GENERAL PRINCIPLES TO GOVERN, AND OPERATING CRITERIA FOR, GLEN CANYON RESERVOIR (LAKE POWELL) AND LAKE MEAD DURING THE LAKE POWELL FILLING PERIOD*

1. The following principles and criteria are based on the exercise, consistent with the Law of the River, of reasonable discretion by the Secretary of the Interior in the operation of the Federal projects involved. The case generally styled "Arizona v. California, et al, No. 9 Original" is in litigation before the Supreme Court of the United States. Anything which is provided for herein is subject to change consistent with whatever rulings are made by the Supreme Court which might affect the principles and criteria herein set out. They may also be subject to change due to future Acts of the Congress.

2. The principles and criteria set forth hereinafter are applicable during the Lake Powell filling period, which is defined as that time interval between the date Lake Powell is first capable of storing water (estimated to occur in the spring of 1963) and the date Lake Powell storage first attains elevation 3,700 (content 28.0 MAF total surface storage) and Lake Mead storage is simultaneously at or above elevation 1146 (content 17.0 MAF available surface storage), or May 31, 1987, whichever occurs first. If, in the judgment of the Secretary, the contents of Lake Powell and Lake Mead warrant such action, and after consultation with appropriate interests of the Upper Colorado River Basin and the Lower Colorado River Basin, the Secretary may declare that in not less than one year from and after the date of such declaration these principles and criteria are no longer applicable.

3. Sufficient water will be passed through or released from either or both Lake Mead and Lake Powell, as circumstances require under the provisions of Principles 7 and 8 hereof, to satisfy downstream uses of water (other than for power) below Hoover Dam which uses include the following:

a. Net river losses
b. Net reservoir losses
c. Regulatory wastes
d. The Mexican Treaty obligation limited to a scheduled 1.5 million acre-feet per year
e. The diversion requirements of mainstream projects in the United States

4. All uses of water from the main stem of the Colorado River between Glen Canyon Dam and Lake Mead will be met by releases from or water passed through Lake Powell and/or by tributary inflow occurring below Glen Canyon Dam.

*Published in Federal Register 27 F.R. 6851, July 19, 1962.

Diversions of water directly out of Lake Mead will be met in a similar manner or, if application of the criteria of Principles 7 and 8 hereof should so require, by water stored in Lake Mead.

5. The United States will make a fair allowance for any deficiency computed by the method herein set forth, in firm energy generation at Hoover Powerplant. For each operating year deficiency in firm energy shall be computed as the difference between firm energy which, assuming an over-all efficiency of 83 percent, would have been generated and delivered at transmission voltage at Hoover Powerplant in that year if water has not been impounded in the reservoirs of the Colorado River Storage Project storage units (Glen Canyon, Flaming Gorge, Navajo, and Curecanti), but excluding the effects of evaporation from the surface of such reservoirs, and the energy actually generated and delivered at transmission voltage at Hoover Powerplant during that year adjusted to reflect an over-all efficiency of 83 percent. At the discretion of the Secretary, allowance will be accomplished by the United States delivering energy, either at Hoover Powerplant or at points acceptable to both the Secretary and the affected Hoover power contractors, or monetarily in an amount equal to the incremental cost of generating substitute energy. To the extent the Upper Colorado River Basin Fund is utilized the moneys expended therefrom in accomplishing the allowance, either through the delivery of purchased energy or by direct monetary payments, shall be reimbursed to said Fund from the Separate Fund identified in Sec. 5 of the Act of December 21, 1928 (45 Stat. 1057), to the extent such reimbursement is consistent with the expenditures Congress may authorize from said Separate Fund pursuant to said Act. The attached Additional Regulation No. 1 for Generation and Sale of Power in accordance with the Boulder Canyon Project Adjustment Act, upon issuance, will be made a part of these principles and criteria.

6. In accomplishing the foregoing, Lake Powell will be operated in general accordance with the provisions of Principles 7 and 8.

7. Storage capacity in Lake Powell to elevation 3,490 (6.5 million acre-feet surface storage) shall be obtained at the earliest practicable time in accordance with the following procedure:

> Until elevation 3,490 is first reached, any water stored in Lake Powell shall be available to maintain rated head on Hoover Powerplant. When stored water in Lake Powell has reached elevation 3,490, it will not be subject to release or diminution below elevation 3,490. The obtaining of this storage level in Lake Powell will be in such manner as not to cause Lake Mead to be drawn down below elevation 1,123 (14.5 million acre-feet available surface storage), which corresponds to rated head on the Hoover Powerplant. In the process of gaining storage to elevation 3,490, the release from

Glen Canyon Dam shall not be less than 1.0 million acre-feet per year and 1,000 cubic feet per second, as long as inflow and storage will permit.

8. The operation of Lake Powell above elevation 3,490 and Lake Mead will be coordinated and integrated so as to produce the greatest practical amount of power and energy. In view of the provision for allowance set forth in Principle 5 hereof, the quantity of water released through each powerplant will be determined by the Secretary in a manner appropriate to meet the filling criteria.

9. In general, it is not anticipated that secondary energy will be generated at Hoover during the filling period. However, any secondary energy, as defined in the Hoover contracts, which may be generated and delivered at transmission voltage at Hoover Powerplant will be disposed of under the terms of such contracts.

10. In the annual application of the flood control regulations to the operation of Lake Mead, recognition shall be given to available capacity in upstream reservoirs.

Attachment

Approved: April 2, 1962

/s/ Stewart L. Udall

Secretary of the Interior

ADDITIONAL REGULATION NO. 1

to the

GENERAL REGULATIONS FOR GENERATION AND SALE OF POWER IN ACCORDANCE WITH THE BOULDER CANYON PROJECT ADJUSTMENT ACT

In accordance with the terms and conditions of the Act of July 19, 1940 (54 Stat. 774), and Article 27 of the General Regulations promulgated May 20, 1941, the following additional Regulation No. 1 is hereby promulgated:

Commencing with June 1, 1987, charges for electrical energy in addition to such other components as may then be authorized or required under the then existing laws and regulations, and to the extent not inconsistent therewith, shall include a component to return to the United States funds adequate to reimburse the Upper Colorado River Basin Fund for moneys expended from such fund on account of allowances for Hoover diminution during the filling period of the storage project reservoirs authorized by the Act of April 11, 1956, (70 Stat. 105), in accordance with paragraph 5 of the General Principles to Govern, and Operating Criteria for, Glen Canyon Reservoir (Lake Powell) and Lake Mead during the Lake Powell Filling Period, approved April 2, 1962. Such component shall be sufficient, but not more than sufficient, to provide said reimbursement in equal annual installments over a period of years equal to the number of years over which costs on account of allowance were incurred by the said Upper Colorado River Basin Fund.

(Adopted by Secretary of the Interior, Stewart L. Udall, on July 2, 1962. Published in the Federal Register 27 F.R. 6850 (July 19, 1962).)

See page 275 et seq. for General Regulations promulgated May 20, 1941.

EXPLANATION OF PROPOSED PROCEDURES FOR COMPUTING DEFICIENCIES IN FIRM POWER GENERATION AT HOOVER DAM DURING FILLING OF COLORADO RIVER STORAGE PROJECT RESERVOIRS

In order to implement principle 5 of the "General Principles To Govern, and Operating Criteria For, Glen Canyon Reservoir (Lake Powell) and Lake Mead During the Lake Powell Filling Period," it became necessary to develop criteria for operating Lake Mead on a theoretical basis as if the Colorado River storage project reservoirs were not impounding water. Principle 5 of the general principles is quoted as follows:

> "The United States will make a fair allowance for any deficiency, computed by the method herein set forth, in firm energy generation at Hoover powerplant. For each operating year deficiency in firm energy shall be computed as the difference between firm energy which, assuming an overall efficiency of 83 percent, would have been generated and delivered at transmission voltage at Hoover powerplant in that year if water had not been impounded in the reservoirs of the Colorado River storage project storage units (Glen Canyon, Flaming Gorge, Navajo, and Curecanti), but excluding the effects of evaporation from the surface of such reservoirs, and the energy actually generated and delivered at transmission voltage at Hoover powerplant during that year adjusted to reflect an overall efficiency of 83 percent. At the discretion of the Secretary, allowance will be accomplished by the U.S. delivering energy, either at Hoover powerplant or at points acceptable to both the Secretary and the affected Hoover power contractors, or monetarily in an amount equal to the incremental cost of generating substitute energy. To the extent the Upper Colorado River Basin fund is utilized, the moneys expended therefrom in accomplishing the allowance, either through the delivery of purchased energy or by direct monetary payments, shall be reimbursed to said fund from the separate fund identified in section 5 of the act of December 21, 1928 (45 Stat. 1057), to the extent such reimbursement is consistent with the expenditures Congress may authorize from said separate fund pursuant to said act. The attached additional "Regulation for Generation and Sale of Power" in accordance with the Boulder Canyon Project Adjustment Act is hereby made a part of these principles and criteria."

In order to develop the criteria for operation of Lake Mead and Hoover Dam, the theoretical study has been divided into two parts: (1) Lake Mead inflow and (2) reservoir operation. These are discussed separately as follows:

LAKE MEAD INFLOW

1. Storage change (including initial accumulation of bank storage) in upstream reservoirs at Lake Powell, Flaming Gorge, Navajo, and the Curecanti system.

2. Recorded flow of the Colorado River at Grand Canyon.

3. The computed theoretical inflow to Lake Mead will be the sum of 1 + 2. Arrangements would be made to obtain end-of-month contents for the month for each of the upstream filling reservoirs immediately after the end of the month. Records of discharge of the Colorado River at Grand Canyon are available under the present operating methods, so no change would be required to obtain that record.

LAKE MEAD OPERATION

1. The theoretical inflow to Lake Mead would be as computed above.

2. Forecasts of Lake Mead inflow would be made exactly as they are made under present operating criteria, and the release from Hoover Dam to meet predetermined requirements based on (a) flood control under regulations being used prior to Glen Canyon; (b) irrigation orders and predetermined levels of Lake Mohave; (c) energy production schedule as computed from June 1 forecast each year with the firm schedule of generation used if the resulting end-of-December content will stay above 17 million acre-feet. In years of less than firm, as indicated by the theoretical study, that percentage of firm will be generated that will permit the end-of-December content to be 17 million acre-feet or downstream water requirements will be released from Hoover Dam, whichever is the greater. Releases to meet downstream requirements will be made each year regardless of resulting reservoir elevations. The committee on integration and interests of the upper basin will be consulted at the beginning of each operating year, and the proposed theoretical study will be discussed. Actual programs of operation of Hoover Dam will be determined at the regularly scheduled integration committee meetings.

It will be necessary to make some assumptions with respect to distribution of firm energy during a theoretical operation year as actual firm will not usually be attained under the actual operating condition. This distribution of firm energy for the theoretical study will be determined as that which would be produced by the release of water to meet the current estimate of downstream requirements during each of the months of June through September and March through May, and the balance distributed to the months of October through February in a pattern similar to that adopted by the regular integration committee, or a river operation committee if established, for the actual operation of Hoover powerplant during that year of operation.

These computations on a monthly basis will be carried on concurrently with the actual recorded operation of Lake Mead and Hoover Dam to compute the deficiency in Hoover firm energy. Attached is a set of computation forms to be used in the determination of the deficiency in firm energy deliveries at Hoover powerplant. The forms will be kept current each month by the Bureau of Reclamation, and copies will be furnished to all interested parties as soon as possible after the end of each month.

UNITED STATES DEPT.
BUREAU OF RECLAMATION

6/1/61

COMPUTATION OF EFFICIENCY IN HOOVER FIRM ENERGY DURING THE FILLING OF COLORADO RIVER STORAGE PROJECT RESERVOIRS

Computed by _____ Date _____
Checked by _____ Date _____

COMPUTATION SHEET FOR ACTUAL HOOVER POWERPLANT OPERATION ADJUSTED TO 83% EFFICIENCY

	ACTUAL RESERVOIR OPERATIONS								ADUSTED POWERPLANT OPERATIONS				
						Lake Mead			Lake Mohave	Hoover		Millions of Kilowatt-hours	
Month	Actual Flow of Colorado River at Grand Canyon 1000 AF	Actual Total Net Lake Mead Loss 1000 AF	Total Hoover Release 1000 AF	Total Hoover Release 1000 CFS	Down-stream Water Requirements 1000 AF	End of Month Content 1000 AF	End of Month Elevation Ft.	Mean Elevation Ft.	Mean Monthly Elevation Ft.	Average Tail-water Elevation Ft.	Average Static Head Ft.	Total Energy at 83% Eff.	Firm Energy at 83% Eff.
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
June													
July													
August													
Sept.													
Oct.													
Nov.													
Dec.													
Jan.													
Feb.													
March													
April													
May													

EXPLANATION OF SHEET 1 OF 3

Column (2): Actual flow of Colorado River at Grand Canyon. Flow measured and data furnished by Geological Survey.

Column (3): Actual total net Lake Mead loss. This is a water budget computation using the measured flow at Grand Canyon as inflow to Lake Mead, the actual release from Hoover Dam and the actual measured storage change in Lake Mead. It includes unmeasured inflow to the river and lake below the Grand Canyon gaging station, evaporation loss from the lake, changes in bank storage, and diversions from the lake to Nevada.

Columns (4) and (5): Total Hoover release. Water flowing in river below Hoover Dam is recorded in this column.

Column (6): Downstream water requirements. This is the minimum monthly downstream water requirement defined in section 3 of operating principles. This requirement will be estimated by months at the beginning of each year, and adjusted to actual at the end of each month.

Column (7): Lake Mead end-of-month content. Surface storage at end of month (changes in bank storage are reflected in column (3)).

Column (8): Lake Mead end-of-month elevation. Elevation corresponding with end-of-month content shown in column (7).

Column (9): Lake Mead, mean elevation. Computed as average of elevations at end of previous month and end of current month.

Column (10): Lake Mohave, mean monthly elevation. Computed as average of elevations at end of previous month and end of current month. This is used in computation of tailwater elevations for Hoover powerplant.

Column (11): Hoover powerplant--average tailwater elevation. Values to be taken from Hoover powerplant tailwater curves, drawing 45-300-59, and will be based upon Hoover release (col.5) and Lake Mohave mean monthly elevation (col. 10).

Column (12): Hoover powerplant average static head. Computed as column (9) minus column (11).

Column (13): Total energy at 83 percent efficiency. Values are computed by equation: Kw.-hr. = 1.025 x efficiency (83 percent) x static head (col. 12) x release in acre-feet (col. 4).

Column (14): Firm energy. Same as column (13), but not to exceed scheduled firm energy (col. 14, sheet 3). Show annual total only in the event there is no deficiency indicated on basis of total annual generation.

UNITED STATES DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

COMPUTATION OF DEFICIENCY IN BOOVER FIRM ENERGY DURING THE FILLING OF COLORADO RIVER STORAGE PROJECT RESERVOIRS

COMPUTATION SHEET FOR THEORETICAL INFLOW AND LOSS FOR LAKE MEAD

Computed by_____
Date_____
Checked by_____

UNITS 1000 ACRE-FEET

Month	ACTUAL RESERVOIR STORAGE CONTENT				RESERVOIR STORAGE CHANGE				Actual Flow of Colorado River at Grand Canyon (From Col.(2) Sheet 1)	Theoretical Flow of Colo. River at Grand Canyon (Sum of Cols. (6) thru (10)	COMPUTATION OF THEORETICAL TOTAL NET LOSS FROM LAKE MEAD		
	Lake Powell	Flaming Gorge	Curecanti Units	Navajo	Lake Powell	Flaming Gorge	Curecanti Units	Navajo			Actual Total Net Loss (Col.3 Sh.1)	Adjustment of Evaporation Loss	Theoretical Total Net Loss
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
June													
July													
Aug.													
Sept.													
Oct.													
Nov.													
Dec.													
Jan.													
Feb.													
March													
April													
May													

EXPLANATION OF SHEET 2 OF 3

Columns (2), (3), (4), and (5): Actual reservoir storage content, Lake Powell, Flaming Gorge, Curecanti units, and Navaho. Values for each of these columns are the actual end of month reservoir surface storage content plus an estimate of initial accumulation of bank storage.

Columns (6), (7), (8), and (9): Reservoir storage change--Lake Powell, Flaming Gorge, Curecanti units and Navaho. Values in these columns are derived from figures in columns (2), (3), (4), and (5).

Column (10): Actual flow of Colorado River at Grand Canyon. Flow of Colorado River measured by, and data reported by Geological Survey.

Column (11): Theoretical flow of Colorado River at Grand Canyon. This is computed as the sum of columns (6) through (10). It is the actual flow of the Colorado River at Grand Canyon increased by reservoir storage changes (algebraic) in the Colorado River storage project reservoirs.

Column (12): Computation of theoretical total net loss from Lake Mead, actual total net loss. This is a water budget computation using the measured flow at Grand Canyon as inflow to Lake Mead, the actual release from Hoover Dam and the actual measured storage change in Lake Mead. It includes unmeasured inflow to the river and lake below the Grand Canyon gaging station, evaporation loss from the lake, changes in bank storage, and diversions from the lake to Nevada.

Column (13): Computation of theoretical total net loss from Lake Mead--adjustment of evaporation loss. This is an adjustment to be applied to the actual total net loss (col. 12) and is the difference (theoretical minus actual) between the theoretical evaporation for the theoretical surface area of the lake which corresponds to the elevation shown in column (9) of sheet 3 and the evaporation computed by the Geological Survey for the actual surface area of the lake. The evaporation rate applied to the theoretical surface area of the lake is the same rate applied by the Geological Survey to the actual surface area.

Column (14): Computation of theoretical total net loss from Lake Mead--theoretical total net loss. Column (12) plus (algebraic) column (13).

UNITED STATES DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

COMPUTATION OF DEFICIENCY IN HOOVER FIRM ENERGY DURING THE FILLING OF COLORADO RIVER STORAGE PROJECT RESERVOIRS

COMPUTATION SHEET FOR THEORETICAL HOOVER POWERPLANT OPERATION ASSUMING NO COLORADO RIVER STORAGE PROJECT AND COMPUTATION OF HOOVER FIRM DEFICIENCY

Computed by_____ Date_____
Checked by_____ Date_____

Month	Theoretical Flow of Colo. River at Grand Canyon 1000 A.F. (From Col.11 Sheet 2)	Theoretical Total Net Loss From Lake Mead 1000 A.F. (From Col.14 Sheet 2)	THEORETICAL RESERVOIR OPERATIONS: Total Hoover Release 1000 A.F.	Total Hoover Release 1000 C.F.S.	Downstream Water Requirements 1000 A.F.	Lake Mead End of Month Content 1000 A.F.	Lake Mead End of Month Elevation Ft.	Lake Mead Mean Elevation Ft.	THEORETICAL POWERPLANT OPERATIONS: Lake Mohave Mean Monthly Elev. Ft.	Hoover Avg. Tailwater Elev. Ft.	Hoover Avg. Static Head Ft.	Millions of Kwh Total Energy at 83% Eff.	Millions of Kwh Firm Energy at 83% Eff.	COMPUTED HOOVER FIRM DEFICIENCY (Col. 14, Sheet 3 minus Col. 14, Sheet 1)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
June														
July														
Aug.														
Sept.														
Oct.														
Nov.														
Dec.														
Jan.														
Feb.														
March														
April														
May														

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Operating Criteria

EXPLANATION OF SHEET 3 OF 3

Column (2): Theoretical flow of Colorado River at Grand Canyon. As computed in column (11) on sheet 2.

Column (3): Theoretical total net loss from Lake Mead. As computed in column (14) on sheet 2.

Columns (4) and (5): Total Hoover release. This is the theoretical release required to produce the predetermined firm energy schedule as shown in column (14) and the theoretical releases for flood control, if required.

Column (6): Downstream water requirements. This is the minimum monthly downstream water requirement. (See explanation sheet 1 of 3, col. 6.)

Columns (7), (8), and (9): These columns show the theoretical end-of-month content, corresponding elevation, and mean elevation for Lake Mead resulting from the computation of theoretical inflow and release shown in columns (2) through (5).

Column (10): Lake Mohave--Mean monthly elevation. Computed as average of elevations at end of previous month and end of current month, and is the same figure as shown in column (10), sheet 1 of 3. This same level can be used because Lake Mohave scheduled levels are predetermined and are followed as closely as possible by adjustment of Hoover releases in the case of actual operations, and by adjustment of Davis releases in the case of theoretical operation which is on the basis of a Hoover power operation schedule. It is used in the computation of tailwater elevations for Hoover powerplant.

Column (11): Hoover powerplant, average tailwater elevation. Values are taken from Hoover powerplant tailwater curves, drawing 45-300-59, and are based upon Hoover release, column (5) and Lake Mohave mean monthly elevation, column (10).

Column (12): Hoover powerplant, average static head. Column (9) minus column (11).

Column (13): Total energy at 83 percent of efficiency. Values are computed by the equation: Kilowatt hours = 1.025 x efficiency (83 percent) x static head (col. 12) x release in acre-feet (col. 4).

Column (14): Firm energy. Theoretical predetermined schedule of firm energy is entered in this column. (Included as part of total in col. 13). Show annual total only in the event there is no deficiency indicated on basis of total annual generation.

Column (15): Computed Hoover firm deficiency. This is computed as the Difference between the theoretical Hoover firm energy and the actual Hoover production adjusted to 83 percent efficiency--firm energy (col. 14, sheet 3) minus firm energy at 83 percent efficiency (col. 14, sheet 1).

NOTE: "Explanation of Proposed Procedures for Computing Deficiencies in Firm Power Generation at Hoover Dam During Filling of Colorado River Storage Project Reservoirs" has been taken from Senate Document No. 7, 88th Congress, 1st Session, March 14, 1963, pp. 19 et seq.