CHAPTER VI

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

A. Background

The Colorado River Storage Project Act of April 11, 1956, Public Law 84-485, 70 Stat. 105, authorized construction of four storage units in the Upper Basin, including Glen Canyon Dam, primarily for river regulation and power production. It would permit the Upper Basin States to utilize their share of Colorado River water and, at the same time, insure the fulfillment of downstream commitments. The Act required the Department of the Interior to submit to the Congress periodically payout and related financial studies. This required estimates of power head at Glen Canyon Dam and assumptions as to streamflows and water uses.

B. Participation by States

As construction progressed, Secretary of the Interior Udall initiated studies, in consultation with the various interests in the Colorado River Basin, to determine how Lake Powell could accumulate storage with the least possible disruption to the many activities then dependent upon the flow of the river. These studies led to formulation of the "Filling Criteria" (see Senate Document No. 7, 88th Congress, 1st Session, March 14, 1963, entitled, "Colorado River Storage Project and Participating Projects," the text of which is included in Appendix 601). A memorandum from the Commissioner of Reclamation to the Secretary of the Interior, dated January 18, 1960, recited the background events.

Pursuant to Secretarial invitations of October 4, 1957, a meeting was held in Washington, D.C., on October 24, 1957, attended by the Governors, or their representatives, of the seven Basin States and by other interested persons.

At that time a statement prepared by the Bureau of Reclamation was discussed which included an analysis of certain assumed procedures under which storage would be accumulated in the Upper Basin reservoirs. This used average flows of the river during the period 1958-1970 and was termed "Hydrologic Bases for Financial Studies, Colorado River Storage Project" (Senate Document No. 101, 85th Congress, 2nd Session; the statement, as revised, is a part of Senate Document No. 77, 85th Congress, 2nd Session). At that meeting, the States of Arizona, California and Nevada offered for consideration their "Tri-State Criteria" (Senate Document No. 96, 85th Congress, 2nd Session).

These were based upon the principles that the Lower Basin's right to the consumptive use of water is superior to the right to store water at Glen Canyon; that releases should be made from Glen Canyon for all Lower Basin consumptive use requirements, the Mexican Treaty requirements, and evaporation and channel losses; and that releases from Glen Canyon shall be in amounts required to generate the contracted quantities of energy at Hoover Dam.

Both were unacceptable to the Upper Basin. California also questioned the assumptions used by the Department of the Interior (Governor Knight's letter of November 25, 1957).

A second meeting was held on December 4 and 5, 1957, in Las Vegas, Nevada, where the Department of the Interior presented clarifying revisions in its hydrological data. Subsequently, an engineering group representing the Lower Basin States and the Bureau of Reclamation met on February 3 and 4, April 17 and 18, June 25 and 26, September 23 and 24, December 8 and 9, 1958, and March 4 and 5, 1959. A series of operational studies were made covering certain assumptions of runoff sequences. These differed from the average streamflows used in the "Hydrologic Bases." A summary dated August 20, 1959, was submitted by the Lower Basin engineering group.

Bureau of Reclamation engineers also met on March 30 and 31, and August 4 through 6, 1959, with the Upper Colorado River Commission engineering committee which had made a number of operating studies. A summary thereof appears in the committee's letter of September 22, 1959.

Certain conclusions became apparent to the Bureau of Reclamation in the discussions which indicated the difficulty of satisfying both Basins in a single set of regulations and that latitude was needed for the Secretary to operate on a year by year basis. These conclusions were:

(1) Nothing should be done at Glen Canyon which would have an adverse effect on the users of water below Hoover Dam or from the mainstream between Lake Mead and Glen Canyon;

(2) Secondary energy should not be generated at Hoover Dam except when all reservoirs are full and a spill would otherwise occur; and

(3) The obtaining of the minimum power head at Glen Canyon reservoir, elevation 3490 (6.1 maf) at the earliest practicable time, should be an objective of any filling criteria.

The most difficult aspect and basic to the solution of the filling problem was an answer as to what to do about any deficiency that might occur in the firm energy generation at Hoover Powerplant incident to filling the Upper Basin Storage Project reservoirs. This was the most troublesome of the problems.

C. *Bureau of Reclamation's Initial Proposal*

On January 18, 1960, the Bureau of Reclamation proposed the following set of governing principles and operating criteria as a tentative proposal open for discussion. These were based upon the proposition that an allowance should be made for computed deficiency in firm energy generation at Hoover, which might be caused by Glen Canyon being on the river. The principles were not applicable to Flaming Gorge, Navajo or Curecanti (see memorandum of July 17, 1962, from Associate Solicitor Weinberg to Commissioner of Reclamation).

Paragraph 1. The principles were asserted to be based upon a reasonable exercise of Secretarial discretion without attempting to define the outer limits of either rights or obligations of any of the States or of the United States, and recognized that changes might be required by the forthcoming Decree in *Arizona* v. *California*.

Paragraph 2. This defines the filling period, during which the principles would apply, as generally the time required to fill Glen Canyon; i.e., elevation 3700, with a cutoff date of May 31, 1987, the date when the Hoover power contracts expire.

Paragraph 3. This states that during the filling period, uses of water below Hoover Dam, other than power, will be satisfied, including delivery of not more than 1.5 maf/yr to Mexico, which is the Treaty obligation. Releases from storage in either Glen Canyon or Lake Mead would depend on the content of the reservoirs and on inflow.

Paragraph 4. This states that the uses of water for consumptive purposes will be met between Glen Canyon and Lake Mead.

Paragraph 5. This provides an allowance for computed deficiency in Hoover firm energy which is created by virtue of operations at Glen Canyon. Determination of deficiency depends upon two calculations. The first is to determine the so-called Hoover basic firm, which is that firm energy that would have been produced at Hoover without Glen Canyon on the river and using an overall efficiency factor for power operations of 83 percent. The second calculation would be to adjust the energy actually generated at Hoover to an efficiency factor of 83 percent rather than the actual efficiency of 70 to 78 percent dictated for the convenience of the allottees. The difference between these two calculations would, for purposes of the allowances, be considered as the deficiency in firm energy.

The Secretary would determine how the allowance would be accomplished; i.e., (1) monetarily, if the incremental cost (fuel replacement cost of generating substitute energy) is less than the selling rate for power from the Upper Basin projects (which would be the case while Glen Canyon was reaching minimum power head), or (2) whether it might be better to compensate the Hoover Dam power contractors with kilowatthours through the interconnection of the two power systems. In the event of an allowance, the Hoover power contractors will continue to pay under their contracts in the same manner as if the amount of energy involved in the deficiency had been generated at Hoover.

Paragraph 6. This is a tie between the general principles and the operating criteria.

Paragraph 7. This sets forth the method whereby the minimum power head (elevation 3490), 6.1 maf available surface storage, would be gained in Glen Canyon. This would be done at the earliest practicable time without drawing Lake Mead below its rated head (elevation 1123) or 14.5 maf available surface storage.

Until elevation 3490 is reached, any water stored in Lake Powell can be released to maintain rated head (14.5 maf at elevation 1123) on the Hoover Powerplant; when Lake Powell reaches elevation 3490, the stored water cannot be released below that point; and in the process of reaching 3490, the release of water at Glen Canyon Dam will not be less than 1.0 maf/yr and 1,000 cubic feet per second (ft^3/s).

Paragraph 8. This provides the principle that the powerplants will be coordinated and integrated without being tied to a specific plan so as to produce the greatest practical amount of power and energy.

Paragraph 9. The decision to coordinate and integrate eliminates secondary energy generation at Hoover, unless a spill is imminent.

Paragraph 10. This permits an earlier cutoff date than the date when Glen Canyon storage has reached elevation 3700 or May 31, 1987, if the conditions warrant such action.

Paragraph 11. This provides that in the annual application of the flood control regulations to the operations at Lake Mead, available capacity in upstream reservoirs shall be recognized.

On February 9, 1960, Secretary of the Interior Seaton approved Reclamation's recommendation that the above proposal be submitted to the engineering committee and then to the States of the two Basins for comment. On February 12, 1960, the Department of the Interior issued the proposed general principles and criteria with a memorandum of explanation dated January 18, 1960.

D. Revised Principles

Comments and suggested modifications of the proposed principles were received from Congressional members and from Basin representatives at a series of meetings held in Las Vegas, Nevada, in March 1960; Los Angeles, California, in May 1960 and April 1961; Salt Lake City, Utah, in January 1961; and in Denver, Colorado, in May 1961. In a memorandum dated June 13, 1961, from the Commissioner of Reclamation to the Secretary of the Interior, the following review was made.

After evaluation of the comments it received, the Bureau of Reclamation revised its previously recommended principles.The most substantive revisions related to Principle 5, dealing with the allowance for a portion of the diminution in power generation at Hoover Dam. Principle 5 was revised so as to take into account the effect on the stream by impoundment of water in all the storage units in the Upper Basin; i.e., Glen Canyon, Flaming Gorge, Navajo, and Curecanti (see letter of January 3, 1962, from Colorado River Commission of Nevada to Secretary of the Interior Udall which advocated that change), but excluding the effects of evaporation from the surface of such reservoirs as part of the theoretical streamflow used in the formula for computing allowance. The Upper Basin Compact treats reservoir evaporation losses as a "consumptive use" and the Upper Basin believed such losses should not be accounted for in computing the amount of "adjustment" in Hoover firm energy generation. The computation of and provision for allowance would not apply to Navajo and Flaming Gorge until the filling operation starts at Glen Canyon.

Reclamation rejected a suggestion that an efficiency factor of 78 percent be used in computing Hoover basic firm energy, from which would be subtracted the energy actually generated at Hoover, adjusted to an efficiency factor of 83 percent, which would tend to minimize the deficiency. Also rejected was the use of the difference between actual generation and contract firm, which would tend to maximize the deficiency.

The Upper Basin States critized the use of the Upper Colorado River Basin Fund, established by the Act of April 11, 1956, in making the payments to meet the deficiency.

The Upper Basin was opposed to the use of storage project energy or storage project revenues to compensate the Hoover power contractors for energy deficiency during the filling period. They questioned the authority of the Secretary of the Interior to use such power output or revenues for that purpose and believed that the existence of the power contracts should not influence the Secretary in developing the operating criteria.

Senator Bennett of Utah criticized Principle 5 for the reasons that consumptive use of water is paramount and power is secondary; that there is no legal requirement in the Compact or Storage Project Act that the Upper Basin States make up Hoover power deficiencies; that the Hoover power contracts anticipated upstream development and a diminution in firm power production during the filling period; that the Lower Basin water and power users benefited by the 30-year delay in building dams in the Upper Basin; and that the Hoover power deficiency did not arise because of the filling of Glen Canyon but was partly due to decreased streamflows (see Senator Bennett's letter to Secretary Udall dated March 6, 1961; see analysis thereof in Assistant Commissioner Bennett's memorandum to the Commissioner of Reclamation dated April 3, 1961; see letter from Governor Clyde of Utah, to Commissioner of Reclamation Dominy dated April 20, 1962; see letter from Senator Allott of Colorado to Secretary of the Interior Udall, dated April 25, 1961; and see letter from Senator Moss of Utah to the President dated May 1, 1961).

The Upper Basin felt that the use of their fund carried with it a responsibility on the Upper Basin for energy deficiencies at Hoover which the Upper Basin denied, and that the use of the fund might adversely affect availability of power revenues to aid in repayment of the costs of the Upper Basin participating projects (see extract of Minutes of Colorado Water Conservation Board dated January 11, 1961). Wyoming Senator Hickey's letter to the Secretary, dated August 17, 1962, questioned the authority to use the Upper Basin Fund as did Senator Moss's letter of July 11, 1961, to Secretary Udall which also suggested establishment of a Lower Colorado River Basin Fund so as to pool power revenues from Lower Basin powerplants in order to meet deficiency payments.

In a letter of July 21, 1960, to the Commissioner of Reclamation, the Upper Colorado River Commission stated its position that there is nothing in the Compact, or in any interpretation thereof, which requires the Upper Basin to compensate, in any manner whatsoever, Lower Basin power users for water legally withheld in the Upper Basin. Although the Commission felt that the general principles were more favorable to the Upper Basin than were the "Hydrologic Bases" (see Upper Colorado River Commision's Report of July 20, 1960), it nevertheless noted that water uses downstream from Hoover Dam and basic firm energy gneration at Hoover Dam are to be made whole at the expense of Upper Basin resources development; that construction of reservoirs, storage of water, and consumptive use of water in the Upper Basin were anticipated and were reasons for negotiating the Compact; and that Hoover Dam should be operated at an efficiency of 83 percent rather than the lower efficiency adopted for the convenience of the Lower Basin in order to use Hoover generators for peaking purposes.

In response, Reclamation disclaimed any intent to declare or infer any responsibility on the Upper Basin for deficiency in energy generation at Hoover and stated that the use of that fund for this purpose is based solely upon, and exercise of, Departmental responsibility in operating a project under its jurisdiction; and that the purchase of replacement energy by the Storage Project is comparable to an operating cost and is similar to the purchase of "firming energy" in years of low runoff. As to the second concern which, said Reclamation, is understandable in the event of less than average flows, provision was made in Principle 5 for reimbursement to the Upper Basin Fund by the Hoover power allottees for whatever monies are used from the fund for that purpose, but not for nonfirm or other energy from the Storage Project powerplants.

Notification of the Department's intent to secure reimbursement was to be accomplished through an additional Departmental regulation for generation and sale of power pursuant to the Boulder Canyon Project Adjustment Act which was to be an attachment to the general principles and criteria. The regulation would state that the rates to be charged for electric energy after 1987 would include a component to assure revenues in the fund to accomplish reimbursement. In Reclamation's opinion, any further action would require legislation.

It was also determined that interest would not be included in the reimbursement to the Upper Basin Fund. Further, Reclamation emphasized its intention to make minimum use of dollars, but maximum use of energy from Federal powerplants for required replacement, and not to use firm energy from Storage Project powerplants if such energy could otherwise be sold at firm power rates.

Reclamation also rejected a proposal that Lake Mead not be drawn down below elevation 1146 (17 maf available surface storage) at least during the time Lake Powell is filling to dead storage level. It felt no undue risk is run when elevation 1123 (14.5 maf) is made the minimum drawndown point; that the objective of gaining minimum power head at Glen Canyon (elevation 3490) in the earliest practicable time would otherwise be defeated; and that provision was already made in Principle 7 for not drawing Lake Mead below the rated head at Hoover Powerplant (elevation 1123).

Other revisions included were:

The official name "Lake Powell" was used in lieu of "Glen Canyon Reservoir."

In Principle 1, it was indicated that the principles and criteria might be affected by possible future acts of Congress.

Principles 2 and 10 were combined. Principle 2 was expanded to include Principle 10 which dealt with possible earlier termination of the principles and criteria, and provision made for consultation with both Upper and Lower Basin interests before termination for reasons other than attainment of either Lake Powell storage reaching elevation 3700 or May 31, 1987.

Principle 8 was shortened without changing the principle.

Principle 9 was revised to recognize the possibility that there might be some generation of secondary energy at Hoover Powerplant during the filling period.

Principle 11 became Principle 10.

The revised Principles and Criteria described in the Commissioner's memorandum of June 13, 1961, additional Regulation No. 1, and an explanation of "Proposed Procedures for Computing Deficiencies in Firm Power Generation at Hoover," were transmitted to all interested parties in both Upper and Lower Basins. On December 22, 1961, the Commissioner of Reclamation reported to the Secretary of the Interior that a review of the comments thereon provided no reason to make fundamental changes in the general principles and operating criteria proposed by the Commissioner on June 13, 1961.

However, the memorandum of December 22, 1961, stated Reclamation's awareness that no set of general principles and operating criteria could possibly fully satisfy all the diverse interests affected. It reiterated that Reclamation had proceeded on the basis of securing a practical approach to the problems of filling, rather than a legalistic approach, based on a reasonable exercise of Secretarial discretion. It then discussed the comments and suggestions received in response to the June 13, 1961, memorandum.

Principle 1. A question was raised as to whether acquiescence by a Hoover power allottee in the exercise by the Secretary of "reasonable discretion" in the operation of the Federal projects involved would invoke a legal liability on that power allottee in respect to power which it has contracted to supply from its share of Hoover power. Reclamation's answer was that contractual relationship between a Hoover power allottee and its customers are outside the realm of Secretarial responsibilities and hence the question was not pertinent to the general principles and criteria.

Principle 2. The suggestion was adopted that the filling criteria should not end automatically when Lake Powell reaches elevation 3700 unless Lake Mead is at or above elevation 1146. Another suggestion was also adopted that the Secretary give prior notice before terminating the filling criteria previous to the attaining of elevation 3700 at Lake Powell. A minimum of 1 year's notice was felt reasonable; i.e., the time required by the Hoover power allottees to make necessary arrangements to accommodate any effects on their operations a change in filling criteria might entail.

It was considered premature to attempt to prescribe postfilling operating rules with the filling criteria but the need was recognized for formulating them as far as possible in advance of the termination of the filling period.

The previous conclusion was affirmed that the application of the filling criteria begin on the date when Lake Powell is first capable of storing water since the effect of storage in any other of the Storage Project reservoirs upon Lower Basin riverflows would be nominal.

Principle 3. Reclamation declined to define in terms of legality and limitation phrases such as "net river losses," "regulatory wastes," and "diversion requirements of mainstream projects."

Principle 4. Reclamation declined to insert "or losses" after "uses," since it would presumably cover evaporation from Lake Mead. To do so would confuse the issue by introducing the aspect of replacing river losses (as distinguished from reservoir losses) for no apparent reason.

Principle 5. This was the heart of the solution to formulation of acceptable filling criteria and invoked the most perplexing problems. Reclamation rejected both the Upper Basin contention that it is under no obligation to make allowances for Hoover power deficiencies and the Lower Basin position that allowances for deficiencies in diminution of both energy and capacity at Hoover should be provided without reimbursement. It adhered to its previous solution as middle ground, based on an impartial appraisal of the issues and a product of judgment as to what constitutes a practical procedure.

Reclamation agreed as worthy of exploration an Upper Basin proposal that the Colorado River Development Fund be used either to make necessary replacement energy purchases or to reimburse the Upper Colorado River Basin Fund on a current basis. (A variation of this was later adopted in Section 502 of the Colorado Basin Project Act.)

Principle 8. Despite the desirability of maintaining rated head at both Hoover and Glen Canyon Powerplants, which could perhaps be an operating rule, Reclamation declined to include a requirement in the general principles that any water stored in Lake Powell above elevation 3400 should be subject to release to maintain rated head at Hoover. Likewise, a Lower Basin proposal was declined that the offsetting of Hoover impairment should have priority on Upper Basin power output to the extent the Secretary cannot find replacement energy for purchase. Reclamation was agreeable to devoting nonfirm energy to this purpose, but not firm energy.

E. Secretarial Approval of General Principles and Operating Criteria

On April 2, 1962, Secretary Udall approved Reclamation's recommendations that the general principles be approved, subject to whatever reconsideration may appear desirable after the Hoover power allottees comment on additional Regulation No. 1, and that the principles be transmitted to the Governors, Senators and Representatives of the Basin States, the Upper Colorado River Commission, the Hoover power allottees, and other interested parties.

F. Additional Regulation No. 1

By letter of April 4, 1962, the Commissioner of Reclamation requested the comments of the Hoover power contractors on additional Regulation No. 1, which provide for reimbursement of the Upper Colorado River Basin Fund after June 1, 1987, in that the rates to be charged for energy after 1987 would include a component to assure revenues in the fund to accomplish reimbursement of the Upper Colorado River Basin Fund. Comments were received from the following named six of the nine contractors. No comments were received from the cities of Burbank, Glendale, and Pasadena, California.

Arizona Power Authority: Declined to comment and urged discussion of the matters it previously raised in connection with the filling criteria for Lake Powell, particularly the lack of a sufficient basis for responsible evaluation of the effect of the filling criteria upon Hoover, Davis, and Parker interests.

California Electric Power Co.: Additional Regulation No. 1 is unfair in forcing the Hoover power contractors to pay for a power loss caused by the filling of Lake Powell. It contends this cost should be paid by the Upper Basin States. If, however, the Hoover contractors must stand the cost, the company prefers to see the funds repaid after 1987, but the monies used should be repaid without interest. Further, the Hoover allottees are being discriminated against by allowing Lake Mead to drop to 14.5 maf during the filling of Lake Powell to its highest elevation, rather than 17 maf; that the low elevation water content will decrease its kilowatt capacity and the energy available to each contractor; and that if an allowance is made by delivering energy to an affected Hoover contractor, it should be delivered at times needed, as determined by the contractor.

Colorado River Commission of Nevada: Questioned the necessity and/or the practicality of considering the proposed regulation at this time since it does not become effective until June 1, 1987.

The Metropolitan Water District of Southern California: Withheld its comments pending study of an alternative proposal to use the Colorado River Development Fund to make allowance for diminution in Hoover basic firm energy during filling period. Since the District has no generating facilities, it will be compelled to purchase substitute energy, which cost will presumably be greater than the contract cost of Hoover energy, so that its view is that the "incremental cost" of substitute energy will refer to the actual cost of such energy to the District at the time and in the quantity required for District operations. Therefore, it prefers substitute energy instead of monetary compensation.

City of Los Angeles: While it assumes that additional Regulation No. 1 contemplates reimbursement without interest, it prefers that the regulation state specifically that such reimbursement is to be without interest.

Southern California Edison Co: The provisions of Article 5 of the filling criteria and proposed Regulation No. 1 relative to reimbursement of the Upper Colorado River Basin Fund from charges for electrical energy to be made at the Hoover Powerplant subsequent to June 1, 1987, would not appear to be authorized by existing law but rather to be in conflict therewith.

It was Reclamation's opinion that the comments it received did not object to the issuance of additional Regulation No. 1, or did not offer substantive reasons opposing its issuance and, therefore, Reclamation recommended the Secretary's promulgation of the Regulation and its publication in the Federal Register.

G. *Promulgation of Principles and Additional Regulation No. 1*

The general principles and operating criteria, as approved April 2, 1962, were published in the Federal Register, 27 F.R. 6851, July 19, 1962.

Additional Regulation No. 1 was adopted by Secretary Udall on July 12, 1962, and published in the Federal Register, 27 F.R. 6850, July 12, 1962.

The texts thereof appear in appendices 602 and 603, respectively.

H. *Closure of Glen Canyon Dam*

The partial closure of Glen Canyon Dam was accomplished at 2 p.m. on March 13, 1963, at which time the Bureau of Reclamation's Lower Colorado Regional Office at Boulder City, Nevada, began computing the "deficiencies." At that time, Lake Mead held 22.3 maf of water at elevation 1188.2 but this dropped to 15.4 maf at the end of January 1964. As of September 30, 1963, the deficiency was about 75 million kWh. By the end of 1963, the elevation of Lake Powell was about 3410 (80 feet short of minimum power point (3490)) with a content of 3.1 maf and, in addition, the runoff forecasts for 1964 indicated another poor runoff year. Studies at that time showed that to avoid drawing Lake Mead below elevation 1123, it would be necessary to release in 1964 the water theretofore impounded in Lake Powell. (For a discussion of an engineering analysis of the risks involved in closing the gates of Glen Canyon, see the Chief Engineer's memorandum to the Commissioner of Reclamation dated August 14, 1963.) The gates were opened temporarily on March 26, 1964, to maintain elevation 1123 at Lake Mead (14.5 maf storage). This was done because the March 1, 1964, forecast of a poor runoff indicated too great a risk of substantial expense to the Upper Basin if the April-July runoff turned out to be substantially less than the then mean forecast of 4.7 maf (News Release - Interior, May 11, 1964). The determination to open the gates was in accord with the filling criteria of 1962, particularly Principle 7, which provided that Lake Mead would not be drawn down below elevation 1123.

Prior to the Secretary's action in opening the gates at Glen Canyon on March 26, 1964, the Governors of the four Upper Basin States in a joint letter of March 17, 1964, urged the retention of water in Lake Powell in order to start generation of energy by August 1, 1964, and stressed the need to arrive at a method of filling the minimum power pool at Glen Canyon at the earliest practicable date. The Upper Colorado River Commission actively explored with various utilities in the Upper Basin the possibility of obtaining energy to supply deficiencies in the Lower Basin in the event Lake Mead was drawn below elevation 1123. On March 25, 1964, the Colorado River Board of California protested the withholding of water in Lake Powell as did Governor Brown of California.

I. *Modification of Filling Criteria - May 11, 1964*

The median forecast of May 1, 1964, for April-July runoff was 5.1 maf. Hence, the Secretary announced on May 11, 1964, that storage of water would be resumed behind Glen Canyon Dam and that "the calculated risk...in resumption of storage is warranted...." The gates were again closed May 11, 1964, at which time the Secretary modified the 1962 filling criteria to reduce by 40 feet, from elevation 1123 (rated power head) to elevation 1083 (minimum power pool) the water level below which Lake Mead would not be drawn by reason of the accumulation of minimum power operating content in Lake Powell, 6.1 maf, and elevation 3490.

The Secretary provided certain conditions to be observed upon the resumption of filling operations at Lake Powell which caused Lake Mead to be drawn below elevation 1123. The most significant condition was that, in addition to the allowance for deficiencies in firm energy generation pursuant to the 1962 filling criteria, the United States would replace impairments in Hoover Powerplant capacity and energy available to the allottees which result from the lowering of Lake Mead below elevation 1123 by reason of storage of water in Lake Powell. The United States would also relieve the allottees of costs of extraordinary maintenance of the turbines and generators resulting from such lowering. Energy and capacity deficiencies resulting from operation below elevation 1123 were identified as impairment energy and impairment capacity. The cost of replacing the deficiencies in capacity and energy and the costs of extraordinary maintenance were to be charged to the

Upper Colorado River Basin Fund (Colorado River Storage Project) but were not subject to reimbursement by the Boulder Canyon Project as was the case for deficiencies in firm energy as determined pursuant to the 1962 filling criteria.

The foregoing was done in accordance with the principles set forth in the document entitled "Operation of Lake Mead Below Elevation 1123 by Reason of Resumption of Storage Operations at Lake Powell," approved by the Secretary of the Interior on May 11, 1964. The text thereof follows:

OPERATION OF LAKE MEAD BELOW ELEVATION 1123 BY REASON OF RESUMPTION OF STORAGE OPERATIONS AT LAKE POWELL

The "General Principles to Govern, and Operating Criteria for, Glen Canyon Reservoir (Lake Powell) and Lake Mead during the Lake Powell Filling Period (27 F.R. 6851, July 19, 1962)," herein referred to as the "Filling Criteria," provide that until Lake Powell attains minimum power operation level (about elevation 3490) any water stored in Lake Powell is to be available to maintain Lake Mead at elevation 1123 (rated head at Hoover Powerplant).

In order to resume filling operations at Lake Powell under runoff conditions which would necessitate drawing Lake Mead below elevation 1123, the Hoover allottees must be maintained in the same position that they would have been in had Lake Powell storage not been resumed. By so doing, water in Lake Mead may be drawn down below elevation 1123 consistent with the objectives of the Filling Criteria. The following conditions will therefore be observed effective upon announcement by the Secretary of the Interior:

1. Outflow from Lake Powell will be reduced to not less than 1,000 ft^3/s.
2. Under no circumstances will Lake Mead be drawn below a minimum power operation level of elevation 1083 as a result of storage of water in Lake Powell. Any storage in Lake Powell will be used to avoid drawing Lake Mead below elevation 1083.
3. In addition to the allowances for deficiencies in firm energy generation determined pursuant to the Filling Criteria, the United States will replace deficiencies in Hoover Powerplant capacity and energy available to the Hoover allottees which result from the lowering of Lake Mead below elevation 1123 by reason of storage of water in Lake Powell. The United States will also relieve the allottees of cost of extraordinary maintenance of the Hoover turbines and generators resulting from such lowering. Costs incurred by reason of this paragraph will be charged to the Upper Colorado River Basin Fund and will not be subject to reimbursement from the separate fund identified in Section 5 of the Act of December 21, 1928, or otherwise charged against the Boulder Canyon Project.
4. Until Lake Mead is returned to elevation 1123 and subject to condition 2 above, Lake Powell will be permitted to exceed minimum power operating level only to the extent inflow exceeds turbine capacity, or as required to assure operation at not less than minimum power operating level.
5. When actual runoff through the month of June becomes known, early in July, the likelihood of attaining minimum power operating at Lake Powell in calendar year 1964 will be reasonably determinable. A decision will be made at that time whether to continue storage at Lake Powell or to release water stored therein in order to raise the elevation of Lake Mead. In arriving at that decision, consideration will be given to a comparison of estimated costs to the Colorado River Storage Project and the decision will be made after consultation with appropriate interests of the Upper and Lower Colorado River Basins.

Releases from Lake Powell were held down to approximately 1,000 ft^3/s most of the time from March 13, 1963, the date of partial closure, to January 30, 1964. From that date to March 26, 1964, releases were increased to about 4,000 ft^3/s and again increased at that time to meet the requirements of 1.0 maf/yr in Principle 7 of the criteria and to maintain minimum Lake Mead active content at 14.5 maf (elevation 1123). Releases were again restricted to a minimum of 1,000 ft^3/s on May 12, 1964, by order of the Secretary at which time Lake Mead was slightly above rated power head elevation. Minimum power operating level (6.1 maf at elevation 3490) was achieved in Lake Powell on August 16, 1964, and the releases increased thereafter holding Lake Powell close to minimum operating level. Energy generation began September 4, 1964.

To attain a minimum power pool at Glen Canyon Dam, the flow at Lee Ferry was restricted to 2,520,000 acre-feet in water year 1963 and 2,427,000 acre-feet in water year 1964. (A table showing the historic flows at Lee Ferry for water years 1953-1976 appears at the end of Chapter VII on "Operating Criteria.")

Because of the tight water situation Secretary Udall on May 16, 1964, directed Lower Basin water users to reduce their water demands by 10 percent for the period of June through December 1964. It was anticipated this would save 400,000 to 500,000 acre-feet of water during the 1964 drought year. The Metropolitan Water District of Southern California was later exempted from this cutback. The Yuma County Water Users' Association, the Yuma Mesa and Bard Irrigation Districts attacked the legality of the cutback order but the Arizona Federal District Court upheld it.

The water surface elevation in Lake Mead dropped to elevation 1098.6 on August 31, 1964, to 1093.5 on September 30, 1964, and to a low of 1088.1 in December 1964. From that low, with favorable runoff in the spring of 1965, it was restored to rated power head elevation of 1123 on June 23, 1965, more than a year after the Secretary's decision to modify the Lake Powell filling criteria.

During June 1965, Lake Powell water surface rose from minimum power elevation of 3490 to about 3511 and the content increased about 1 maf (Annual Report, Colorado River Board of California, 1964-1965). By September 30, 1965, Lake Powell storage increased 2.25 maf over the storage on September 30, 1964, to a total of 8.64 maf at elevation 3530.

The following statistics are pertinent:

	LAKE MEAD		LAKE POWELL	
	Elevation	Content (Million acre-feet)	Elevation	Content (Million acre-feet)
Normal High water	1222	27.3	3700	27
Rated Head on Powerplant	1123	14.5	3600	15
Min. Power pool	1083*	10.7	3490	6.1
Nevada Pumps (Min. level)	1050	8.0		

*Elevation below which turbines vibrate, excessive cavitation takes place

Lake Powell, March 26, 1964
3,120,000 acre-feet

Lake Powell, May 8, 1964
2,576,000 acre-feet

Colorado River, Lee Ferry, April-July runoff forecast, May 1, 1964

Additional storage needed for minimum power head at Lake Powell, 3.6 million acre-feet

Minimum	3,600,000 acre-feet
Mean	5,100,000 acre-feet
Maximum	6,600,000 acre-feet

Note: With a recurrence of the lowest recorded precipitation during the last 50 years for May, June and July, the April-July runoff this year could be as low as 3,000,000 acre-feet.

J. Storage - Lake Powell and Lake Mead

The following table shows the active storage in Lake Mead and Lake Powell on September 30 (the end of the water year) following the March 13, 1963, initial closure of Glen Canyon Dam, the change in storage during the year, and the annual releases at Lee Ferry and from Lake Mead during the year.

			Unit 1,000 acre-feet				
	Active storage at end of year				Annual release from reservoirs		
			Storage change during year		Colo. River below	Colo. River below	Pump from
Year ending September 30	Lake Powell[1]	Lake Mead[2]	Lake Powell	Lake Mead	Powell[3]	Mead[4]	Mead[5]
1964	4,214	11,628	+3,674	−5,745	2,414	8,234	27
1965	6,466	14,708	+2,252	+3,080	10,820	7,917	23
1966	6,423	15,004	− 43	+ 296	7,854	7,769	25
1967	6,360	*14,375	− 63	* + 265	7,797	7,832	27
1968	7,514	15,018	+1,154	+ 643	8,334	7,831	31
1969	9,708	16,131	+2,194	+1,113	8,823	7,986	34
1970	12,039	16,769	+2,331	+ 638	8,672	7,895	42
1971	13,609	16,886	+1,570	+ 117	8,591	8,233	40
1972	12,488	17,451	−1,121	+ 565	9,311	8,267	66
1973	17,284	20,176	+4,796	+2,725	10,110	7,937	77
1974	18,010	19,358	+ 726	− 818	8,266	8,847	86
1975	20,202	20,154	+2,192	+ 796	9,255	8,374	81
1976	19,640	20,022	− 562	− 132	8,482	8,320	91
1977#	16,143	20,205	−3,497	+ 183	8,211	7,562	90

* New capacity table in effect April 1, 1967.
1 Excludes dead storage of 1,998,000 acre-feet.
2 Excludes dead storage of 2,378,000 acre-feet (table of 1967).
3 Colorado River at Lee Ferry.
4 Colorado River below Hoover Dam.
5 Total pumpage from Lake Mead.
\# Unpublished records, subject to correction.

K. Extent of Deficiencies and Impairment Energy Furnished

The following table shows the water releases from Hoover Dam, the actual power generation at Hoover Dam, the energy delivered to the Hoover power allottees, the computed power generation absent and with the filling of the Colorado River Storage Project reservoirs and the accumulated Hoover firm energy deficiencies caused by the accumulation of storage in the Upper Basin reservoirs. (The figures were compiled from the annual reports of the Colorado River Board of California and the Upper Colorado River Commission.)

RELEASES FROM HOOVER DAM AND ENERGY DELIVERY
TO HOOVER POWER ALLOTTEES
(1962-63 to 1974-75)

Operating Year June 1 - May 31	Releases from Hoover Dam (acre-feet)	Actual Power Generation Hoover Dam	Energy Delivered to Allottees	Computed Power Generation Absent Filling of CRSP Reservoirs	Computed Power Generation With Filling of CRSP Reservoirs	Accumulated Deficiency as of June
		((Millions		of	kWh))	
1962-63	8,752,000	3,638	3,654			46
1963-64	8,548,000	3,167	3,649			551
1964-65	7,782,000	2,584	3,721			1,680
1965-66	7,658,000	2,708	3,661	4,073	3,148	2,605
1966-67	8,152,000	2,963	3,670	4,079	3,368	3,316
1967-68	7,828,000	2,802	3,617	4,062	3,226	4,152
1968-69	8,014,000	2,944	3,638	4,059	3,367	4,844
1969-70	7,975,000	3,072	3,716	4,068	3,431	5,481
1970-71	8,144,000	3,123	3,652	4,018	3,482	6,033
1971-72	8,157,000	3,148	3,646	4,043	3,565	6,511
1972-73	7,869,000	3,072	3,612	3,979	3,466	7,024
1973-74	8,480,000	3,374	3,542	4,097	3,930	7,191
1974-75	8,653,000	3,426	3,538	4,006	3,895	7,312

Capacity and energy were purchased and delivered to the Hoover power allottees to replace the loss in capacity and energy at Hoover Powerplant due to operation of Lake Mead below 1123. This occurred during the period May 23, 1964, to June 22, 1965. During this period, 1,579,760 kilowattmonths of impairment capacity and 185,605,788 kWh of impairment energy (including losses) were purchased from non-Federal suppliers at a cost of $3,652,256 (paid for by the Upper Colorado River Basin Fund with no provision for reimbursement) and 152,755 kilowattmonths of capacity and 18,075,365 kWh of energy were supplied by the Storage Project.

L. Efforts to Change or Terminate Filling Criteria

Following the April 2, 1962, approval of the General Principles and Filling Criteria, several bills were sponsored in the 88th Congress by representatives of the Upper Basin States which would relieve the Upper Colorado River Basin Fund from payment for energy deficiencies at Hoover Dam. Those in the 88th Congress were S.2915, H.R.11686 and H.R.11847. They would have authorized making the monetary allowances from the receipts of the Colorado River Development Fund, which was set up by the 1940 Boulder Canyon Project Adjustment Act to receive $500,000 annually from Hoover Dam power revenues for use in further water resource development in the Basins. No action was taken by the 88th Congress on the bills.

The same proposals were introduced in the 89th Congress as H.R.397 on January 5, 1965, and S.935 on February 1, 1965. No action was taken on the bills (see Annual Report, Colorado River Board of California, 1964-65, page 23).

In 1968 during the negotiations leading up to the enactment of the Colorado River Basin Project Act dated September 30, 1968, the Upper Basin interests proposed termination of the filling criteria. The criteria were continued. Nevertheless, the efforts to terminate led to Section 502, which provided for reimbursement to the Upper Colorado River Basin Fund for money "heretofore or hereafter" expended therefrom to meet deficiencies in generation at Hoover Dam during the filling period of storage units of the Colorado River Storage Project pursuant to the filling criteria. The text of Section 502 follows:

"The Upper Colorado River Basin Fund established under section 5 of the Colorado River Storage Project Act (70 Stat. 107; 43 U.S.C. 620d) shall be reimbursed from the Colorado River Development Fund established by section 2 of the Boulder Canyon Project Adjustment Act (54 Stat. 774; 43 U.S.C. 618a) for the money expended heretofore or hereafter from the Upper Colorado River Basin Fund to meet deficiencies in generation at Hoover Dam during the filling period of storage units of the Colorado River Storage Project pursuant to the criteria for the filling of Glen Canyon Reservoir (27 Fed. Reg. 6851, July 19, 1962). For this purpose, $500,000 for each year of operation of Hoover Dam and Powerplant, commencing with fiscal year 1970, shall be transferred from the Colorado River Development Fund to the Upper Colorado River Basin Fund, in lieu of application of said amounts to the purposes stated in section 2(d) of the Boulder Canyon Project Adjustment Act, until such reimbursement is accomplished. To the extent that any deficiency in such reimbursement remains as of June 1, 1987, the amount of the remaining deficiency shall then be transferred to the Upper Colorado River Basin Fund from the Lower Colorado River Basin Development Fund, as provided in subsection (g) of section 403."

In 1969, during the formulation of the operating criteria pursuant to Section 602 of the Colorado River Basin Project Act, the Upper Basin interests again sought termination of the filling criteria through the exercise of the Secretary's option to terminate.

By memorandum of February 25, 1969, the Regional Director of the Bureau of Reclamation at Salt Lake City, Utah, recommended that the Commissioner of Reclamation concur with the Upper Basin position that the Upper Basin Fund be reimbursed for all expenditures to meet deficiencies and impairments in generation at Hoover Dam during the filling period of the storage units. This would include costs associated with operations at Lake Mead below as well as above elevation 1123. By memorandum of April 23, 1969, the Commissioner rejected that suggestion as inconsistent with the filling criteria.

On October 1, 1969, the Upper Colorado River Commission adopted a resolution requesting the Secretary of the Interior to discontinue the Hoover deficiency payments made from the Upper Colorado River Basin Fund. The Commission asked that this action be effective July 1, 1970, when the operating criteria were to be effective. The request was not granted.

A similar request for termination of the filling criteria was made in a letter of March 31, 1970, from the Governors of the four Upper Division States to the Secretary. The Chief Engineer's comments thereon were provided the Commissioner by memorandum dated April 7, 1970. As stated in the Secretary's response of June 8, 1970, to the Governors of the Basin States, the Department concluded to continue the filling criteria. However, the Secretary attempted to meet the objections of the Upper Basin States in part by stating that, except as limited by minor variations in marketing conditions, all energy to meet Hoover deficiencies in the future was expected to be purchased, and under Section 502 of Public Law 90-537, these costs would be repaid to the Upper Colorado River Basin Fund.

On February 27, 1971, the Upper Colorado River Commission passed a resolution that the Secretary reverse his 1970 decision to continue the filling criteria. The Secretary did not change that decision.

Again in 1975, the Upper and Lower Colorado Regional Offices of the Bureau of Reclamation drafted a notice which would terminate the filling criteria on the grounds that the combined active storage in Lake Powell and Lake Mead was essentially equal to 41 maf and that the intended purpose of the filling criteria had been satisfied. The notice was not adopted by the Department of the Interior and the filling criteria were continued as viable guidelines.