding years, several parties traveled to and from Hole-in-the-Rock and Bluff. There is no suggestion any place in the Church history of any attempt to move any of these expeditions either up or down the San Juan River by boat.

The record of the settlement of the San Juan River country, as disclosed by Exhibit 620, shows that the overland travel from Hole-in-the-Rock to Bluff was accomplished by overcoming stupendous difficulties.

It is impossible to escape the conclusion that, had the San Juan River the slightest capacity for navigation, it would have been so used by the Mormon settlers. In all the history of the towns on the San Juan River, no merchant ever brought in any supplies by way of the river. The San Juan settlements were supplied by wagon trains from Santa Fe, New Mexico; Durango, Colorado; and, later, Thompson Springs, Utah. (Vol. 4, pp. 600, 605, 702; Vol. 3, p. 506.)

Early War Department Expedition

In 1857, the Secretary of War directed Lt. Joseph C. Ives to explore the Colorado River. Lt. Ives's report is Exhibit 12.

Lieutenant Wheeler, United States Topographical Engineer, conducted an expedition up the Colorado River in 1871. His report is Exhibit 73.

Lt. Ives and Lt. Wheeler did not agree on the precise point that might be regarded as the head of practical navigation. But the disagreement is immaterial, for both fixed it as far below Lees Ferry.

See also Freeman, Exhibit 81, Chapter XI, p. 252;

Dellenbaugh, Exhibit 13, Chapter XII, p. 294.

Stanton survey, 1889-1890

During the period May 25, 1889, to March 24, 1890, Robert B. Stanton, Chief Engineer of the Denver, Colorado, Canyon, and Pacific Railroad Company, and a member of the American Society of Civil Engineers, made a survey of Green and Colorado Rivers from Green River, Utah, to Needles, California, for the purpose of determining the feasibility and cost of building a railroad paralleling the river through the canyon. (Survey Exhibit 175.) It is significant that throughout the canyon section his location contemplated the

"stealing from the river." or, in other words, the construction of a roadbed on material blasted into the river channel (Field Notes, Exhibit 176. Labyrinth Canyon notes of May 25, 1889; Stillwater Canyon notes of May 29; Cataract Canyon notes of June 14; Narrow Canyon notes of June 22; Glen Canyon notes, June 29, December 27.) As soon, however, as he reached a section of the river far below Lees Ferry he recognized that the method of construction used above would interfere with navigation.

Stanton, without a doubt, was a competent engineer, thoroughly familiar with problems of transportation. He had personally been over every foot of the Green and Colorado Rivers between Greenriver, Utah, and the mouth of the Virgin River. On the sections of the rivers here in question he saw no navigable possibilities, present or future, because his plan of railroad construction in that section contemplated a permanent roadbed built upon material blasted into the river.

Stanton's field notes (Exhibit 176) of his expedition were kept with meticulous care from day to day. They are a model of engineering detail. The experience of this expedition, as recorded by Stanton in the field, demonstrates the absolute unfitness of the Green and Colorado Rivers in Utah as highways of commerce.

Nims, Kane, Edwards, and MacDonald, survivors of the Stanton expedition, were witnesses, and their oral testimony corroborates Stanton's field notes.

Nims, Vol. 7, p. 1381, Vol. 8, p. 1428; Kane, Vol. 11, p. 1982; Edwards, Vol. 10, p. 1892, Vol. 11, p. 1948; McDonald, Vol. 12, p. 2150. (See Photos, Exhibits 179 to 220; Exhibits 174, 177, 178.)

Stanton's subsequent actions support the conclusions drawn from his field notes.

On his second expedition, his boats and supplies were shipped by rail to Greenriver, Utah. He did not launch his boats at Greenriver, but hauled them overland to the Colorado River, at the mouth of Crescent Creek, via Hanksville and launched them there. (Vol. 10, p. 1895.)

In 1899 when he was engaged in placer mining in Glen Canyon, he shipped a big launch to Flagstaff by rail and thence overland to Lees Ferry and had it with three other boats rowed and towed upstream to Hite. (Vol. 20, p. 3612.)

In 1899 when he was constructing a large dredge on the Colorado River, he actually built a road in to the river and hauled tons of machinery to the river overland. (Vol. 12, p. 2202.)

Stanton knew the rivers from experience, and his failure to use them for transportation leads to but one conclusion—not navigable.

Small boats and rafts on the Grand (Colorado) River

Information concerning any early navigation upon the Grand is meager.

Freeman records Samuel Adams travelled the Grand River in 1869. The Colorado River, Ex. 81 Chapter IX, p. 201.

Kendrick surveyed Stanton's Railroad from Grand Junction, Colo., to the Junction with the Green River in 1889. The Colorado River, Ex. 81, p. 294.

Kane was on the Grand in 1888 in a raft. Vol. 11, p. 1983, and McDonald in 1888, Vol. 12 p. 2161.

The experience of these persons on the river suggest no possibilities of use of this section of the river as a highway of commerce.

The Powell expeditions (1869, 1871)

The expeditions of Major J. W. Powell of 1869 and 1871 descended the Green and Colorado Rivers from Green River, Wyoming. The first expedition ended at the mouth of the Virgin River; the second at the mouth of the Kanab. The reports of these expeditions are complete. The personnel of the expeditions included geologists, engineers, and topographers. At no place in the diaries of the members of the expeditions or in the official reports is there any suggestion indicating navigable possibilities of the rivers in Utah. On the contrary, the progress of the expedition was so impeded by rapids and sand bars, that the conclusion is non-navigability.

Powell Ex. 51.

Dellenbaugh. The Romance of the Colorado River. Ex. 13.

Dellenbaugh. A Canyon Voyage. Ex. 14.

Dellenbaugh, Oral Testimony, Vol. 9, p. 1514.

Thompson, Diary Ex. 627.

Jones, Diary, Ex. 628.

Bishop, Diary, Ex. 629.

Best expedition of 1891

J. B. Best was in charge of prospecting party which left Greenriver, Utah, July 10, 1891. The boats used (Vol. 10, p. 1905) and the experience of the party were similar to those of the Stanton party.

Edwards, Vol. 10, p. 1905.

Kane, Vol. 11, p. 2001.

McDonald, Vol. 12, p. 2194.

Photo Exhibits 222 to 262.

The steamer "The Major Powell" (1891)

In the year 1891, a steamboat was launched at Greenriver, Utah, known as *The Major Powell*. (Photo. Ex. 474, 5, 6.) The boat was run down the river as far as Wheeler's Ranch, about 20 miles below Greenriver, Utah, and there abandoned by the owners. (Vol. 10, p. 1916.)

In the spring of 1893, William H. Edwards and some associates leased this boat from the owners for the purpose of taking tourists down the river. (R. Vol. 10, p. 1916.) The boat was approximately 35 feet long, 8-foot beam, and drew 18 inches of water (R. Vol. 10, p. 1917), and was equipped with an upright boiler with two 6 H.P. engines connected to twin screws.

Mr. Edwards and his associates made the necessary repairs upon the boat, and, in the month of

April, 1893 (R. 1920), started down the river on a trial trip. Mr. Edwards was an experienced riverman. In order to assist them in the operation of the boat on the return trip and upon other trips, Edwards made marks upon the canyon walls to indicate the points where bad sand bars and other obstructions might be encountered (R. vol. 10, p. 1919).

The boat was equipped with a block and tackle for the purpose of assisting it off sand bars by making a line fast to the shore. (R. Vol. 10, p. 1920.)

The boat encountered numerous sand bars on the down trip and finally reached a point about a quarter of a mile above the first rapid in Cataract Canyon. At this point, the boat turned around and returned to Wheeler's Ranch.

The trip upstream was not quite as difficult as the one downstream, because in many cases the boat could be backed off the sand bars. (R. Vol. 10, p. 1921.) The boat was tied up at Wheeler's Ranch, and no attempt was made to take it into the town of Greenriver, because, as described by Edwards, he "did not think it possible to get it (the boat) up there; too much rock and rough water." (R. Vol. 10, p. 1922.)

A second trip was made down the river about ten days later and practically the same difficulties were encountered as upon the first trip. Edwards testified (R. Vol. 10, p. 1923) that while the river was higher on the second trip, it had shifted the bars so that neither the markings nor the informa-

tion gathered upon the first trip was of much assistance to him in operating the boat.

On the second trip, the boat again returned to Wheeler's Ranch (R. Vol. 10, p. 1924) and was tied and abandoned there. The engines and boilers on the boat were taken off and used in connection with a plant at Greenriver, Utah. The hull of the boat was abandoned. (R. Vol. 10, p. 1925.)

The history of this boat is important on the question of navigation because it was an enterprise undertaken commercially and undertaken at the instance of the Rio Grande Western Railroad. (R. Vol. 10, p. 1925.) It was the first and only attempt to operate commercially upon the Green River, prior to the admission of Utah as a state. The experiment resulted in failure and the failure was due principally to those physical characteristics of the river which always will prevent the successful operation of boats.

Placer mining on San Juan River prior to 1896

During the gold rush in the San Juan River in 1892, some of the placer miners used flat-bottomed rowboats, drawing a few inches of water. The boats were used principally for crossing and recrossing the rivers. There were a few boats which came downstream from Bluff, Utah, but none ever went up to Bluff. The trips downstream were accomplished only by overcoming difficulties with rapids, sand waves, rocks, and bars. At times,

the river did not have sufficient water to float a boat. (Vol. 12, P. 2313.) The extent of the use of boats, the difficulties in operation, and the purposes for which used are set forth in the testimony of the following witnesses:

Loper, Vol. 12, p. 2312 et seq.;
 Raplee, Vol. 3, p. 462 et seq.;
 Mendenhall, Vol. 19, p. 3454 et seq.

Most of the supplies taken into the placer sections went in overland by pack animals or wagons.

Nielson, Vol. 3, p. 444;
 Harshberger, Vol. 13, p. 2502.

The use of boats was temporary and vanished with the bursting of the gold boom.

Placer miners in Glen Canyon prior to 1896

For approximately 7 or 8 years prior to 1896, placer mining was carried on in Glen Canyon. A post office was established at Hite, Utah, on the Colorado River at the mouth of North Wash in 1889. (Vol. 20, p. 3567.) All of the mails and supplies were brought in overland via Hanksville. Greenriver, Utah, was considered generally as the railroad connection. These placer miners used flat-bottomed rowboats frequently to take supplies down the river from Hite. On trips down the river considerable difficulty was encountered with rapids and sand bars. The upstream trips were

accomplished only by rowing and towing. The physical characteristics of the river and the method of operation of boats during this period are described by—

Homer J. Hite, Vol. 20, p. 3560 et seq.
 John P. Hite, Vol. 20, p. 3605.
 Lou M. Chaffin, Vol. 17, p. 3264 et seq.;
 Vol. 18, p. 3298.

Homer J. Hite describes (Vol. 20, p. 3564) a raft loaded with mining machinery which was taken from Hite to Ticaboo Bar, 18 miles, and also the difficulties in freighting the machinery in from Greenriver. It was necessary to wait for high water before starting the raft. (Vol. 20, p. 3615.)

The population of the canyon was small and probably never at any time exceeded 100.

The use of boats by the placer miners was a temporary expedient. It was neither substantial nor permanent. The operation of boats and rafts was hazardous. It never at any time rose to the dignity of commercial navigation.

Edwards's dredge

In the year 1895 William H. Edwards (Vol. 10, p. 1933) was placed in charge of a dredge located on the Green River eight miles below the town of Greenriver. It was capable of handling about one yard of gravel per minute. All of the machinery for this outfit, consisting of a good many tons, was

brought down overland on the west side of the river. The dredge was set up on the east side of the river, and all of the machinery was forded across the river in the months of September and October. The dredge employed about 20 men. (R. 1934.) The dredge consisted of two 100 horsepower boilers, a steam engine, and electric generator. The boilers consumed from 5 to 8 tons of coal per day (R. 1935), which was all brought down by wagon overland from Greenriver, Utah. Coal is a commodity which is easily transported on water on scows. Edwards knew the river and this no doubt was the reason he preferred overland transportation.

Overland transportation used

In the early days of Utah, the demand for cheap transportation existed. Freight and passengers were ready to travel the river if travel were possible. The hardships of overland travel were stupendous. The roads were rough, the country barren, and both travelers and animals suffered from heat and thirst. In the parts of the United States where none of these hardships existed, rivers were used for trade and travel. Even necessity could not transform the Green, Colorado, and San Juan in Utah into highways of commerce over which trade and travel could pass in the customary modes.

VIII

COMMERCIAL EXPERIMENTS AND MINOR BOATS

Boating experiences on the Green, Colorado, and San Juan Rivers demonstrate that these rivers in Utah possess none of the attributes of highways of commerce

Physical characteristics which prevent these rivers from meeting the test of navigability in fact have already been discussed. But, aside from these physical deficiencies, the actual experience of men with boats upon the rivers completes the picture of nonnavigability. Before considering the testimony with reference to boating experience on these rivers, the decisions should be examined in order to ascertain the correct principles for measuring the navigability of rivers. A river, in order to be navigable, must possess in its natural condition a use or a susceptibility of use which will constitute the river a highway of commerce over which trade and travel are or may be conducted in the customary modes of trade and travel on water. Commerce in boats must be of a substantial or a permanent character. It can not be a commerce which is temporary, precarious, and unprofitable; neither does a theoretical commerce meet the test. The principles of navigability were laid down in the case of *The Daniel Ball*, 10 Wall. 557; and in that case the evidence showed that the Grand River in Michigan was of such capacity that it was "capable

of bearing a steamer of 103 tons burden loaded with merchandise and passengers."

Navigability was discussed in *The Montello*, 20 Wall., 430. The question in that case was whether or not the Fox River was navigable and the evidence showed that, since the year 1675, the river had been used as a highway of commerce by fur traders, merchants, and others for trade and travel into the western country. The Court followed the rule laid down in *The Daniel Ball*, *supra*, and said at page 441 as follows:

It would be a narrow rule to hold that in this country, unless a river was capable of being navigated by steam or sail vessels, it could not be treated as a public highway. The capability of use by the public for purposes of transportation and commerce affords the true criterion of the navigability of a river, rather than the extent and manner of that use. If it be capable in its natural state of being used for purposes of commerce, no matter in what mode the commerce may be conducted, it is navigable in fact, and becomes in law a public river or highway. Vessels of any kind that can float upon the water, whether propelled by animal power, by the wind, or by the agency of steam, are or may become, the mode by which a vast commerce can be conducted, and it would be a mischievous rule that would exclude either in determining the navigability of a river. It is not, however, as Chief Justice Shaw said, "every small

creek in which a fishing skiff or gunning canoe can be made to float at high water which is deemed navigable, but, in order to give it the character of a navigable stream, it must be generally and commonly useful to some purpose of trade or agriculture."

In *United States v. Rio Grande Dam & Irrigation Co.*, 174 U. S. 690, the Rio Grande River in New Mexico was held nonnavigable. The Supreme Court applied the rule of *The Daniel Ball* and *The Montello*, and, in the course of its opinion, said (page 699):

Obviously, the Rio Grande within the limits of New Mexico is not a stream over which in its ordinary condition trade and travel can be conducted in the customary modes of trade and travel on water. Its use for any purposes of transportation has been and is exceptional, and only in times of temporary high water. The ordinary flow of water is insufficient.

The Daniel Ball and *The Montello* cases were followed by the case of *Leovy v. United States*, 177 U. S. 621. It was said (at page 632) as follows:

It is a safe inference from these and other cases to the same effect, which might be cited, that the term "navigable waters of the United States," has reference to commerce of a substantial and permanent character to be conducted thereon.

The bayou was held not navigable.

The evidence in this case showed that boats of from 25 to 30 tons capacity and drawing 3½ feet of water had passed through the Bayou in question, and that this had continued for a number of years. The particular instances and conditions under which boats were operated, taken from the transcript of the record, are included in an appendix to this brief and printed on pages 219-221.

In *Harrison v. Fite*, 148 Fed., 781, 783, 784, the Circuit Court of Appeals for the Eighth Circuit, speaking through Judge Hook, said:

To meet the test of navigability as understood in the American Law a watercourse should be susceptible of use for purposes of commerce or possess a capacity for valuable floatage in the transportation to market of the products of the country through which it runs. It should be of practical usefulness to the public as a public highway in its natural state and without the aid of artificial means. A theoretical or potential navigability, or one that is temporary, precarious, and unprofitable, is not sufficient. While the navigable quality of a watercourse need not be continuous, yet it should continue long enough to be useful and valuable in transportation; and the fluctuations should come regularly with the seasons, so that the period of navigability may be depended upon. Mere depth of water, without profitable utility, will not render a watercourse navigable in the legal sense, so as to subject it to public servitude,

nor will the fact that it is sufficient for pleasure boating or to enable hunters or fishermen to float their skiffs or canoes. To be navigable a watercourse must have a useful capacity as a public highway of transportation.

Of the evidence the Court said (p. 787):

Witnesses testified that in times of high water there had been no successful navigation of it in recent years, except with a gasoline launch drawing but a few inches of water, and with canoes, skiffs, and dugouts of the hunters and fishermen; that it is not being used to float the products of the fields and forest to market, and can not be profitably and successfully used for that purpose.

The evidence in that case disclosed that the river had been used by duck hunters, by licensed steamboats, lumber and log rafts and by merchants. The particular instances of the operation of boats, taken from the transcript of the record, are printed in an appendix to this brief on pages 227, 228.

In the case of *North American Dredging Co. v. Mintzer*, 245 Fed. 297, the Court of Appeals for the Ninth Circuit, in declaring the nonnavigability of the San Pedro Canal, cited with approval the above quotation from the case of *Harrison v. Fite*. The Court of Appeals adopted the findings of the District Court on the question of fact, and these are set forth in *Mintzer v. North American Dredging Co.*, 242 Fed., 553. It appears in that case that the particular channel in question was never used or regarded as navigable for any species of water craft

other than for duck boats and punts for hunting and fishing (p. 557). However, some of the property adjacent thereto had been acquired by the Standard Oil Company and on a few occasions power boats and scows of light draft were taken up through the San Pablo Creek or Canal and entered this channel on flood tide carrying supplies to the Standard Oil Company, but it was found that, excepting periods of high tide, it was impracticable to use the channel for navigation without deepening it.

The Circuit Court of Appeals for the Sixth Circuit, in the case of *Toledo Liberal Shooting Company v. Erie Shooting Club*, 90 Fed. 680, speaking through Circuit Judge Lurton, and concurred in by Circuit Judge Taft, said (page 682):

At no time is the greater part of this marsh susceptible of supporting "commerce" in any reasonable sense of the term. That the water stands permanently, and that it has a deep opening into Lake Erie, does not establish that this shallow body of water is capable of sustaining commerce, or is burdened with a public use. It is nothing more or less than a marsh opening into the lake. To be navigable in law, it must be navigable in fact; that is, capable of being used by the public as a highway for the transportation of commerce.

None of the characteristics of commercial navigability are shown here. It is the natural feeding ground of the duck and other

water fowl. In their pursuit by canoe and flat-bottomed ducking boats the water may be navigated. That is not commerce and proves nothing. The same test would convert every pond and swamp capable of floating a boat into a navigable stream or lake. This bay is not a highway, never has been, and never can be. At the common law the term "navigable" had a technical meaning and was applied to all streams or bodies of water in which the tide ebbed and flowed. All such waters were public. That definition is not applicable in this country, and all waters are held navigable in law, and subject to a public use, which are by their character capable of use as highways, for purposes useful to trade or agriculture. It is the capability of being navigated for useful purposes which is the test.

See appendix, page 228, for boats operated on the waters in question.

In the case of *Gulf & I. Railway Company of Texas v. Davis*, 26 F. (2d) 930, the court had under consideration the navigability of a stream known as Mud Bayou. In arriving at the conclusion that the bayou was nonnavigable, the court said:

The application of this point of view to this case makes its solution easy. There has not been, and is not now, any commerce on Mud Bayou. No stretch of the most vivid imagination can envision conditions under which it will be in its natural state an aid to commerce.

In that case it was admitted that there had been no navigation upon Mud Bayou, but it was also admitted that boats of light draft could conduct commerce over it, should there be a commercial demand.

In discussing this phase of the case (page 933), the court said:

Upon these authorities defendants declare that, since the facts establish, as they do, that there is water enough in Mud Bayou to support water-borne commerce in boats of light draft up to the railroad bridge and above, if there were any to go there, and that this Mud Bayou empties into East Bay Bayou, East Bay Bayou into East Bay, and East Bay into the Gulf of Mexico, so that the stream in question has connection, immediate and practical, with a recognized highway of commerce, interstate and foreign, a finding is required that, though it has not in the past been navigated, and is not now being navigated, it is a navigable stream, because it is capable of use by the public for the purposes of transportation and commerce, whenever such transportation and commerce become available.

Plaintiffs, on the other hand, while admitting that as a matter of fact boats of light draft could conduct commerce over Mud Bayou and beyond the bridge, if there was any commerce actual or potential, to be conducted, declare that while the presence of sufficient water in the stream to support

water-borne commerce is important, where the evidence shows that there is commerce in esse or in posse to be conducted, it is of no significance where the facts establish not merely that there is no commerce and has been no commerce, but in all probability there will in fact never be any, and this they say they have affirmatively established.

Plaintiffs say that the rule has never been better stated than in *Harrison v. Fite* (C. C. A.) 148 F. 783, quoted with approval in *North American Dredging Co. v. Mintzer*, (C. C. A.) 245 F. 297, 309. That plaintiffs are right in insisting, where a stream has never been impressed with the character of navigability by past use in commerce, that commerce actually in esse or at least in all reasonable possibility in posse is essential to navigability, I think can not be doubted.

The case is also important because it deals with future capability of navigation upon a stream on which no navigation existed or had existed prior to the trial of the case. The case was affirmed in 31 F. (2d) 109.

In *Economy Light & Power Co. v. United States*, 256 U. S. 113, the court had under consideration the navigability of the Desplaines River. The court applied the test of navigability laid down in *The Daniel Ball* and *The Montello*, but that river had behind it 150 years of history as a navigable stream and had been regularly and commercially used for trade and travel. The history of the navigation of

this stream is set out in detail in the opinion of the Circuit Court of Appeals. See *Economy Light & Power Co. v. United States*, 256 Fed. 792.

In the case of *Oklahoma v. Texas*, 258 U. S., 574, the navigability of the Red River between Oklahoma and Texas was before the Supreme Court. The Court reached the conclusion that the river was nonnavigable, saying, at page 591:

We conclude that no part of the river within Oklahoma is navigable and therefore that the title to the bed did not pass to the State on its admission into the union.

There had been some sporadic attempts to navigate the Red River commercially and these are set forth at page 589 of the opinion.

Lanesport, Arkansas, which is near the Oklahoma boundary, has been the usual head of navigation; but for several years before railroads were extended into that section, boats of light draft carried merchandise up the river to the mouth of the Kiamitia and other points in that vicinity and took out cotton and other products on the return trip. This occurred only in periods of high water, and was accomplished under difficulties. In very exceptional instances boats went to the mouth of the Washita, where some had to await the high water of the next season before they could return. When the railroads were constructed this high water or flood navigation ceased. That was between 1875 and 1880.

According to many witnesses, whose knowledge of this part of the river reaches back for a long period, the depth of the water at ordinary stages has come to be less than it was from 1850 to 1870, when they first knew it. Portions of the banks have been swept away and sand in great quantities has been brought downstream, making the river wider and shallower than at the time of the navigation just mentioned.

Additional information as to the kind, character, and purpose of boats actually used on the Red River have been digested from the abstract of the record and are set forth in pages 205-219 of appendix to this brief.

It also appears from the opinion that Congress had from time to time appropriated large sums of money to improve the river. A practical commercial use for navigation as distinguished from a theoretical or an exceptional use, impressed the court as a test of navigability (page 591).

While the evidence relating to the part of the river in the eastern half of the State is not so conclusive against navigability as that relating to the western section, we think it establishes that trade and travel neither do nor can move over that part of the river, in its natural and ordinary condition, according to the modes of trade and travel customary on water; in other words, that it is neither used, nor susceptible of being used, in its natural and ordinary condition as a highway for commerce. Its characteristics

are such that its use for transportation has been and must be exceptional and confined to the irregular and short periods of temporary high water. A greater capacity for practical and beneficial use in commerce is essential to establish navigability.

This case is important in determining the issue of navigability in the case now before the court because, as has previously been pointed out in this brief, the Red River has physical characteristics, which impede navigation, similar although in a lesser degree, to those of the Colorado, Green, and San Juan rivers, and for the further reason that the attempts at navigation and actual navigation upon the Red River far exceeded anything which has ever been done, attempted, or hoped for on the Green, Colorado, and San Juan rivers.

In the case of *Brewer-Elliott Oil Co. v. United States*, 260 U. S. 77, the court had under consideration the navigability of the Arkansas River. In deciding that the Arkansas River was not navigable in Oklahoma above the Grand River, the Court said at page 86:

A navigable river in this country is one which is used, or is susceptible of being used in its ordinary condition, as a highway for commerce over which trade and travel are or may be conducted in the customary modes of trade and travel on water. It does not depend upon the mode by which commerce is conducted upon it, whether by steamers, sailing vessels, or flat boats, nor upon the difficul-

ties attending navigation, but upon the fact whether the river in its natural state is such that it affords a channel for useful commerce.

The attempts to navigate the Arkansas River are set out in more detail in the opinion of the District Court. (See *U. S. v. Brewer-Elliott Oil & Gas Co.*, 249 Fed. 609; S. C. 619.) Other attempts at navigation have been digested from the record and printed in the appendix to this brief, pages 221-223.

The physical characteristics of the Arkansas River are not unlike those of the Red River. It also appears from the testimony that large sums of money had been appropriated by the Government to improve navigation upon this river.

In *United States v. Holt State Bank*, 270 U. S., 49, 56, the rule of navigability was reaffirmed in this language:

The rule long since approved by this Court in applying the Constitution and laws of the United States is that streams or lakes which are navigable in fact must be regarded as navigable in law; that they are navigable in fact when they are used, or are susceptible of being used, in their natural and ordinary condition, as highways for commerce, over which trade and travel are or may be conducted in the customary modes of trade and travel on water; and further that navigability does not depend on the particular mode in which such use is or may be had—whether by steamboats, sailing vessels or flat-boats—nor on an absence of occasional diffi-

culties in navigation, but on the fact, if it be a fact, that the stream in its natural and ordinary condition affords a channel for useful commerce.

The character of the commerce on the river is stated as follows (p. 57):

Mud River, after passing through the lake, connected at Thief River with a navigable route extending westward to the Red River of the North and thence northward into the British possessions. Merchants in the settlements at Liner and Grygla, which were several miles up Mud River from the lake, used the river and lake in sending for and bringing in their supplies.

For additional evidence of navigation on Mud River see appendix, pages 223-227.

With the above principles of law in mind, evidence with reference to boats on the Green, Colorado, and San Juan rivers will be examined.

"The Undine"

In 1901, a pretentious boat named *The Undine* was launched at Greenriver, Utah. This boat had an 8-foot beam and was about 48 feet in length (R. 4244); draft 14 inches loaded (Vol. 24, p. 4210). It was a coal burner, equipped with marine engines and propelled by a paddle wheel on the stern. (See photograph, Exhibit 121.)

This boat was put on the river strictly for commercial purposes and the general plan was to operate the boat between Greenriver and Moab and to a

proposed sanitarium which was to be built near the head of Cataract Canyon. (Vol. 24, p. 4214.)

About half way between Greenriver, Utah, and the mouth of the San Rafael, the steamer hit a large rock which punched a hole in the side of the boat. The boat again started on its way, and, between the mouth of the San Rafael and the mouth of the Green River, and also between that point and the town of Moab, its progress was impeded by sand bars. (Vol. 24, p. 4213.)

The boat was equipped with block and tackle and poles and from time to time lines were run ashore and made fast to rocks and trees for the purpose of getting the boat off the sand bars. (Vol. 24, p. 4213, 4216.) The boat at last reached the town of Moab. The *Undine* was taken a few miles above Moab, where the boat was wrecked while attempting to ascend the riffles. (Vol. 5, p. 967; Vol. 29, p. 5121.) It was abandoned at the place wrecked.

Ross, who testified concerning the *Undine*, had much experience on the rivers, and his testimony may be consulted as to the difficulties encountered in the operation of boats. (Vol. 24, p. 4216.)

"The City of Moab," later "The Cliff Dweller"

In May, 1905, there was launched at Greenriver, Utah, a boat, *The City of Moab*, 50 feet long, 16 or 18 feet wide, with a draft of from 12 to 14 inches, equipped with marine engines, and costing approximately \$15,000. (Vol. 4, page 665.) The boat was put in commission for the purpose of transporting

freight and passengers between Greenriver, Utah, and the town of Moab, on the Colorado River. (R. 666; Vol. 17, page 3243.)

The boat encountered all kinds of difficulties on its initial downstream trip. There were many groundings between Greenriver, Utah, and the mouth of the San Rafael (R. Vol. 4, p. 726), and between the mouth of the San Rafael and the mouth of the Green River groundings were constantly made upon the sand bars (R. 727).

The boat was equipped with poles, pulleys, and ropes (R. 667) and the ropes were frequently made fast to the shore, in order to assist the boat off the sand bars. During the entire trip, a pilot went ahead and made soundings, in order to ascertain the best water (R. 672).

After the boat reached the mouth of the Green River, it attempted to go up the Colorado River, but was unable to get past The Slide. The boat then turned around and started back up the Green River.

On the trip up Green River, the same difficulties were encountered with sandbars. The boat was finally gotten up as far as Wolverton's Ranch (Vol. 4, page 734) and was tied at that point. The owners and crew proceeded from that point by wagon to the D. and R. G. Railroad, and returned to their homes by rail (R. 673).

The experience of this boat has an important bearing upon navigation because it was a serious attempt to utilize the Green and Colorado rivers

for trade and travel. The trip was made during the month of May. The stream flow during that month is larger than in any of the other months of the year with the exception of June and possibly July.

The owners of the boat were not satisfied with their first experiment and caused the boat to be remodeled (Vol. 4, page 735) and equipped with a stern wheel and steam boilers. (Vol. 18, pp. 3405, 3409.) It was renamed The Cliff Dweller.

The trip in the remodeled boat was made downstream to Valentines Bottom and at this point the fuel was getting low and the owners decided to return to Greenriver, Utah.

The difficulties encountered by the boat on the second trip were practically the same as on the first trip. (Vol. 4, pages 737 to 740, Vol. 27, p. 4821.) The boat was finally gotten back to a point about a half mile below Greenriver, Utah (R. 740), where it was dismantled by the owners and shipped to Great Salt Lake.

"The C. H. Spencer"

The largest boat which was ever put in operation (in 1911-12) upon the Colorado River was the *C. H. Spencer*. This boat cost approximately \$30,000. (Vol. 16, p. 3010.) It was 92½ feet long, had a beam of 25 feet and drew from 18 to 20 inches of water light. (Vol. 16 p. 3007.) The boat was launched at the mouth of Warm Creek, Utah. It was purely a commercial enterprise and was to be used for the purpose of transporting coal from

the mouth of Warm Creek to a large dredge immediately opposite Lees Ferry. (R. Vol. 14, p. 2600; see photographs, Exhibits 11D (Photo. 296), 416, 467, 468, 469.) The boat made two round trips to Lees Ferry. It was then taken down to Lees Ferry and was tied up. It made no further trips. (Vol. 16, p. 3019.) It eventually sunk at Lees Ferry.

The *Spencer* was operated with great difficulty and in order to prevent the boat from spinning around in whirlpools and getting onto sand bars, it was necessary that it come down stream backwards and drag a one hundred foot chain made out of five-eighth-inch iron. (Vol. 16, p. 3027.) Commercially, the boat was a failure.

The same company also had a 40-foot boat with a 6-foot beam equipped with a 40-horsepower gasoline engine, known as the *Violet Louise*. (Vol. 16, p. 3022.) This boat was operated in and about Lees Ferry and made one trip to Warm Creek. It broke loose at Warm Creek during a flood following a rain and drifted down below Lees Ferry. Johnson roped it, placed it on a sled, and with 5 or 6 yoke of oxen dragged it back to Lees Ferry. The boat was abandoned on the shore. (Vol. 16, p. 3021 to 3024.)

The same company had a steel boat, 23 feet long with a 4-foot beam equipped with a 35 or 40 horsepower gasoline engine. The silt in the river burned out the bearings. The boat was eventually placed on the shore and not used further on the river. (Vol. 16, p. 3025.)

The history of the *C. H. Spencer* is important because all of the testimony shows that between Warm Creek and Lees Ferry the river is deeper and freer from obstructions than in any other portion of the river above Lees Ferry. If the boat could not be successfully operated in that stretch of the river, it could not be operated on any other section of the Green, Colorado, or San Juan rivers above that stretch.

The barge of the Moab Garage Co.

In the year 1925, the Moab Garage constructed a flat-bottomed barge 15 feet wide and 75 feet long, with pointed bow, and stern wheel. The barge drew approximately 4 inches light and 20 inches loaded to fully capacity of 20 tons. (Vol. 5, p. 962.) The boat was first equipped with a motor taken from an automobile engine. (R. 961.) Later an industrial motor was installed. The boat was constructed for the purpose of performing a transportation contract which the Moab Garage Company had with the Midwest Exploration Company to transport certain oil-drilling supplies from the town of Thompson on the Denver & Rio Grande Railroad to the Company's drilling sites on the Colorado River below Moab. (R. 962.) The Garage contract provided a rate of \$1.75 per 100 pounds from Thompson to Well No. 1. The distance from Thompson to the dock at Moab was approximately 34 miles by wagon road, and the contract contemplated a transportation rate from Thompson to the river bank by truck at the rate of

50 cents per 100 pounds. That allowed \$1.25 per 100 pounds for the 18 miles of water transportation. The barge cost approximately \$7,000. Later there was a readjustment of the rates of transportation to oil wells farther down the river. The total amount of tonnage hauled both ways approximated 4,000 tons, and the total revenues received by the Moab Garage Company was about \$40,000. (Vol. 6, p. 971.)

The operation of the boat was almost under the exclusive jurisdiction of the witness Virgil Baldwin. (Vol. 6, R. 1155.) The boat consumed approximately 5 gallons of gasoline per hour. (Vol. 6, R. 1165.) The operation of the barge was attended by many difficulties on account of the constant rearrangement of sand bars (R. 1166), and this was especially true when no trips had been made for several days. When this occurred it was difficult to operate the boat without getting on the sand bars. (R. 1166.) The boat was easier to operate downstream than it was up, but on the downstream trip sand bars were encountered and it took much longer to get off than it did on the upstream trip. (R. 1168.) Going downstream it was possible to make approximate speed of 8 miles per hour; coming upstream approximately 3 miles per hour. (R. 1169.) Sand bars were encountered on approximately 75 per cent of the trips. (R. 1170.)

The principal points where the barge encountered difficulty are shown at pages 1172 *et seq.* The barge was equipped with a capstan and a 500-foot

steel line which from time to time was made fast to the shore to assist the boat off the sand bars. (Vol. 6, p. 1182.) In the winter season ice gave trouble with the operation of the barge (1194). The barge was frequently stuck on the sand bars in the afternoon, and it was necessary to stay all night on the river. (R. Vol. 6, p. 1207.) Most of the trips were made with the barge during the first year of its construction. Business tapered off until, at the present time, there is practically nothing for the barge to do. (R. 1212.)

It will be seen from the above extracts from the testimony that the Moab Garage barge was constructed for a special purpose. The rates charged for transportation were excessively high and the use of the river by the barge within the meaning of the cases heretofore cited must be termed a temporary or an exceptional use.

The operations of the Midwest Refining Company in that territory were under the direction of John B. Cleary. (Vol. 16, p. 2894.) He had special charge of the transportation facilities to and from the wells. (R. 2906.) Early in the operations Mr. Cleary surveyed a road from the railroad to the well. (R. 2907.) Mr. Cleary testified that a producing oil field required somewhere between 15,000,000 and 42,000,000 pounds of freight each year (R. 2910), and that in his opinion the boat of the Moab Garage did not have sufficient capacity to transport this amount of freight (R.

2911). In order to meet the anticipated requirements for transportation, the road was surveyed (Vol. 16, p. 2962, Exhibits 462, 463, 464, 464a, and 464b) and also a pipe line (Exhibit 461).

Mr. Aurand, an engineer for the Midwest Refining Company (Vol. 7, p. 1338), also investigated the question of navigability of the river and rejected it (Vol. 7, p. 1368, 1376) as a means of transportation.

Mr. Prommel, another engineer of wide experience (Vol. 5, p. 989) investigated the transportation problem and concluded that, in the event the field turned out to be a producing one, it would be more economical to construct a road than to rely upon the river transportation (Vol. 5, p. 1007).

In the last year, the barge of the Moab Garage Company has only made a few trips and undoubtedly in the near future, it will be dismantled because there is no further use for it.

During the oil excitement, and from time to time since then, the Moab Garage Company has operated small power boats for compensation. The difficulties attending the operation of boats of this character were marked on account of the change and shifting of the sandbars in the river. (Vol. 6, p. 1187.) One of the boats was used by Lt. Col. E. J. Dent in his examination of the section of the river between Moab and the mouth of the Green River. His experience is typical of that of other persons who have attempted to operate power boats upon the river. (Vol. 7, p. 1217 et seq.)

Other boats

HARRY T. YOKEY

Harry T. Yokey (Vol. 18, p. 3385, 3398), of Greenriver, Utah, experimented with boats upon the Green River from 1902 to the present date. His first experience was with a rowboat, but subsequent to that time he owned and operated a number of power boats upon the river. The largest boat was the *Black Eagle* (Vol. 18, p. 3411) which was a boat about 40 feet long with a 6-foot beam and draft about 7 or 8 inches. The boat was equipped with a 20-horsepower compound vertical marine engine. It burned wood or coal. This boat made one trip downstream about 100 miles. The boiler tubes blew out; the engine and boiler were taken out and the hull abandoned.

Yokey's trips were mostly for the purpose of experimenting with the river, hunting, etc. At the time the witness testified, there were no power boats left on the river at Greenriver, Utah. (Vol. 18, p. 3418.) In spite of the fact that he had made a great many trips down the river, he had difficulty in finding the channel. (Vol. 18, p. 3422.)

Yokey's testimony as a whole demonstrates the impossibility of commercial navigation of the rivers between Greenriver, Utah, and Moab.

THOMAS G. WIMMER

Thomas G. Wimmer, formerly a citizen of Greenriver, Utah, experimented with boats upon the

river. His experience commenced in 1900. His largest boat was *The Marguerite* (Photo Exhibit 263), a boat 30 feet long, with an 8-foot beam (Vol. 27, p. 4735), drawing 2½ feet when loaded. It had a capacity of 3 tons. (Vol. 27, p. 4736.) It was originally equipped with a gasoline engine and a stern wheel. He made one trip to Moab with a party of 25. (R. 4744.)

Wimmer had a Government contract to transport supplies and equipment for a drilling rig which was testing a dam site on the Colorado River immediately below the mouth of the Green River. All of these supplies were hauled from Wimmer's ranch. By hauling these supplies from the ranch the riffles and bad water between his ranch and Greenriver, Utah, were avoided. For the experience on the river in connection with this work see Vol. 11, pp. 2094 et seq. and Vol. 20, pp. 3685 et seq.

Wimmer had considerable difficulty in and about the operation of these boats. (Vol. 27, p. 4814; See also Exhibit 631.) According to Wimmer, at the present time, there are no boats on the Green River and there are no power boats at Greenriver, Utah. Wimmer has left Greenriver and his boats were abandoned. (Vol. 27, p. 4823.)

HENRY E. BLAKE

Henry E. Blake, now a resident of Monticello, Utah, came to Greenriver in the spring of 1909 for

the purpose of launching a boat on the Green River and investigating the possibility of river trade between Greenriver and Moab, Utah. (Vol. 30, p. 5205.) That year he constructed a boat, the *Ida B*, 24 feet long, 6-foot beam, flat bottomed, equipped with a 14-horsepower internal-combustion engine. (Vol. 30, p. 5205, 5206.) The *Ida B* cost \$1,500. (Vol. 30, p. 5233.) This boat was wrecked below Wimmer's ranch. (Vol. 30, p. 5222.) He later constructed a boat called *The Utah* at a cost of from \$75 to \$100. He used the engine of the *Ida B*. *The Utah* was abandoned about five miles below Greenriver and allowed to rot. (Vol. 30, p. 5223.) He launched another boat in the year 1927. This boat was also wrecked. (See photograph No. 11, Exhibit 77.) The cost of this boat was between \$300 and \$400. (Vol. 30, p. 5225.)

Blake appears to have made very few trips for compensation. One was an experimental trip when he transported 1,000 pounds of peaches from Moab to Greenriver. (Vol. 30, p. 5213.) Blake accompanied Wimmer on a trip of Salt Lake City boosters. (Vol. 30, p. 5212.) A significant fact in connection with this river party is that all of the supplies for the party were hauled down to Wimmer's ranch in wagons and there loaded on the boat. After three unsuccessful attempts, Mr. Blake has abandoned river navigation for newspaper work.

EDWIN J. WOLVERTON

Wolverton experimented with boats for hunting and tourist travel over a number of years. He built the *Wilmot* at a cost of approximately \$1,350. It was first a stern wheeler, and then changed to a side wheeler. (Vol. 31, p. 5398.) The machinery was removed and the hull abandoned. (Vol. 31, p. 5402.) He built the *Colorado* at a cost of \$350. The engine was removed and the hull used as a scow. (Vol. 31, p. 5402, 3.) It was a light-draft boat, and light draft was desirable because, as Wolverton expresses it, "It was a constant strain on one, dodging obstacles in the river" * * * "such as sand bars and rocks." (Vol. 31, p. 5404.) He built the *Navajo* at a cost of \$500. This boat was abandoned at his ranch. (Vol. 31, 5410, 1.)

Mr. Wolverton's experiments with navigation must be added to the other commercial and semi-commercial failures. (See Exhibit 633.)

CLYDE L. EDDY

The Clyde L. Eddy expedition in the year 1927, was purely a sporting expedition. The trip was taken in specially constructed decked over boats. (See Exhibit 17.) The boats were frequently on sandbars. (Vol. 1, p. 45.) (See Photos Ex. 16 to 49.)

THE KOLB PARTY

The Kolb expedition left Green River, Wyoming, September 18, 1911 (Vol. 4, p. 764), equipped with

two boats of the Galloway type and decked over at each end. In the trip through Stillwater and Labyrinth Canyons many sand bars were encountered. (Vol. 4, p. 790.) Through Glen Canyon they encountered four rapids which gave them some trouble. (Vol. 5, p. 804.) This expedition, like the Eddy expedition, was more of a sporting event. Ellsworth Kolb later made a trip on this river with a Government party in the year 1921. This expedition started from Greenriver, Utah. (R. 764.) The boats drew about 18 inches of water and between Greenriver and the mouth of the San Rafael the boats had considerable difficulty with sand bars. (Vol. 5, pp. 823, 825.) Through Cataract Canyon the members of the party habitually wore life preservers. (Vol. 5, p. 838.) Below Cataract Canyon the sand bars were again encountered. (Vol. 5, pp. 841, 850; Photos Exhibits 104 to 120.)

JULIUS STONE

On September 12, 1909, Stone and Galloway pushed off from Green River, Wyo., and traveled down the Green and Colorado Rivers to Needles, California. Galloway was an old seasoned boatman on the rivers. The party had the usual troubles through the canyons, and their trip was constantly impeded by sand bars, riffles, and rapids. (Vol. 10, page 1773.)

Stone previously spent much time in Glen Canyon, and his testimony gives an interesting picture of boating in the canyon. (Vol. 10, page 1769.)

Lumber rafts

Branson floated a few lumber rafts down the Colorado River from Castle Creek to Moab. (Vol. 27, page 4712.) The largest contained about 15,000 board feet. Compared with lumber rafting on the Red River (See Appendix 205 et seq.) they were of small consequence.

Minor boats

Rowboats, skiffs, scows, rafts, and catamarans propelled by oars, sails, outboard motors, poles, or by towing have been operated upon the rivers.

This floating equipment was used (a) in connection with exploring, prospecting, hunting, surveys and reconnaissance investigations. The use of boats for these purposes throughout all sections of the rivers was generally downstream. (b) In connection with operations for placer mining the operations were confined largely to a portion of Glen Canyon in the Colorado River and on the San Juan River between Chinle Creek and Spencer Camp. Although operations were generally downstream, some of the boats were used both ways for short distances between bars and camp locations. (c) In connection with hunting and trapping the use of boats was confined largely to sections between Moab and Green River, Utah, although an occasional hunter or trapper went through Cataract Canyon and Glen Canyon. (d) There was little evidence of the use of boats solely for pleasure.

Explorations, prospecting, surveys, and reconnaissance investigations

The principal expeditions for exploration and mapping purposes included:

(a) Powell's first expedition, 1869, from Green River, Wyoming, to Virgin River, recorded in his report "The Colorado River of the West," Exhibit 51.

(b) Powell's second expedition, 1871, Green River, Wyoming, to Kanab Creek, recorded by Dellenbaugh in "A Canyon Voyage," Exhibit 14 and "Romance of the Colorado," Exhibit 13; diaries of Jones, Exhibit 628, Bishop, Exhibit 629, and Thompson, Exhibit 627.

(c) Brown and Stanton expedition, 1889-1890, Green River, Utah, to Needles. Field notes by Stanton, Exhibit 176.

(d) Best expedition, to locate a lost mine, 1891. Green River, Wyoming, to Lees Ferry; testimony by Edwards, Vol. 10, page 1902; McDonald, Vol. 12, page 2194; Kane, Vol. 11, page 2001.

(e) Galloway and Stone, 1909, Green River, Wyoming, to Needles; testimony by Stone, Vol. 10, page 1773.

(f) Russell, Loper, and Monette, 1907, steel boats, covered hatches. Testimony by Loper, Vol. 13, page 2347.

(g) Kolb Bros., 1911-1912, Green River, Wyoming, to Needles; testimony by Kolb, Vol. 5, page 803.

(h) U. S. Geological Survey, 1921, Green River, Wyoming, to Lees Ferry; testimony by Cheno-weth, Vol. 21, page 3885; Kolb, Vol. 5, page 812.

(i) U. S. Geological Survey, 1921, San Juan expedition from Chinle Creek to mouth of the San Juan, Trimble, and Miser, Exhibit 56, and testimony by Miser, Vols. 20 and 21, pages 3728 to 3796; Trimble, Vol. 21, page 3865; Loper, Vol. 12; Blake, Vol. 5, page 886.

(j) U. S. Geological Survey expedition, 1922, Hall's Crossing to Lees Ferry. Stabler, Vol. 22, page 4054; Freeman, Vol. 14, page 2572; Thomas, Vol. 13, page 2488.

(k) Eddy expedition, 1927, Green River, Utah, to Needles; testimony by Eddy, Vol. 1, page 31.

With the exception of the first Stanton expedition, the rowboats generally used were of a special covered-hatch type with airtight compartments, from 16 to 18 feet in length, draft of from 8 inches to 18 inches, sturdily constructed, and designed to meet the special conditions of the river. The first Stanton type (Stanton field notes, Exhibit 176) were of light construction without covered hatches and the failure of this type of boat is evidenced by the fact that the party lost four out of six boats in going through Cataract Canyon (Summary of Exhibit 176), and three men drowned in Marble Canyon.

Without exception, all of the exploratory trips were made downstream, with only one or two instances where the boats retraced their routes for

short distances upstream by combination of rowing and towing, or both.

Placer mining.—The principal operations in connection with placer mining have been on the Colorado River between Hite, 162 miles above Lees Ferry, and the seat of the Stanton operations near the mouth of Wilson Creek, 121 miles above Lees Ferry, and have included work on the following bars:

Name	Bank	Approximate distance above Lees Ferry
Klondike Bar.....	Right.....	Miles 65
New Year Bar (Camp Stanton).....	Left.....	122
Moki Bar.....	Left.....	128.5
California Bar.....	Left.....	130
Olympia Bar.....	Right.....	132
Good Hope Bar.....	Right.....	145
Tickaboo Bar.....	Right.....	148

A maximum of 25 men may have received mail at one time from Hite. (Vol. 20, page 3568.)

The Colorado River boats and scows were used to some extent to take supplies from Hite to the various bars, and boats were rowed and towed back up to Hite (Stone, Vol. 10, page 1767). Barges were also used at the Stanton operations to bring supplies across the river from the mouth of Wilson Creek, down which a road had been blasted to the New Year Bar, located across and somewhat upstream from Wilson Creek (Weber, Vol. 15, page 2626; Hite, Vol. 20, page 3576; Bennett, Vol. 17, page 3180; Loper, Vol. 13, page 2440; Chaffin, Vol. 18, page 3301).

In addition to these, there is evidence as to operations on bars near the mouth of the San Juan River by means of a barge (Frothingham, Vol. 24, page 4980), and surveyed locations by Stanton (Exhibit 176 and testimony by Stone, Vol. 10, page 1765) of bars below the mouth of Wilson Creek on which some prospecting has taken place (Vol. 20, page 3622).

Placer operations on San Juan River have been confined largely to the stretch between Spencer's Camp, 38 miles above the mouth and Chinle Creek, 132 miles above the mouth. The principal operations were at Spencer's Camp, Zahns Camp, 41.5 miles above the mouth; bars at the mouth of Nokai Canyon, 44 miles above the mouth of Copper Canyon, 46.8 miles above the mouth; vicinity of Moonlight Creek, 65.5 miles above the mouth; Johns Canyon, 82.5 miles above the mouth; Honaker Trail, 96.5 miles above the mouth; Mendenhall Loop, 110 miles above the mouth. According to Mendenhall (Vol. 19, page 3518) as many as 150 men were in operation on the various bars along the San Juan River during part of the period, 1892-3-4.

Small boats were used occasionally on the San Juan to bring supplies from outfitting posts at Bluff and Mexican Hat to the various bars. These boats were, without exception, crudely constructed skiffs or barges, and used solely to take supplies downstream. The use of these boats for this purpose was occasional. Most of the supplies came in by

pack or wagon. (Zahn, Vol. 11, page 2039.) There is no record of boats having been brought upstream more than two or three miles. (Harshberger, Vol. 13, page 2502; Barnes, Vol. 13, page 2532; Mendenhall, Vol. 19, page 3518.)

Hunting and trapping.—John and Parley Galloway and their father, Nate Galloway, the designer of the Galloway type of boat which has been used almost universally by exploration parties on the Green and Colorado River, seem to have done most of the trapping. Testimony of the two sons (Vol. 6, pages 1040 and 1123) indicates that their Father trapped on all stretches between Green River, Wyoming, and Lees Ferry." The operations of the two sons have been confined largely to the section of the Green and Colorado Rivers between Green River, Utah, and Moab, with two expeditions through Cataract and Glen Canyons. Hite, Vol. 20, page 3579, speaks of trappers sending hides from Hite overland. The operations in Green River were confined solely to downstream trips. Operations in Cataract Canyon and Glen Canyon were downstream. The record also indicates that there has been some boat operation in connection with deer hunting, especially on the Green River between Green River, Utah, and the mouth. (Vol. 30, page 5289; Vol. 26, page 4604.)

The hunters and trappers used the river because the animals which they sought frequented the river canyons. They did not use the rivers as a high-

way for travel in the sense the Fox River and the Des Plaines rivers were used by the fur traders. (Turner, Vol. 30, page 5292.)

Use of boats for pleasure.—There was some use of the Green and Colorado Rivers for pleasure purposes. Investigations have been made to determine the feasibility of taking tourists upstream from Lees Ferry to the Natural Bridge Monument, a distance of 68 miles, but no boats were ever put in operation for this purpose. (Vol. 10, page 1731.) The nearest approach to pleasure operation was probably the trips made by Rust in folding canvas boats (Vol. 12, page 2268) which were made entirely downstream between North Wash and Lees Ferry, the boats and supplies being taken overland to North Wash. (Vol. 27, page 4869).

Typical boating experiences.—The difficulties in connection with navigation of small boats and scows used in the preceding operations vary throughout the different sections of the river. They may be summarized as follows:

Green River, Utah, to mouth.—The operation of boats over rapids and riffles between Green River, Utah, and the mouth of the San Rafael is always accompanied with some danger and confined almost exclusively to downstream operation as far as boats without motors were concerned. (Blake, Vol. 5, page 922.) Below the mouth of the San Rafael difficulties encountered were largely in connection with sand bars. Parley Galloway (Vol. 6, page

1126) describes operation as follows: "There are strips you don't have quite so much trouble, but the other places you have enough to make up for it." Again (Vol. 6, page 1142): "In places we find little strips we get along all right, in other places the boat will run on the gravel and sand bars." Nye (Vol. 24, page 4181), in going downstream with rowboat to which was attached an Evinrude motor, states that he was in the water most of the time between Green River, Utah, and the mouth of the San Rafael and hardly an hour a day he was not in the river pulling boat off bars below the mouth of the San Rafael. Ross (Vol. 24, page 4196) discusses rowing and towing boat upstream and (Vol. 24, page 4203) rowing with two sets of oars upstream and also towing the boat from Valentine Bottom to Wimmers Ranch; made an average of 9 miles a day. Loper (Vol. 13, page 2348). Kirkpatrick (Vol. 15, page 2666) discuss typical operations of rowboats in this stretch. Col. Dent made only 5 miles in 5 hours upstream with Moab Garage passenger boat and could find no crossing. (Vol. 7, page 1241.) It is significant that all of the trips with small boats between Moab and Green River were made down the Green and up the Colorado rather than vice versa.

Colorado River, Moab to head of Cataract Canyon.—In connection with upstream progress of rowboats used in trapping expeditions, Parley Galloway (Vol. 6, page 1135), states: "While it is always bad enough with a rowboat, some of it you

can row and some of it you can tow your boat the best way you can. We have sand bars running behind a sand bar sometimes had to turn and go back again and find some little channel that you could get your boat through." Mendenhall (Vol. 19, page 3495) discusses the operation of one boat with two men—"worked our way up any way we could; rowed when we could, towed when we could, and poled some." Nye (Vol. 24, page 4186) upstream operation of outboard motor, discussed frequent bar trouble and was just able to get boat through The Slide with motor running full speed. Other operations of small boats used in survey work and oil investigations: Prommell (Vol. 6, page 1032); Kirkpatrick (Vol. 15, page 2679); Yundt (Vol. 15, page 2774); Dobbin (Vol. 7, page 1308); Hoyt (Vol. 1, page 157); Dent (Vol. 7, pages 1234 to 1238).

Cataract Canyon.—The record throughout describes especially hazardous conditions in Cataract Canyon. Even the most skilled boatmen were rarely shown to be able to take a boat through without a mishap or portage. The record of the Stanton expedition, Exhibit 176, testimony by Kolb (Vol. 5, p. 831); Eddy (Vol. 1, page 62); McDonald (Vol. 12, page 2176); Edwards (Vol. 10, page 1908), Stone and many others, describe the hazards of Cataract Canyon. Practically all parties were equipped with life preservers and only the most experienced boatmen stayed with the boats.

Galloway (Vol. 6, page 1119) stated "carried the duffle in Cataract Canyon portaged nearly from one end to the other." Galloway (Vol. 6, page 1112):

In some places you had to pull it (boat) over rocks. You can't push it out and make it go through without getting it wrecked into the rocks somewhere and losing it. In that case you had to drag it along over rocks the best way you could until you got where you could start it again.

Glen Canyon.—Galloway (Vol. 6, page 1107) testifies:

There is no part of the river (Glen Canyon section) that a man if he can boat it at all, and will use proper precautions, that he will not run into the difficulties that exist there if he don't watch out what he is doing.

The downstream operation is a constant fight with sand bars, boils, swirls, shipping water, swamping in sand waves, grounding on rapids. Col. Dent (Vol. 7, page 1293); Loper (Vol. 13, page 2436); Thomas (Vol. 13, page 2488); Caldwell (Vol. 13, page 2522); Bennett (Vol. 13, page 2407); Hite (Vol. 20, page 3627). Upstream navigation was a question of 90 per cent tow and 10 per cent row. Loper (Vol. 13, page 2431); Galloway (Vol. 6, page 1133) never tried to go upstream with rowboats. Boats have been dragged and rowed by Loper from Lees Ferry to Hite and from Red Canyon to Hite. (Vol. 13, pages 2360 and 2371.) Average upstream progress about 7 or 8 miles a day. Marrs (Vol. 13, page 2458) discussing operation of motor boats

upstream from Warm Creek, states "if you lose a minute you will drift back more than you can make in 15 minutes." Barnes (Vol. 13, page 2536) describes taking an 18-foot motor boat, 18-inch draft, upstream from Lees Ferry to Dandy Crossing in 13 days; average upstream progress 12 miles a day; lined boat many times; wrecked three times; launch capsized once. Freeman (Vol. 14, page 2586) shows constant fighting of sand bars and currents and riffles while six men took four boats to Halls Crossing, 119 miles in two weeks. (Average upstream progress 8 miles a day.) Operation of boats and scows as ferry boats to get supplies back and forth across the river, discussed by Weber (Vol. 15, page 2626); Bennett (Vol. 13, page 2407); Harshberger (Vol. 12, page 2510); Mendenhall (Vol. 19, page 3475), described rowing and towing the boat from the mouth of the San Juan River to Hole-in-Rock. Hite (Vol. 20, page 3612) describes how it took 13 men 26 days to bring launch up to Hite; Kolb (Vol. 5, page 811) doubts if he would be able to take a boat upstream through Glen Canyon rapids.

San Juan River.—The farthest distance a boat was taken upstream on the San Juan River was approximately for a distance of about 17 miles in the vicinity of Piute Farms. Loper (Vol. 13, page 2416); Miser (Vol. 21, page 3764). The boat was towed the entire distance. Mendenhall (Vol. 13, page 3468) describes downstream operation as "pretty hard work getting through all the way to

the mouth." Miser (Vol. 20, page 3733); Loper (Vol. 12, pages 2313, 2327); Blake (Vol. V, page 888).

The subject of minor boats might be pursued indefinitely. The citations given represent types of boats and experiences, and are fair examples of conditions on the rivers. To add others, would unnecessarily extend this brief.

Overland travel preferred

Greenriver, Utah, and Moab were the only towns connected by the rivers. Before the general use of automobile trucks, these towns were four days overland apart. The trip on the river took even longer. To-day the trip is made regularly in about two hours. The difficulties of overland travel in the old days could produce no successful use of the rivers between these two towns, and it is improbable that in future the automobile trucks will be displaced by use of the river.

Merchandise to and from Moab (Vol. 29, p. 5059), Bluff (Vol. 3, p. 368) and Monticello went overland; Hite was supplied via Hanksville overland (Vol. 29, p. 5150). The mail for Hite came in overland. (Vol. 20, p. 3568.) Stanton blasted a road in to the Colorado River to bring in mining machinery from Greenriver, Utah. (Vol. 12, p. 2202-6; Vol. 20, p. 5146.) Harshberger investigated the Colorado River to ascertain if he could bring down mining machinery from Greenriver. He brought it down overland. (Vol. 13, p. 2514.)

Zahn, on the San Juan (Vol. 11, pp. 2053, 2070), brought in machinery and supplies overland. Lees Ferry mail and supplies came in overland. (Vol. 16, p. 3050; Vol. 17, p. 3062.) Supplies for the Government drilling outfit were hauled to Wimmer's Ranch overland and there placed on boats. (Vol. 20, p. 3690.)

Stanton sent boats overland (second expedition) from Green River to Creseent (Vol. 11, p. 1990), Moab Garage Co. from Moab to mouth of San Rafael (Vol. 2, p. 177), Galloway from Greenriver to North Wash (Vol. 6, p. 1062), Governor Dern, en route from Moab to Glen Canyon, preferred overland trip (Vol. 31, p. 5382).

Wimmer took boats overland either from Greenriver or Richfield to Glen Canyon and hauled supplies overland from Greenriver to Glen Canyon. (Vol. 27, p. 4836.)

Good Hope Company built wagon road in canyon between Good Hope and Tickaboo Bars. (Vol. 17, p. 3174.)

Overland travel was over difficult roads. The country was barren and long stretches were without water. It was necessary to transport both feed and water for the wagon and pack animals. The difficulties of overland travel accentuated the desirability for river travel if possible. The fact that the river was not used for transportation is persuasive evidence that the rivers possessed no navigable possibilities.

Thousands of dollars have been spent on experiments with commercial navigation on the Green and Colorado Rivers. Large boats, small boats, steamboats using coal or wood for fuel, gasoline boats ranging from those equipped with small outboard motors to 40-horsepower gasoline engines; boats with paddle wheels, propellers in tunnels; screw propellers; specially designed riffle climbers have all been tried. The Moab Garage boats alone survive. Commercial navigation on these rivers has been a failure. The revenues derived from freight and passenger traffic represent a small part of the cost of the boats. Failure of commercial navigation has been due to the fact that the rivers possess characteristics which will always prevent them from serving the public as highways of commerce.

To-day there are no boats of any kind on the Green River, none in Glen Canyon, none on the San Juan. The three or four at Moab are without freight or passengers and will no doubt soon follow the others into wreck and decay.

IX

INDIAN RESERVATIONS ADJACENT TO THE RIVERS

Significance of the acts of Congress and Executive orders affecting the Navajo and other Indian reservations in Utah

On behalf of the Government certified copies of treaties and official orders concerning the Navajo and other reservations affecting lands in and adja-

cent to the Colorado and San Juan rivers were offered in evidence. (Exhibit 71.) Testimony concerning these reservations was offered by the witness Hugh V. Campbell. (Vol. 23, pages 4104 et seq.) Lands lying within the State of Utah were included in Executive Orders of May 17, 1884, November 19, 1892, May 15, 1905, and orders of the Secretary of the Interior of October 15, 1907, May 28, 1908, July 17, 1922, and February 19, 1929. All of the lands in Utah lying south and east of the San Juan and Colorado rivers are either in a state of reservation or withdrawal for Indian purposes, as indicated upon the map. (Exhibit 70.) All of these lands have been in a state of reservation for a long period with the exception of lands lying west of the 110th meridian which were restored from withdrawal from 1892 to 1905 and from July 17, 1922, to May 19, 1929.

The Executive Order of May 17, 1884, creating a reservation for Indian purposes in Utah, described the reservation as running up and *along the middle channel of the Colorado and San Juan rivers*. The pertinent portion of the order reads as follows:

It is hereby ordered that the following-described lands in the Territories of Arizona and Utah be, and the same are, withheld from sale and settlement and set apart as a reservation for Indian purposes, viz:

Beginning on the one hundred and tenth degree of west longitude at 36 degrees and

30 minutes north latitude (the same being the northeast corner of the Moqui Indian Reservation); thence due west to the one hundred and eleventh degree thirty minutes west longitude; thence due north to the middle of the channel of the Colorado River; thence up and along the middle of the channel of said river to its intersection with the San Juan River; thence up and along the middle channel of the San Juan River to west boundary of Colorado (32 degrees west longitude, Washington meridian); thence due south to the thirty-seventh parallel north latitude; thence west along said parallel to the one hundred and tenth degree of west longitude; thence due south to the place of beginning: *Provided*, That any tract or tracts within the region of country described as aforesaid which are settled upon or occupied, or to which valid rights have attached under existing laws of the United States prior to date of this order, are hereby excluded from this reservation.

At the time this order was promulgated the President and other officers of the Government had the benefit of the reports of Powell (Exhibit 51), Ives (Exhibit 72), Wheeler (Exhibit 73, not published until 1889), and of many other military and scientific expeditions (See Appendix to Wheeler Report). If with the information at hand, the Government chose to part with the river beds of the San Juan and Colorado Rivers, it was because those rivers were known to be, at the places described,

nonnavigable streams. This inference is clearly justified by the language of the Supreme Court in the case of *Brewer-Elliott Oil Co. v. United States*, 260 U. S., 77, wherein it is stated as follows:

It is a natural inference that Congress in its grant to the Osage Indians in 1872 made it extend to the main channel of the river, only because it knew it was not navigable. This would be consistent with its general policy. Rev. Stats., Sec. 2476; *Oklahoma v. Texas*, 258 U. S., 574; *Scott v. Lattig*, 227 U. S., 229, 242; *Railroad Company v. Schurmeir*, 7 Wall. 272, 289. If the Arkansas River is not navigable then the title of the Osages as granted certainly included the bed of the river as far as the main channel, because the words of the grant expressly carry the title to that line.

The significance of the Executive Order of President Arthur in including in the reservation a portion of the beds of the San Juan and Colorado rivers is pointed out by the Supreme Court in *United States v. Holt State Bank*, 270 U. S. 49, 55:

But, as was pointed out in *Shively v. Bowlby*, 152 U. S. 1, pp. 49, 57-58, the United States early adopted and constantly has adhered to the policy of regarding lands under navigable waters in acquired territory, while under its sole dominion, as held for the ultimate benefit of future States, and so has refrained from making any disposal thereof, save in exceptional instances when impelled

to particular disposals by some international duty or public exigency. It follows from this that disposals by the United States during the territorial period are not lightly to be inferred, and should not be regarded as intended unless the intention was definitely declared or otherwise made very plain.

It follows that the river beds were included in the Executive order because it was known at that time that the rivers were nonnavigable.

There is some difference between the status of the lands lying east of the 110th meridian and those lying west, as shown by Exhibit 71 and R. 4112. The portion lying west, although as heretofore shown, also reserved by Executive Order of May 17, 1884, was restored on two occasions. It was again withdrawn for Indian purposes. The Secretary of the Interior again withdrew it on February 19, 1929, for the purpose of securing the enactment of legislation for its inclusion within a permanent reservation, as required by the Act of March 3, 1927, 44 Stat. 1347.

The portion lying east of the meridian was under consideration by the Attorney General in his opinion of May 12, 1924. (34 Op. Attorney General, 171.) The reservation was held to be one which the President could legally make. Serious doubt was expressed as to whether the President, having once made the reservation, could abolish it. A reservation had been created with respect to which "the Indian right of occupancy is as sacred

as the fee title of the sovereign." Such Executive Order reservations are subject to allotment under the General Allotment Act of February 8, 1887 (24 Stat. 388), and under authority of the Act of March 3, 1927 (44 Stat. 1347), may be leased for oil and gas purposes for the benefit of the inhabitants of the reservation pursuant to the Act of May 29, 1924 (43 Stat. 244), and Section 3 of the Act of February 28, 1891 (26 Stat. 795), which governs the leasing of Indian lands generally.

X

SCIENTIFIC RESEARCH ON THE RIVERS FROM 1857 TO DATE BY THE UNITED STATES DISCLOSES THAT THE RIVERS IN UTAH ARE VALUABLE FOR WATER SUPPLY, IRRIGATION, AND POWER AND NOT FOR NAVIGATION

The Government, over a period of sixty years, has spent thousands of dollars investigating the utilization of these rivers. The findings of the engineers are inconsistent with navigation.

The Colorado River has been under observation, survey, and study and has formed the subject of reports to Congress since the end of the Civil War. (Secretary of the Interior, page 2, Exhibit 62.) The results of these studies and investigations are largely included in maps and reports which have been introduced in evidence by the Government in this case as follows: Beginning with Major Powell's report in 1875, "The Exploration of the Colorado River of the West" (Exhibit 51), based on his observations of 1869-1871 and continuing through to

Water Supply Paper No. 617, dated 1929, "Upper Colorado River and its Utilization," by Robert Follansbee; 1,800 miles of river and reservoir surveys, part of which are included as Exhibit 10; thousands of photographs, part of which are included as Exhibits 11-A to 11-E; complete reports on the water and flood-control problem, as contained in reports by E. C. LaRue (Exhibits 58 and 62); reports on the mineral resources as contained in Exhibit 638; Exploratory Survey by the Corps of Engineers, U. S. Army (Wheeler Report, Exhibit 73); reports of a more general nature such as those by Miser and Gregory on the San Juan, Exhibits Nos. 56 and 63; studies of silt by Howard, Exhibit 494; classification of maps and land area, Exhibits 505 and 506; cadastral survey to locate the land net as shown by Exhibits 605 to 607; and geologic investigations by Baker, Reeside, Dobbin, Nye, and others.

All of these investigations and studies have been made with but one idea in view, namely, to assure as far as possible "wise development and use of resources now economically important and preservation or protection of resources having potential value for the future." (Secretary of the Interior, page 89, Annual Report for 1927.)

It is most significant that as a result of the investigations which have been made, projects have been outlined in the various reports, Exhibits 58, 62, 63, 505, 506, and oral testimony of Stabler.

Vol. 22, page 4041; Richardson, Vol. 20, page 3676; Bissell, Vol. 22, page 4076. These projects will make complete use of the water resources in connection either with irrigation, water power and supply, or flood control. All of the vacant public lands adjacent to the river in question in the State of Utah have been withdrawn (Exhibits 508 to 557) for use in connection with the projects outlined.

Briefly, in so far as lands adjacent to the Colorado, Green, and San Juan rivers in Utah are concerned, the projects contemplate the construction eventually (see exhibits and testimony previously noted) of the Dewey reservoir site on Colorado River above Moab to a capacity of over two million acre-feet for the purpose of reducing floods and equalization of the flow for water supply, power, and irrigation use; the development of the Flaming Gorge site to a capacity of three million acre-feet on Green River near the Wyoming State line for similar use; the construction of power sites in the canyon section between Flaming Gorge and Green River, Utah; the irrigation of additional lands adjacent to Green River in the vicinity of Ouray and Green River, Utah; the possible development of a reservoir site just below the junction of the Green and Colorado, backing water to the towns of Greenriver and Moab, Utah; the construction of a reservoir site on San Juan below Bluff to a capacity in excess of two million acre-feet for flood prevention and as a silt collector; and

the construction of a reservoir in Glen Canyon near Lees Ferry with a possible capacity of over sixty million acre-feet which would back water to the mouth of Green River.

As outlined in Exhibit 507 the construction of these and other projects provide water for the ultimate irrigation of nearly 600,000 acres of land in Utah and the development of over 600,000 horsepower in Utah.

The withdrawal of the lands insures the wise development of resources economically important. Moreover, in the studies for maximum use and benefit, navigation was considered in an Army engineer report. (State Exhibit 18.)

None of these reports indicate a use of the rivers in Utah for navigation. The primary value of the Colorado, Green, and San Juan rivers in that State has been and always will be for water supply, irrigation, and power development.

XI

UTAH SINCE STATEHOOD HAS TREATED THE RIVERS AS BEING NONNAVIGABLE

The scientific investigation by the United States over a period of 60 years into the possible uses of the rivers exclude any conclusion that the rivers are navigable. Utah has sat silently by from statehood until 1925 and permitted the Government to make expenditures for these investigations without comment or claim, intimating that the State

asserted ownership to the river beds based upon navigability.

Scores of placer miners have operated in the beds of these rivers claiming rights under location notices posted and filed under the laws of the United States. (See Exhibit 3, pp. 559 to 604, Stipulation Vol. 25, p. 4282.) There is no evidence that Utah has ever protested against this method of procedure, and sought to compel the placer miners to acquire their rights under the laws of Utah. Such conduct is not conclusive on the question of navigation, but taken with all of the other facts and circumstances in the case, it is a matter to be considered.

See *Mintzer v. North American Dredging Co.*, 242 Fed. 583, 560, 561.

As we have seen, it has never been in fact navigated in any true sense, and has not been treated or considered, either by the public or by the state, as capable of navigation. While this lack of recognition by the state is not conclusive, it is nevertheless not without potency as a fact in its bearing on the question, since it is not to be lightly presumed that the state will part with its title to property of known or recognized value for public use.

In the year 1925 the oil prospects in the Colorado River bed below Moab became interesting. One company had expended large sums of money in the development of permits, granted under the laws of the United States, Act of February 25, 1920 (41

Stat. 437), which included parts of the bed of the Colorado River (Exhibits 465, 466). The State of Utah immediately asserted the navigability of the rivers, and granted leases to other persons to the same portions of the river bed (See Exhibits 608 to 617, 634 to 637) upon which Government permits had already been issued.

Each of the State leases contained the following clause (Art. VIII-A):

It is understood that the title to said lands of the State of Utah may be disputed by the United States or those claiming under it. Pending active litigation involving the title to said lands of the State of Utah or its right directly or through a lessee to develop and operate said lands for oil and/or gas and to produce said products from said lands, instituted either by the United States or those claiming under it, or by the State of Utah or Texas Production Company as its lessee, the requirement of actual drilling on said lands shall be suspended, and also all other operations or activities on said lands; provided, however, that in spite of such litigation, Texas Production Company shall nevertheless pay to the State of Utah the rentals hereinabove provided.

It is further understood and agreed that in the event of any such litigation so involving the title of the State of Utah to said lands or its right directly or through Texas Production Company as its lessee to develop and operate said lands for oil and/or gas and to

produce said products therefrom Texas Production Company will at its own cost and expense and without cost or expense to the State of Utah defend or prosecute such litigation as the case may be.

It is evident from this clause that the State of Utah declined to assume any responsibility in maintaining the validity of the leases, and, hence, also the navigability of the streams. That litigation was cast upon those who accepted the State leases. Intrastate navigable streams are charged with a servitude in favor of the public, and the obligation rests upon the State to maintain the integrity of that servitude for the benefit of the public who desire to navigate the streams. A navigable stream presupposes a highway of commerce, valuable to the public for the purposes of transportation, and Utah has not claimed that use for the rivers in the past. By its attitude it has denied that the use existed. Navigability of the rivers should be asserted for the primary purpose of establishing the rivers as public highways of commerce.

In order to sustain its position, Utah in 1927 enacted the following law (Laws of Utah, 1927, page 8):

SECTION 1. *Colorado River in Utah and Green River in Utah declared to be navigable streams.*—That the State of Utah does hereby declare that the Colorado River in Utah and the Green River in Utah from

time immemorial and at the time of the admission of Utah into the Union as one of the States of the United States of America were and ever since have been and are now navigable streams.

SEC. 2. *Title to the bed of all navigable rivers vested in State of Utah, when—exceptions.*—That the title to the beds of said rivers and of each of them, as well as the title to the beds of all other streams and lakes which at the time of said admission of Utah into the Union were navigable in fact, vested in the State of Utah at the time of its said admission into the Union and said title has at all times thereafter been and now is vested in the State of Utah, except such portion or portions thereof as may have been heretofore disposed of by the State of Utah pursuant to law, by express grant.

Utah by this law solemnly states that the Green and Colorado Rivers are navigable throughout the State of Utah. The absurdity of the law appears when it is considered that in certain stretches of both rivers only men of iron nerve have ever been down them and then only in specially constructed boats. This law can not deprive the Government of any of its rights in the river beds, because, as has been previously shown in this brief, the rights of the parties to this suit were fixed as of the date of statehood.

The bill alleges (Paragraph D, page 11) that the rivers are not navigable *interstate*. The answer ad-

mits (Paragraph 3, page 6) that the rivers are not navigable *interstate*, but the answer at numerous places asserts that the rivers are navigable *intrastate*. The evidence shows that in the section of the Colorado River between the foot of Cataract Canyon and Lees Ferry, Arizona, the best water for the operation of boats is between Warm Creek, Utah, and Lees Ferry. There are no rapids in this section of the river. Utah seeks to secure to itself the advantages of an intrastate navigable stream, without being subjected to the obligations incident to an interstate stream. Under the evidence, Utah can not consistently maintain that the Colorado is navigable intrastate and deny its navigability interstate to Lees Ferry. When Utah admits non-navigability interstate, it admits in substance that the Colorado River is nowhere navigable in Utah.

XII

NONNAVIGABILITY OF THE RIVERS HAVING BEEN ESTABLISHED, THE TITLE TO THE RIVER BEDS REMAINS IN THE UNITED STATES AND THE UNITED STATES IS ENTITLED TO THE RELIEF SOUGHT

The United States, as the riparian owner of the uplands adjacent to the sections of the rivers in question, owns the river beds because the rivers are nonnavigable. This principle is established in the case of *Oklahoma v. Texas*, 258 U. S. 574, 591, where, after arriving at the conclusion of nonnavigability of the Red River, the court said:

We conclude that no part of the river within Oklahoma is navigable and therefore that the title to the bed did not pass to the State on its admission into the Union.

Prior to the statehood of Utah, the United States owned all of the present State of Utah, including the beds of all streams, except such lands as the United States had disposed of. If the title to the beds of the Green, Colorado, and San Juan rivers did not pass to the State of Utah upon its admission into the Union, the ownership of the river beds continues to remain in the United States.

See also *Brewer-Elliott Oil Co. v. United States*, 260 U. S. 77, and *United States v. Holt State Bank*, 270 U. S. 49.

Utah as a State is without power to acquire either by State court decision or State legislative enactment, any of the public lands of the United States.

Van Brocklin v. Anderson, 117 U. S. 151.

Bagnell v. Broderick, 13 Pet. 436.

Jourdan v. Barreit, 4 How. 169.

Gibson v. Chouteau, 13 Wall. 92.

Utah has expressly disclaimed any such power.

Section 2, Article III, Constitution of Utah

This section was required by the enabling act of July 16, 1894. (28 Stat. 107.)

By legislative enactment, Utah has disclaimed any interest in the beds of nonnavigable streams.

See Laws of Utah, 1921, page 318, Sec. 5575:

* * * Nothing herein contained shall be construed as a legislative declaration of ownership by the State of Utah of the beds of nonnavigable rivers or streams.

Both the United States and Utah, therefore, are in harmony in declaring that the ownership of the beds of nonnavigable streams is in the riparian owners.

It follows that the United States is entitled to the relief sought.

Respectfully submitted for the consideration of the Special Master.

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MARCH, 1930.

APPENDIX

SUBSTANCE OF TESTIMONY ON NAVIGATION FROM RECORDS IN OTHER CASES

State of Oklahoma v. State of Texas (258 U. S. 574)

In the testimony, very little is said respecting navigation upon Red River from Marshal County west, reference being made in the testimony of one witness regarding the area adjacent to Tillman County, one of the westerly counties, that there has been no navigation on the river within his recollection, people using boats for fishing and hunting only. (R. 1403.)

The testimony of another witness resident in Jefferson County refers to a ferry boat operated near Ryan. (R. 1486.)

Another witness referred to a ferry boat operated in Love County in Tp. 8 S., R. 2 W. (R. 1522.) Upon the section of river adjacent to the counties from Marshal County eastward to the Arkansas line; there appears to have been considerable traffic at one time or another, and the testimony deals principally with these sections so far as boating history is concerned.

D. C. Tumej (R. 1550), 84 years of age, residing at Platter, Bryan County, Oklahoma, lived all his life in neighborhood of Preston, Texas. He stated that steamboats came up there before the war; one came to old Preston and stayed until spring; one went to the mouth of Big Mineral and

stayed all winter; it came up on a rise in the river. One was stranded at Preston and stayed there all winter. The one that came up to Big Mineral had a saloon and groceries on it. The pilot house was torn off of the one that stayed at Preston, by the boat trying to run under a cable, and it had to stay until the pilot house was repaired. These boats came before the civil war. A keel boat came up and started up the Washita, but hit a rock about a mile up and was sunk. He heard of a boat coming up in 1884, to Colbert, but did not see it; that it was the last boat he heard of on the river. During the time these boats came up, the channel was deeper than it is now; the river was more narrow and there was more water in it at its ordinary stage. Since the river has widened and has become shallower, it would be possible to navigate the river with steamboats if the snags could be gotten out of it, and hold the water in one place, but the river has spread out so in the valley, the water is more shallow now and there are more sand bars formed than when he first knew the river. These bars, of course, change from one place in the river-bed to another. He believed the river could be improved by confining this sand, so that it could be made navigable; he further stated that they could go up now in time of rises. The rises sometimes come suddenly. There is no certainty as to when a rise will come down the river. He knew of some years in which there was no overflow. One cannot depend upon a rise coming at any particular time.

The steamboats coming up the mouth of Big Mineral and Preston had boilers on them: they were loaded with dry goods, groceries and whiskey;

one went to the mouth of Big Mineral and stopped, staying all winter, selling groceries and dry goods to the people and in return took money, hides, buffalo robes and country produce. By spring they pretty well sold out their stock of groceries and dry goods; they again came back to Preston with a heavily loaded boat, and sold groceries and whiskey there. The boat did not stay there but a little while. It was loaded with all kinds of furs and hides and went out in the spring.

There was a great deal of hunting and trapping up and down the river in the early days—beaver, otter, skunk, mink, and coons were trapped. There were a great many fur-bearing animals in the river bottoms then, but they were all trapped out about twenty-five years ago. The hunting and trapping was done by people on both sides of the river. They were hunting and trapping as far back as he could remember. The keel boat going up the mouth of the Washita came before the civil war. It was propelled by steam; it had a boiler on it and it was about a hundred feet long, and probably 14 ft. wide. He heard the men on the boat talk about Shreveport and New Orleans. The first boat that he saw coming up the river was called the "*Ruby Sal*."

Dan H. Collins, 40 years old, farmer, of Colbert, Oklahoma, who lived there all his life, saw the *Annie P.*, and the Government snag boats up there. (R. 1557.)

G. W. Webb, residence 1½ miles south of Achille, southern part of Bryan County, 4 miles from Red River; 40 years old, testified (R. 1562) that he did not know of any navigation on the river but heard of a steamboat which came up the river in 1898. He had a gasoline boat down at Kiamichi on the

river and tried to bring it up the river; it was 16 ft. wide and 36 ft. long; the bridge was 14 ft. wide and 20 ft. long. The Kiamichi is something like 300 miles from where I live. The boat drew 32" of water and he did not find the water deep enough to bring it unless he could get a rise. He brought the boat up in 1908, and got it here on a rise in the river. The boat was built by one of the lumber companies to raft logs. He brought it up the river to use as a ferry boat.

R. P. Draper (R. 1567), County Surveyor, Choctaw County, Okla., 60 years old, lived in that county since 1903; before that time resided in Lamar County, Texas, opposite Choctaw County, Okla., testified: The boat coming down the river in 1867 was the first one he knew of and that was in the fall or winter season. It was named the Cuba; it drew between 3½ and 4 feet when loaded. Since the changes described as having taken place in Red River he would not now consider the river navigable. There were several boats since that time which he saw, the last navigation occurring in 1875. Since that time there have also been gasoline launches on the river. These gasoline boats were principally used for rafting timber; quite a lot of timber has been rafted down the river to different mills along the river; they generally happen to catch a rise; they could not do much in the ordinary stage of the river. There has been a good deal of logging on the river in his recollection; hardwood and cottonwood principally; some places in the valley were heavily timbered with large timber when he first knew it; there was a great deal of that class of timber in the river valley on both sides of the river; that timber has been pretty well cut out.

Some of it was cedar, out of which telephone and telegraph poles were made, and some of a still larger class. It was the custom to float these logs down the river to sawmills adjacent to the river. Some of them were even floated to Fulton, Arkansas, and below there even. Walnut logs were floated down the river; logging was quite a large industry in the Red River valley for a great many years, and floating and rafting the logs down the river was one of the usual and ordinary methods of carrying those logs to market.

Texas people used the river for this purpose, as well as Oklahoma people. After the invention of motor boats, these boats were used in shoving the rafts along; but that was not done extensively; it did not seem to be a success. They generally took advantage of the rises and rafted the logs down during a rise. The Texas & Pacific Railroad was built along the river in the early seventies. The boat he spoke of as landing at Hickory Bluff Landing was a steamboat; it was carrying cotton for some point up the river. Up to the time the railroad came, a large portion of the cotton grown on Red River was shipped out by steamboats or flat boats. He did not remember any boats after the railroad was built to Caddo, Oklahoma, that was the nearest market other than that afforded by the Texas & Pacific.

J. W. Threlkill (R. 1572), 60 years old, address Grant, Okla., lived nearly all his life near Red River in Oklahoma and Indian Territory. He testified that his recollection goes back to '71 or '72, when he was eleven years old. The river was not then being navigated, only one or two boats came up the river. He saw one about 1874; it was a steamboat

and he saw it as it was coming back, about 8 or 10 miles above the mouth of the Kiamichi. The river was then on a little rise. One boat sank at Slate Shoals. He knew of no other boats except gasoline boats that were used in the timber business; they were used to bring supplies up the river for a period of fifteen years or so. Ash, cotton, and some walnut were floated down the river, which could not be moved in low water, but when the water was high enough, the rafters would turn it loose. The timber was put into rafts and fastened together; this logging continued for ten or fifteen years until the timber was all cut out. The first raft was taken to Fulton, Arkansas. The timber was taken from above the mouth of the Boggy, which is 30 or 35 miles above the mouth of the Kiamichi; the rafting continued throughout all the year at any time a little rise would take it down. The last rafting he saw occurred about 12 years ago. Not all the commercial timber in this county was rafted down the river; some mills were set up there, though the handle factory is continuing to cut out ash timber and take it down the river.

G. W. Oaks (R. 1575), Hugo, Okla., 70 years old, testified that as a boy he saw a steamboat loading cotton at his grandfather's gin. He was not sure whether this was before or after the civil war. He remembers the old Pine Bluff landing. There were several points along the river where boats landed. Thinks steamboats went up and down the river until along in the seventies. One he recalled was blown up about at Slate Shoals. The river used to be deeper than it is now. The people then fished in the river; they do now occasionally. Game was plentiful when he was a boy and people hunted

on both the Oklahoma and Texas side; occasionally he heard of trappers on the river. There were large trees in the river valley when he was a boy, varying in size from that of your leg to 3 or 4 ft. in diameter; they have decayed or been cut down or blown down, much of this was cut and used for sawlogs, and in some places they were rafted down the river. The cedar was cut for telegraph and telephone poles.

L. W. Oaks (R. 1578), Frogville, Okla., 1½ miles from Red River, 64 years old, testified that there used to be little boats running up and down the river which carried out cotton and products of the country before the coming of the railroads; they brought in dry goods and groceries and things of that sort from Shreveport and New Orleans; there were various landings up and down the river where there were stores that got these things from steamboats. Prior to the coming of the railroads one of the ordinary means of obtaining supplies and shipping out products of the country was the shipment of goods up and down Red River. He remembered when the river valleys were timbered with merchantable timber; a lot of it was rafted out. Rafting logs continued off and on as long as there was merchantable timber in the country. He thinks there is about as much water in the river now, as a general thing, as there ever was. The river valley lands are regarded as productive lands, and that is true as to those on the Texas side as well as on the Oklahoma side.

W. H. Pearcey (R. 1570), 76 years old, address Grant, Choctaw County, Okla., testified that the largest cottonwood tree he ever saw was 4 or 5 feet in diameter; the largest walnut was three or four

feet; he did not recall any very large cedar trees in that area. Saw black gum trees two feet in diameter. When the merchantable timber was cut out, it was sawed and marketed. Lately there has been no rafting. It has been ten or twelve years since any rafting was done. Timber was rafted in large rafts to Arthur City from the Boggy and up the river above there. When he first knew the river it was something like 75 to 100 yards wide. Only small rafting could be done unless there was some extra water. During low-water stages the sand bars would interfere. When the river was low they would send small rafts, the size of the raft depended upon the stage of the water.

W. J. Oaks (R. 1581), 72 years old, residing at Grant, Choctaw County, Oklahoma, stated that before the railroad was built to Paris, Texas, some little boats came up Red River. In 1874 and 75 the boats brought salt, tobacco, molasses and liquor to the mouth of Kiamichi, and peddled them to the citizens, carrying cotton back to New Orleans. The boats principally came to the mouth of the Kiamichi, but have gone above there. They have come as high as Arthur City. In 1873 a boat came up during an early rise in the spring of the year and lodged on the rocks at Shoals. The captain later undertook to take it off and it blew up. There was one large boat but he thought the boats he used to see were not more than 50 or 60 feet long and they drew about 2½ feet of water. When the railroads came, commerce by way of boats ceased. Cedar, hickory, and pecan trees grew in the river bottoms. Before the railroad was built, this timber was cut off and floated down the river. Walnut was taken out after the railroads were built.

Q. Herndon (R. 1584), McCurtain County, Okla., 60 years old, testified that walnut timber was rafted down the river in good sized rafts when he first went there. Game was plentiful, and fur-bearing animals were trapped on both sides of the river. He saw two steamboats on the river; the last one in 1914. It was a Government dredge boat. There was a steamboat landing at old Albion, but he never saw any steamboats land there. Old Rowland was an old steamboat landing, and so was Briley's landing. I think the Briley landing and the old Rowland landing were the same.

Garrett Igo (R. 1587), 80 years old, lived in country since 1848, when he came to Red River County, Texas, testified that he navigated Red River from 1866 to 1874. He was Captain of the *Belle Crook*, which was in 1866. He was on the *J. L. Briley* in 1872 and 1873. He made a trip or two on the *R. T. Briley* which was put on in 1876. These boats ran from Fulton, Arkansas, to the mouth of the Kiamichi, which was then considered the head of navigation. They were nearly all stern wheel boats, drawing about four feet of water, and carrying 1,000 bales of cotton. They were nearly all flat bottom boats. There were a number of other boats on the river during that time. They generally ran from January up until April. About half a bank stage was required to run a boat. When the boats were not in use they were tied up either at Fulton or New Orleans. The boats would go through to New Orleans once or twice in a season. There was a raft in the river at Fulton which was sometimes very difficult to get through. It would take about ten days to make the round trip from the mouth of the Kiamichi to New Orleans.

They freighted molasses, whiskey, and groceries up Red River before there were any railroads; that it was their business to sell to the farmers, and they took back cotton, cottonseed, and salt. They usually tied them up when there was no freight to carry.

In very low water they had to sound the bottom frequently for bars, by sending a skiff out in front to take a sounding. In low water they went very slowly because if they struck on a sand bar they might stay there a week or a month. This did not occur very often. He had known of boats to be snagged and sunk. The *Ham Howell* was one such and the *Clevis* another. At the old *Rowland* landing he had seen as many as four big side-wheel boats there at one time, some of which would take 1,700 bales of cotton. They had a great deal more water in the seventies than they have now. Those large boats ran then. When the railroads were built the steamboats were put out of business for commercial purposes except an occasional cottonseed boat. He saw one or two trading boats in 1906. He saw the Government dredge boat once or twice when it was up in this country. Red River had been considered a navigable stream only in the winter season. They could not compete with the railroads. It had been 20 years since he observed Red River except to cross it at different points. They could navigate some localities of it now by catching high water, if they did not have the railroads. He saw one keel boat on Red River. That was just a hull of an old boat that had been used. It was at old *Rowland*.

Keel boats were used in navigation before the invention of steamboats. They drew about 3 feet

of water. He operated flat boats on Red River where a cotton boat sank, and took the cotton off with flat boats. They used their steamboats as trading boats, bringing up sugar, coffee, molasses, etc., and buying beef, cotton, and cottonseed. These trading boats operated on the river until the railroads came; after that, whiskey boats continued to come up the river. He had been up to old Preston twice, in 1849 and in 1909. These upper Red River boats carried from 800 to 1,000 bales of cotton; they were flat-bottomed boats, one hundred feet long, and 30 or 40 feet wide; 30 feet was the average. Most of the boats running on the river were stern-wheel boats. The steamboats had no effect on the sand bars. The *Ham Howell* and the *R. T. Briley*, the *Bonnie Lee*, and the *Royal George* ran after the Civil War. He remembered Ben Kuntz and John Kuntz. The boats were called the Kuntz lines. The *Era* and the *New Era* both ran before the Civil War. The Kuntz line and the Morgan line ran up and down upper Red River; they had a number of boats running on upper Red River along in this section of the country. He remembered a boat called the *Red River Planter*; it ran on the river in this section of the country.

Captain Cheatham ran the *Frontier*; he had a salt works up in the Kiamichi River and ran another boat called the *Southern*. He remembered a boat called the *Francis Jones*, and the *R. M. Jones* and the *Walla Busha*. The Jones boat was built to haul cotton off of the old Shawneetown farm. He remembered a boat called the *Jim Turner*. People living along Red River in those days marketed their crops from October until along in the spring. During the summer months there was nothing up

here for boats to haul out. During the fall and spring when there was anything to ship out, and the river was at the correct stage, the boats would come up and take it out. The boats brought merchants' goods to Clarksville, Sherman, and Honey Grove. Passengers came on those boats. Except for conveyance by wagon from Shreveport and Gaines Landing, the navigation of the Red River by boat was the only means of commerce for this section of the country. It was a matter of debate whether the removal of the raft in Louisiana did more to hinder or help the navigation of Red River up along the Texas border; some thought it made the water shallower, and some thought it helped. He remembered a steamboat by the name of the *Oliver* that ran to Clarksville, Texas. Fort Towson is just a little east of the Kiamichi River. Boats sometimes went a mile up the Kiamichi River to get cotton. When he first came to this country in 1847 there was a great deal of timber growing in the valleys on Red River, both on the Oklahoma and the Texas side. Cottonwood, walnut, hickory, pecan, ash, sycamore, gum, and bois d'arc. He saw cottonwood trees that were five feet in diameter; and a walnut tree that was 4 feet in diameter which was sold for \$900.

F. D. Tuaffee (R. 1592), Idabel, McCurtain County, Okla., testified that there had been no navigation of the river within his recollection and the only boats he saw had been Government snag boats. From his observation of the river he would judge it to be navigable only at a high tide. The rises are uncertain. To a certain extent the local rises occur from the middle of March to May; then the

winter snow melts in the mountains, and we have what we call the June rises.

W. T. Graham (R. 1596), 65 years of age, was sheriff of McCurtain County, Okla., 4 years. Testified that small boats were running on the river when he was a boy, but he could remember none except Government snag boats since 1894. He had been on boats and had gone up to old Captain Wright's place at a rock landing just above the mouth of the Kiamichi. He was the first sheriff of McCurtain County, elected in 1907 and served 4 years. He knew of no whiskey boats that came up the river except the little stern-wheel boats that would have a regular bar on them. These boats carried meat, flour, sugar, and coffee, selling supplies to the people along the river, and carried cotton back; they would bring in supplies to the people and carry back the produce of the country.

Isaac Johnson (R. 1597), 62 years old, lives 6 miles south of Idabel, Okla., testified that he saw boats on Red River since he had lived there (25 years); they used to come up Red River every winter after the rainy season set in, until the Texas & Pacific Railroad was built; he did not recall exactly what year that railroad was built, but since that time the boats had not run regularly on the river. His house is right on the river in a bend, and he could see up and down the river for miles. The last boat he remembered was about 100 ft. long and 30 ft. wide, an oil burner he thinks, brought from St. Louis by a factory in Paris, Texas. It was a flat bottom boat and ran in 1909. He saw it coming from St. Louis and afterwards saw it going back down the river, and again saw it going back up the

river. He remembered the date because statehood came in 1907. He did not know what became of the boat; it was used by the timber people in rafting timber down the river; ash timber was put on it by the handle factory which owned it. If it made more than 3 trips he did not see it. The steamboats used to come up bringing freight, and carry cotton back, but the commercial boats did not run on the river since the railroads came into the country. The last boat he saw had a wooden hull, and the river was at a very low stage when the boat went up.

Before the Texas & Pacific was built, the supplies were brought up by steamboat, and the cotton and produce of the country were carried back. In cotton-growing countries like this, the business of the country is conducted in the fall and winter, and during this season the boats would come up; the rises would occur at the right time for moving the commerce of the country; other rises occurred at other times, but there was nothing for the boats to come for except during the fall and winter. Government snag boats have worked on the river. Boats were used on a six or seven foot rise. He sometimes worked on boats; they carefully measured the water when they were afraid of bars. He saw a man on the bow of boats in the early days cast a line to measure the water. There were whiskey bars on the boats. During the low-water season in this country people would go to Jefferson, Texas, for their supplies; steamboats ran there all the time. Between boating seasons they went overland for freight. The boating season would last during December, January, February, March,

and April. The cotton gins had large sheds built to hold the stuff, and farm products would be stored until the water got high enough for steamboats to come and get it; at other times cotton was hauled out overland.

Leovy v. United States (177 U. S. 621)

William O'Brien, witness for Government, occupation, fisherman, hunter and general workman, stated that he worked on the dam complained of; that a man named John Collet went through the pass while he was working there with a lugger which had oysters in it. He did not know exactly how much she drew: may have been 2½ feet or more. Collet came back next day through the pass. The boat was going from the river to the gulf.

Patrick Calaghan, a witness for the United States, maintained an orange grove and truck farm and ran a trading boat to Pilot Town all the way down. Stated that he was acquainted with Red Pass but went clear through with his boat only once. It was a small yawl boat which was turned into a gaff sail. He could not say how much water it drew. As far as he could recollect, it was about in 1864.

R. M. White, for the United States, was engaged in the trading business; was acquainted with the country since 1875. Stated that we have taken out willows on barges drawing from 4 to 5 feet of water by a tug boat. This occurred a little over 4 years ago. He saw luggers go through the pass to the Gulf; he saw boats go through loaded with oysters but no boat can pass through since the construction of the dam.

John Collen, for the United States, was engaged in the oyster business. Owned a boat which he described as a 35-barrel boat which drew about $2\frac{1}{2}$ or 3 feet loaded. He carried oysters through the pass three winters all the way through to the Gulf. He stated that the pass is about 12 miles long and with a depth ranging from 5 or 6 to 10 or 12 feet. Capt. Mitchell and others went through there with luggers and boats, the luggers holding about 120 or 125 barrels of oysters.

Marco Benditich, for the United States, stated that he ran a lugger in the oyster business for many years, frequently going through Red Pass. The last time he went through was 7 years ago with a load of lumber, drawing about $3\frac{1}{2}$ feet. His oyster boat was about 6 tons capacity, 30 odd barrels. He also went through with the lugger *Dexter* drawing 4 feet of water.

Marco N. Benditich, for the United States, was engaged in the oyster business and owned boats; passed through Red Pass two months before it closed with load of lumber drawing about $3\frac{1}{2}$ ft. and saw other luggers going through all sizes.

Luke Scovell, for the United States, was engaged in fishing and went through the pass with his boat every year. The boat called *Lugger Ste. Luke*—little more than 7 tons burden. Went through the pass with this boat loaded with lumber. Also passed through with this and other boats over a period of 15 years.

Michael Fantivitch, for the Government; engaged in the oyster business; went through the pass with his oyster boat every year up to 1894. His boat, a lugger called the *Margary*, was a 125-barrel boat and drew 4 feet of water.

Bozzo Bogetto, for the Government, navigates luggers; engaged in the oyster and lumber business from 1881 to 1893. He went through the pass each year with 100 or 110 barrel boats drawing $3\frac{1}{2}$ ft. at least.

Peter Stevelovich, engaged in the oyster business; went through the pass with his boats, the biggest one drawing 4 ft. of water; others 3 to $3\frac{1}{2}$ feet. Stated that the pass was good for luggers.

Steffano Rusich ran oyster boats; went through the pass for about 17 years; had big boat 120 barrel capacity, $3\frac{1}{2}$ ft. draft; other smaller boats and skiffs.

Brewer Elliott Oil & Gas Co. v. United States
(260 U. S. 77)

The findings of the District Court and Circuit Court of Appeals respecting the subject of navigability were approved by the Supreme Court.

In the report of the decision of the District Court (249 Fed. 609) at page 619 et seq. the Court sets out the substance of the evidence adduced by the testimony of officers of the Corps of Engineers and official reports of the engineers and same need not be repeated here.

The testimony of Gen. W. L. Sibert and others discloses that boats had at times gone up the river far above the mouth of the Grand, but the river could not be practically used for commerce.

Gen. Sibert testified that he had occasion to acquire data with reference to navigation of the Arkansas as to the point at which navigation would cease and as to attempts at navigation of the upper Arkansas. Witness while in the service at Little

Rock found no data showing movement of commerce on the Arkansas above the mouth of the Grand as recorded in the commercial statistics and never knew of any practical use of the Arkansas for navigation purposes above the mouth of the Grand, which was considered as the head of navigation by steamboat operators generally and by practically all of the Government engineers and assistants with whom he came in contact. Witness at no time came in contact with any records of any commerce above the mouth of the Grand although he had heard and knew that one or two boats had in times past gone up there, but there was no commerce on the river. It could not be practically used for commerce. He stated that by practical navigation is meant the navigation that can be relied upon to justify or cause its use in the transportation of products.

Edward Houston, steamboat man, stated that he was engaged since 1853 in that business between the mouth of the Arkansas and Ft. Gibson. He stated that sometimes the river was not navigable between Little Rock and Pine Bluff. In earlier days he stated that they did navigate it longer with certain types of boats. The steamboats used in the early days drew from 9 to 12½" and the keel boats drew only 3".

David D. Chapman. Witness testified that up to 7 years ago he had operated on the river for a period covering about 40 years. He remembers the steamboat "*Aunt Sallie*." Stated that while he was captain he took a trip to Arkansas City, Kansas. It took 15 days going and 12 days getting back. Some difficulty was encountered on the re-

turn trip. He stated that Ft. Gibson is considered as the head of navigation and does not consider the river navigable above that place. In the early days stern wheel boats were used. A picture of the "*Aunt Sallie*," taken July 4, 1878, at Arkansas City, was exhibited. 365 persons were aboard at that time. The boat drew 2 ft. of water loaded.

W. M. Murdock stated that about 1870, one Walton built a flat boat at Arkansas City and put a saw mill engine on it and some kind of a wheel and started for Wichita. A number of boats were built in the early days to haul lumber down to Arkansas City, then the end of the railroad.

R. E. Cook was acquainted with the river about 20 years. He once owned a small boat called the "*Carrie Clyde*" which drew 16" to 18" light and 24" to 30" when loaded. He brought it up about 20 miles above the Grand. The boat got out of the channel and was abandoned on the return trip after the load was removed. "*The City of Muskogee*," another boat, was brought from Cincinnati to Muskogee. Several trips were made in a boat called the "*Mary D.*" from Muskogee to Redland, a railroad point above Ft. Smith. The draft was 16" to 18" light and did not exceed 36" when loaded. Never went above the mouth of Grand River. "*The City of Muskogee*" was somewhat larger than the "*Mary D.*" and drew a little more water.

United States v. Holt State Bank (270 U. S. 49)

Chris Saastad, witness for the Government, first saw Mud Lake the latter part of June, 1892, when he crossed it in a small, flat bottom boat. In crossing, the boat was rowed in places and it was neces-

sary to pole it in others. In one place in particular the oars struck and it was necessary to pole the boat to get across. There appeared to be a kind of bar in this section. The route followed was up Thief River into Mud River and then into Mud Lake, and up the river west of the lake. He saw the lake nearly every year since. In 1900, the lake was almost all dry. You could not get a boat across, but it afterward filled up again. He was on the lake in various years since 1892; crossed both ways. In the fall of the year the lake abounded in wild ducks and geese, and was a favorite hunting ground, the hunters using boats to get to the islands. During the years, many settlers came in and went through, using the river to get in and then crossing the lake. Langley, who had a store up there, used the river and Mud Lake when open. There was a sand bar extending from the west island, but there was an opening between the bar and the shore.

John Knutson was 30 years in the vicinity and knew the lake since about 1892. In the early years, the water was entirely clear but later grew up in reeds and rushes. 1900 was a very dry year. Frequently crossed the lake, small boats being used. In the early years, used oars mostly, but later weeds and grass grew up and it was necessary to pole in many places. He frequently took hunters out on the lake in his boat and also did some trapping. Practically all of the settlers in the locality had boats. He saw gasoline boats coming up there, but they could not use them for the weeds. George Williams, of Thief River Falls, took one launch out there for the last couple of years before the dredge went there but he could not do anything

with it because his rudder got full of weeds first few rods he made. Arpin had a boat up there in 1909. He said the boat was too big and was never on the lake before the ditch was put in there. The boat pulled the coal barges for the dredge and was used on Thief River to haul coal to the dredge. The lake was drained in 1910. He never saw this boat on the lake, just small rowboats or something like that. He saw Horgs boat on Thief River, not on the lake. He never saw Gabrielson run a gasoline boat there.

John Gabrielson came to the country in 1904. He rowed up Thief River into Mud Lake. The lake was tapped in 1910. In that year he made 2 or 3 trips in the launch from Thief River to Grygla in the spring of the year, and then the water went down and he could not go any more. When he started out there was so much water in that part of the country that he did not stop for anything. It was not necessary to attempt to follow the channel.

Chris Norbeck came up there in 1903. He saw Mud Lake from 1904 to 1910, when it was drained. There was always a little more water in the spring of the year. He used to cross the lake often in a boat. He went down Mud River, crossed the north side of the lake into Thief River and went down Thief River. The boat was rowed and poled in places and other places it was necessary to get out and pull it over the shallows.

William J. LaBree has lived at Thief River Falls for 40 years. In 1893 or 1894 he visited the lake; found plenty of water. It was a high year. He took a flat-bottom boat from Thief River to Holt and went across the lake. A number of years afterward he went there duck hunting, going up Thief

River and crossing the lake. The depths were variable, and the boat was rowed, poled, and pulled in places.

Michael Sorem went to the lake hunting and crossed it frequently. He stated that it was very fair rowing but had to push the boat ahead at times.

Tom C. Severson knew the river since 1895 and used boats for shooting.

Two other witnesses testified that they had used rowboats crossing and hunting upon the lake.

Fladcland, witness for the defendant, knew the lake since 1899. He was engaged in general merchandise business for years. He traveled from Thief River to Grygla by boat, made the trip five times and had goods brought up that way. Used rowboats and also gasoline launch. In 1900 shipped in supplies and merchandise. Had channel cut 200 rods, 6 or 8 feet wide through the peat so as to navigate the boats. Some rowboats, some gasoline boats. His brother-in-law built a boat 22 feet long which carried 2,500 or 3,000 lbs. merchandise. He himself had a rowboat which would carry 2,500 lbs. He ran a gasoline launch all the way through. He saw Brown and Johnson up there in 1900 with a boat 25 or 30 ft. long.

Milton Forder knew the country about 25 years. He went up Mud Lake hunting and crossed the lake in a rowboat. He built a flat boat to carry freight from Thief River Falls to settlers. The heaviest load he carried was 3,000 lbs. He used the lake to get in and out of the country in the summer.

Peterson, witness for the defense, used boat for hunting on the lake a good many times, also while camping there.

Oscar Langlie kept store at Liner from 1898 to 1905. He transported household goods by boat from Liner. He came up Thief River through Mud Creek into the lake and up Mud River using a rowboat.

Four other witnesses testified that rowboats were used by settlers generally, many of the flat-bottom type.

Harrison v. Fite (148 Fed. 781)

A gasoline boat, Government inspected, 38 feet long, 7 feet wide, 5 feet wheel, freight capacity 4 to 5 tons; drawing from 1 to 2 feet of water was operated for a period of three years by a merchant who maintained wild game trading stations on various points on Little River. (R. 448, 449.)

For many years a licensed pilot operated steamboats on Little River, the largest of which was 84 tons, which drew 3 feet not loaded and up to 5 feet loaded. (R. 512.)

Lumber rafts were frequently operated. (R. 515.)

Boats were used for transporting cotton seed, wagons, etc. (R. 522.)

Lumber rafts containing thirty-five to forty thousand feet of lumber. (R. 555.)

Another boat of 19 tons capacity, Government inspected, drawing 2 feet of water. (R. 600.)

In the years 1891 and 1892 one witness brought down two lumber rafts containing 60,000 feet and 90,000 feet of lumber, respectively. (R. 621.)

In the years 1893 and 1894 a witness operated a steam boat commercially, the size not given. (R. 638.)

Between the years 1881 and 1883, a witness operated three flat boats. The first, 60 feet long and 12 feet wide and the top deck 17 feet wide. The second boat, 9 feet wide and 39 feet long. The third boat, 9 feet wide and 30 feet long. Two of the boats were operated by horse power and the other by man power. (R. 644.) The boats were used for carrying stock and for the carriage of freight. (R. 650.)

Another witness operated a boat of 5 or 6 tons capacity (R. 659) which was used for transporting merchandise on the river (R. 661).

In addition to the other boats, numerous hunting skiffs, dugouts, and lumber rafts were operated from time to time on Little River.

Toledo Liberal Shooting Company et al. v. Erie Shooting Club et al. (90 Fed. 680)

The case involved the navigation of certain water designated on the map as Maumee Bay. The following was the character of the boats used for commercial fishing on the water in question:

Boats twenty to twenty-four feet long; five to seven feet wide, carrying two sails; drawing about four inches of water. (R. 116.)

The part of the Bay in question was habitually used by commercial fishermen and the fishermen used various types of row boats, sail boats and power boats. (R. 145, 153, 174, 182.)

The Bay was also used by pleasure fishing boats. (R. 107, 433.)