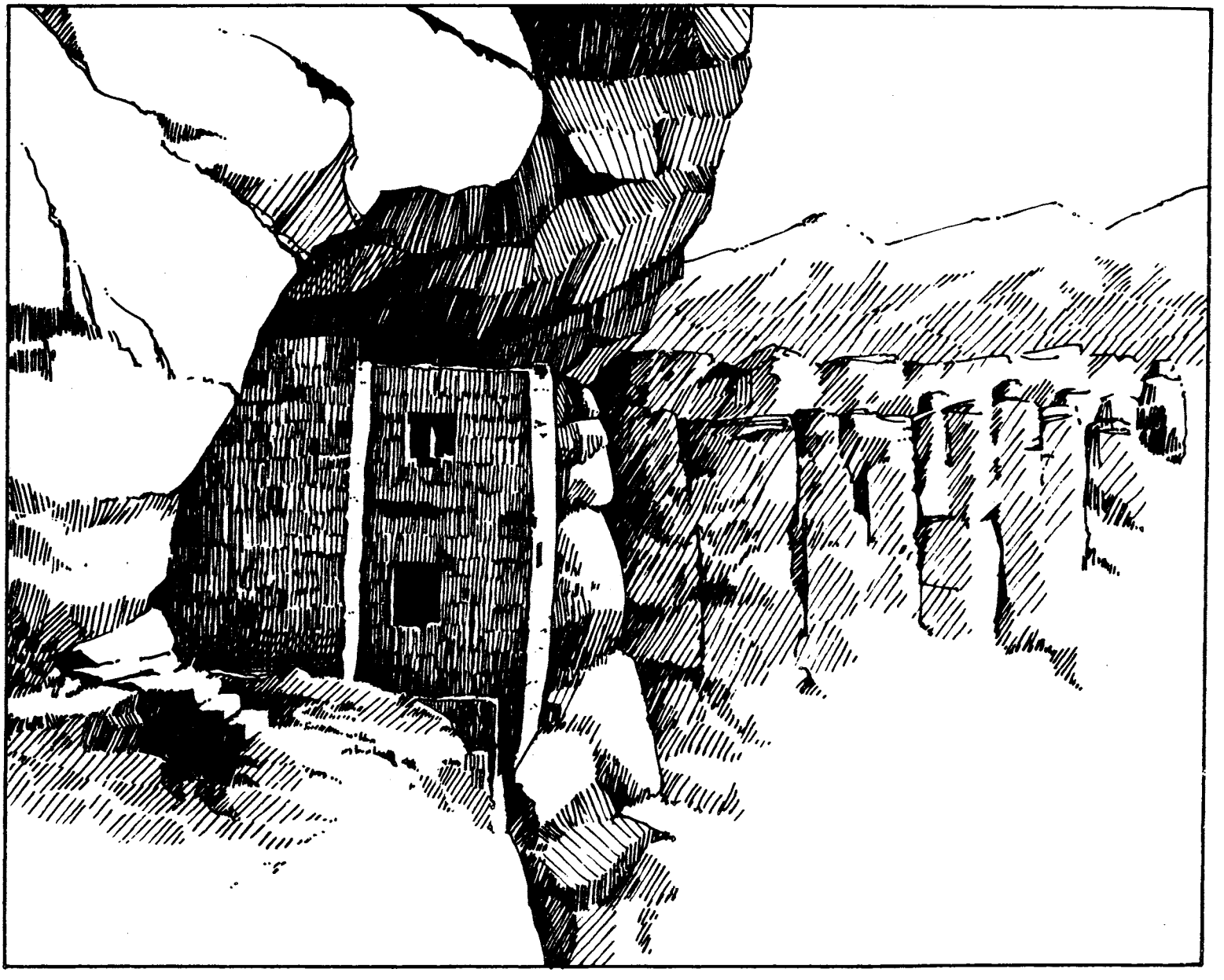
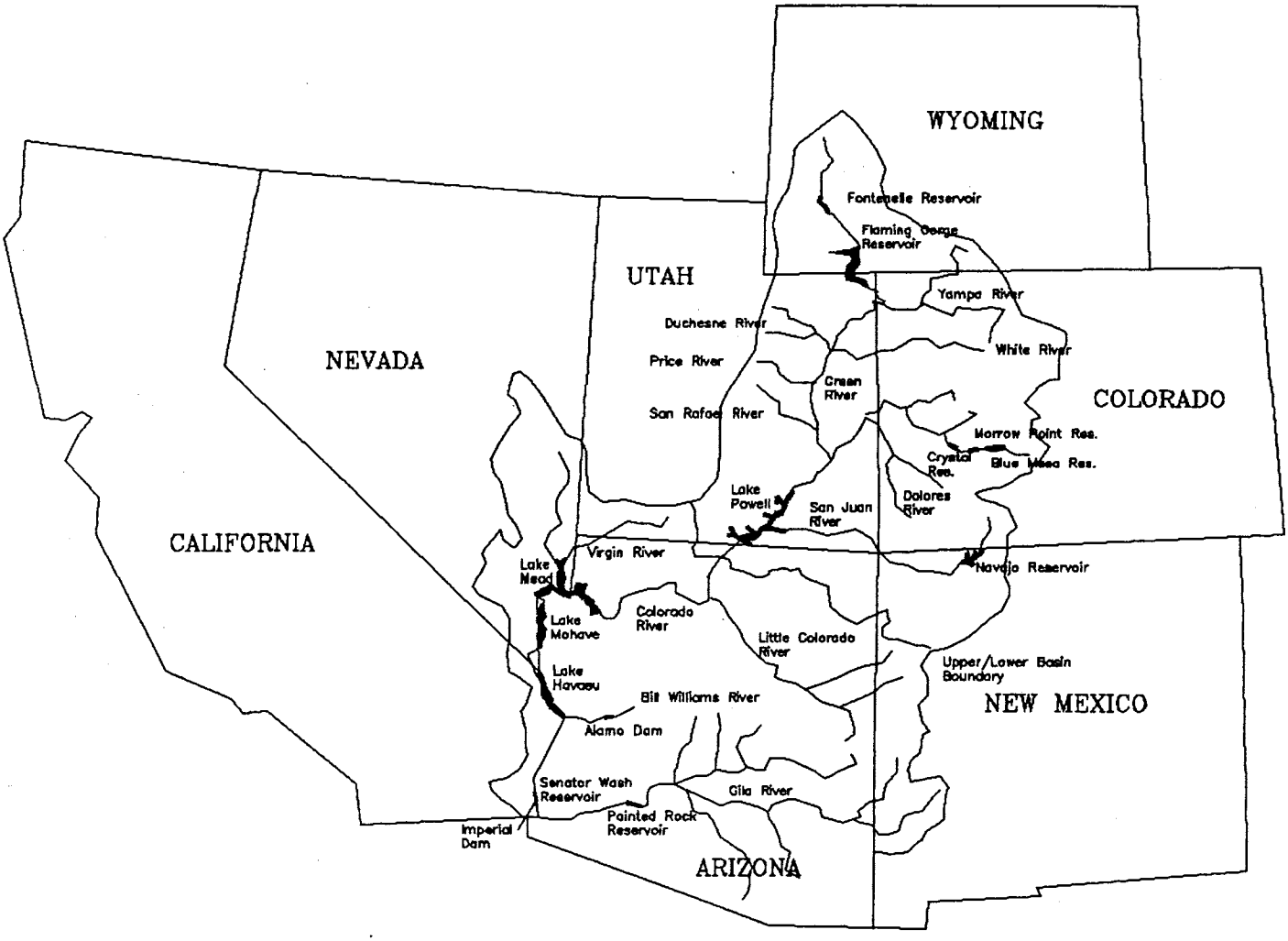
18th Annual Report

Operation of the Colorado River Basin 1988 Projected Operations 1989



Colorado River Basin



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United States
Department of the Interior
Bureau of Reclamation

January 1989

Prepared pursuant to the Colorado River
Basin Project Act of 1968
Public Law 90-537

Introduction

The operation of the Colorado River Basin during the past year and the projected operation for the current year reflect flood control, domestic use, irrigation, hydroelectric power generation, water quality control, fish and wildlife propagation, recreation, and Colorado River Compact requirements.

Storage and release of water from the Upper Basin reservoirs are governed by all applicable laws and agreements concerning the Colorado River, including the impoundment and release of water in the Upper Basin required by Section 602(a) of the Colorado River Basin Project Act of September 30, 1968 (Public Law 90-537). The operation of the Lower Basin reservoirs reflects Mexican Treaty obligations and Lower Basin contractual commitments.

Nothing in this report is intended to interpret the provisions of the Colorado River Compact (45 Stat. 1057), the Upper Colorado River Basin Compact (63 Stat. 31), the Water Treaty of 1944 with the United Mexican States (Treaty Series 994, 59 Stat. 1219), the Decree entered by the Supreme Court of the United States in Arizona v. California et al. (376 U.S. 340), the Boulder Canyon Project Act (45 Stat. 1057), the Boulder Canyon Project Adjustment Act (54 Stat. 774; 43 U.S.C. 618a), the Colorado River Storage Project Act (70 Stat. 105; 43 U.S.C. 620), the Colorado River Basin Project Act (82 Stat. 885; 43 U.S.C. 1501), or the Hoover Power Plant Act of 1984 (98 Stat. 1333).

Authority for Report

Pursuant to the Colorado River Basin Project Act (Public Law 90-537) of 1968, I am pleased to present to the Congress, and to the Governors of the Colorado River Basin States, the eighteenth annual report on the Operation of the Colorado River Basin.

This report describes the actual operation of the reservoirs in the Colorado River drainage area constructed under the authority of the Colorado River Storage Project Act, the Boulder Canyon Project Act, and the Boulder Canyon Project Adjustment Act during water year 1988 and the projected operation of these reservoirs during water year 1989 under the "Criteria for Coordinated Long-Range Operation of Colorado River Reservoirs," published in the Federal Register June 10, 1970.

Donald Paul Hodel, Secretary
United States Department of the Interior

Actual Operations Under Criteria - Water year 1988

The initial plan of operation for water year beginning October 1, 1987, and ending September 30, 1988, was based on forecasted reservoir inflow conditions for October through January and average inflow conditions through the rest of the water year 1988 and scheduled releases from Lake Powell of 11.2 million acre-feet (MAF). This plan of operation would have created 5.05 MAF of vacant space in the Colorado River reservoir system by the end of September 1988, of which 1.8 MAF would have been in Lake Powell. With this plan of operation the contents of Lakes Powell and Mead would have been within 1.4 MAF of each other at the end of September 1988.

The April through July forecast of runoff into Lake Powell made on January 1, 1988, was 6.8 MAF or 83 percent of the long term average. The long term average is calculated by the Bureau of Reclamation using 80 years of natural flow data (1906-1985) and current depletion levels. Accordingly, releases from Glen Canyon Powerplant averaged about 14,000 cubic feet per second (cfs) or 42 percent of maximum powerplant capacity for January through February. The monthly April-July forecasts increased slightly for February then decreased each month until on June 1, the forecast was 5.1 MAF or 63 percent of the long-term average. In response to these forecasts and to insure filling Lake Powell, powerplant releases averaged 11,400 cfs for March, 9,100 cfs for the months April through June, and 11,700 cfs for July.

Climatic conditions for the water year 1988 were very dry for much of the Upper Colorado Region and surrounding areas. The western states were dominated by high pressure zones throughout the year resulting in lower than normal precipitation. The amounts of precipitation for the water year ranged from much below normal (less than 50 percent) over the Upper Green River Basin to near or slightly above normal in the San Juan drainage.

Lake Powell inflows remained below average through the spring runoff with a snowmelt runoff peak of 34,900 cfs being observed on May 22, 1988. The actual unregulated April-July runoff into Lake Powell was 4.8 MAF in 1988, or 59 percent of average. Unregulated runoff is the inflow to Lake Powell adjusted for the change in storage of the upstream reservoirs discussed in this report. The lake reached its maximum elevation on July 5, 1988 of 3,693.31 feet, or 95.75 percent full.

The total unregulated runoff flow into Lake Powell for the water year was 8.2 MAF or 68 percent of the long-term average. Water supply for the San Juan River above Navajo Dam for the water year was also 68 percent, while the Gunnison River above Blue Mesa Dam was 56 percent, the mainstem Colorado River above Grand Junction, Colorado was 75 percent, and the Green River above Flaming Gorge Dam was at 54 percent of the long-term average. Total releases from Glen Canyon Dam were 8.23 MAF while the regulated inflow for the year was 8.6 MAF.

As required by Section 602 of Public Law 90-537, the operation of the Colorado River system is coordinated with Federal and State agencies that have interest in the Colorado River. The Annual Operating Plan (AOP) for water year 1988 was prepared by the Bureau of Reclamation in consultation with representatives from the Governors office of the seven Basin States, the Upper Colorado River Commission, the International Boundary and Water Commission, the U.S. Corps of Engineers, and Western Area Power Administration. These same representatives are consulted as river operations under the AOP are modified as required during the year as runoff predictions are adjusted to snowpack and climate variability. These consultations are with a technical forum for resolving operational issues on the Colorado River.

Projected Plan of Operation Under Criteria - Water Year 1989

Determination of "602(a) Storage"

Section 602(a)(3) of the Colorado River Basin Project Act of September 30, 1968 (Public Law 90-537), provides for the storage of Colorado River water, not required to be released under article III(c) and III(d) of the Colorado River Compact in Upper Basin reservoirs, to the extent the Secretary of the Interior (Secretary) finds it necessary to assure compact deliveries without impairment of annual consumptive uses in the Upper Basin.

Article II of the "Criteria for Coordinated Long-Range Operation of Colorado River Reservoirs" (Operating Criteria) provides that the annual plan of operation shall include a determination by the Secretary of the quantity of water considered necessary to be in Upper Basin storage as of September 30 of the current year.

This determination shall consider all applicable laws and relevant factors including, but not limited to the following: (a) historic streamflows; (b) the most critical period of record; (c) probabilities of water supply; (d) estimated future depletions in the Upper Basin, including the effects of recurrence of critical periods of water supply; (e) the "Report of the Committee on Probabilities and Test Studies to the Task Force on Operating Criteria for the Colorado River," dated October 30, 1969, and such additional studies as the Secretary deems necessary; and (f) the necessity to assure that Upper Basin consumptive uses are not impaired because of failure to store sufficient water to assure deliveries under Section 602(a)(1) and (2) of Public Law 90-537.

Taking into consideration these relevant factors, the Secretary has determined that the active storage in Upper Basin reservoirs forecast for September 30, 1989, exceeds the "602(a) Storage" requirement under any reasonable range of assumptions which might be applied to those items previously listed. Therefore, the accumulation of "602(a) Storage" is not the criterion governing the release of water during the current year.

Mexican Treaty Obligations

Annual calendar year schedules of monthly deliveries of water in the limitrophe section of the Colorado River, allotted in accordance with the Mexican Water Treaty of 1944, are formulated by the Mexican Section and presented to the United States Section, International Boundary and Water Commission (Commission), before the beginning of each calendar year.

Upon 30 days advance notice to the United States Section, Mexico has the right to modify, within the total schedule, any monthly quantity prescribed by the schedule by not more than 20 percent. During water year 1988, Mexico received a total delivery of about 2,700,000 acre-feet at the Northerly International Boundary (NIB).

Of the 2,700,000 acre-feet of mainstem Colorado River water reaching the NIB, about 1,560,000 acre-feet were delivered through the Pilot Knob Powerplant and Wasteway from the All-American Canal. An estimated 510,000 acre-feet were released through Laguna Dam. The remainder of the flow at NIB was made up of return flows to the Colorado River below Laguna Dam, and returns to the Gila River below the gaging station near Dome, as well as small Gila River releases from Painted Rock Reservoir.

Because of the current water supply conditions, the United States will make scheduled deliveries of 1,500,000 acre-feet of Colorado River water to the Republic of Mexico in calendar year 1989. Under most probable water supply conditions, flow at the NIB will total approximately 1.6 MAF during calendar year 1989, due to a small amount of additional water being released while Senator Wash Reservoir is out of operation for repairs and testing. Representatives of the Republic of Mexico will be kept informed of operating schedules through the United States Section of the Commission.

Projected Plan of Operation - Water Year 1989

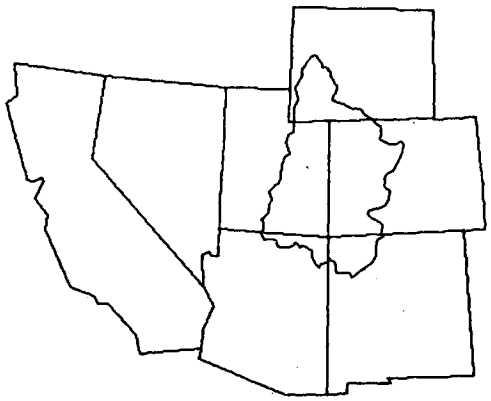
A proposed operation plan for water year 1989 for major reservoirs of the Colorado River system was formulated and distributed to representatives of the Colorado River Basin States in November 1988. This plan was prepared in accordance with the Operating Criteria published June 4, 1970, in compliance with Section 602, Public Law 90-537. The plan reflects operation for flood control, domestic and irrigation use of water, hydroelectric power generation, water quality control, fish and wildlife propagation, recreation, and Colorado River Compact requirements.

During the first two months of water year 1989, releases will be at 28 percent of powerplant capacity at Glen Canyon, then releases will increase to 40 percent during December 1988. Releases from January through July will be based upon the runoff forecasts received during that time but will result in greater available space on August 1, 1989, than the minimum flood control requirement of 1.5 MAF.

The plan calls for a total Glen Canyon release in water year 1989 of 8.23 MAF under reasonable minimum inflow conditions. An annual release of 8.45 MAF would be required under most probable inflow conditions, which would fill Lake Powell to 95 percent full at the end of the runoff season and also equalize the active contents of Lake Powell and Lake Mead to within 500,000 acre-feet of each other by September 30, 1989. With a reasonable maximum inflow during water year 1989, the projected Glen Canyon releases would be 14.1 MAF. This volume of inflow would require 81 percent of maximum powerplant releases during April through June, 70 percent during July and August, and 55 percent during the remainder of the water year.

The projected operation for most probable runoff conditions for the major reservoirs in the Colorado River Basin for water year 1989 is described in the following pages.

Charts showing the projected monthly outflows from each reservoir for the three assumed hydrologic conditions are presented with each reservoir operation. Each of these assumptions uses the most current hydrologic information available by including actual forecasted October through December 1988 inflows. The monthly inflows for the remainder of the year were based upon the following assumptions: (1) reasonable maximum based upon the annual volume of inflow which would be exceeded about 10 percent of the time. (2) most probable based upon the annual 1906 through 1985 natural flows developed for the Colorado River Simulation System (CRSS) model depleted up to current levels; and (3) reasonable minimum based upon the annual volume of inflow which would be exceeded about 90 percent of the time.



UPPER BASIN RESERVOIRS

FONTENELLE RESERVOIR (GREEN RIVER)

Water Year 1988

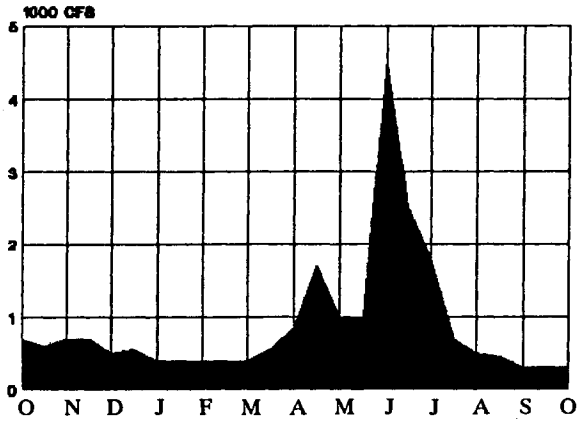
The water year 1988 plan of operation for Fontenelle Reservoir was to maintain the water surface elevation as near as possible to 6,443 feet. This elevation restriction was imposed due to ongoing modification work to correct excessive seepage from the reservoir.

The January 1, 1988 forecast of April through July runoff was 750,000 acre-feet, or 89 percent of the long-term average. The forecast continued to decline through the spring runoff until on June 1, it was 510,000 acre-feet, or 61 percent of average. This low forecast was a result of the dry weather pattern of persistent high pressure zones over the western states resulting in split jet flows forcing most of the winter storms north into Canada and south of the Colorado River Basin into the southern states areas. With the combination of below average runoff and releases matching inflows, the reservoir elevation at Fontenelle was maintained near 6,443 feet throughout water year 1988.

The last of March and early April reservoir inflows started to increase as the spring runoff began and releases were increased to maintain the desired reservoir elevation. Maximum releases of 4,500 cfs were obtained on May 31, June 1, and June 10, as the inflow into the reservoir peaked at 4,524 cfs on June 7. Fontenelle Reservoir reached a peak elevation of 6444.1 feet on April 16, 1988.

The actual April through July runoff into Fontenelle Reservoir was 401,000 acre-feet which was 48 percent of average. Inflow for the entire water year 1988 was 659,000 acre-feet or 55 percent of average. The total release from Fontenelle Dam for water year 1988 was 652,000 acre-feet. Since the reservoir level was below the minimum power elevation for most of the year the powerplant at Fontenelle was not used during water year 1988.

ACTUAL RELEASES **WY 1988**



FONTENELLE RESERVOIR

Reservoir	Acre-feet	Elevation, feet
Maximum Storage	344,834	6,506
Rated Head	233,789	6,491
Minimum Power	194,962	6,485
Surface Area, full		8,058 Acres
Reservoir Length, full		18 Miles
Powerplant		
Number of Units		1
Total Capacity		10,000 KW

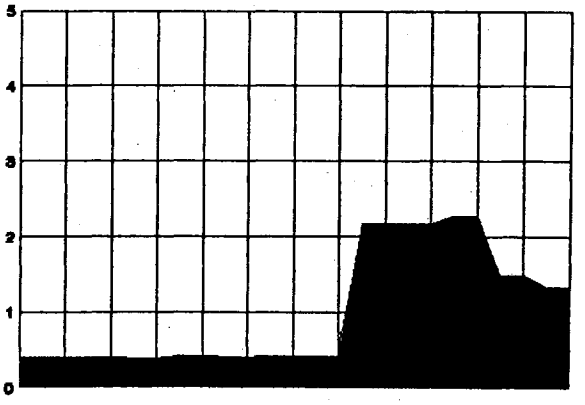
Water Year 1989

The projected plan of operation for Fontenelle Reservoir for water year 1989 is to refill the reservoir by the end of the runoff season. Due to the installation of a diaphragm wall located along the centerline axis of the dam, some restrictions are set on refilling the reservoir. Refilling recommendations are for a maximum filling of 1 ft/day above elevation 6,480 feet, and an unrestricted filling rate below this elevation.

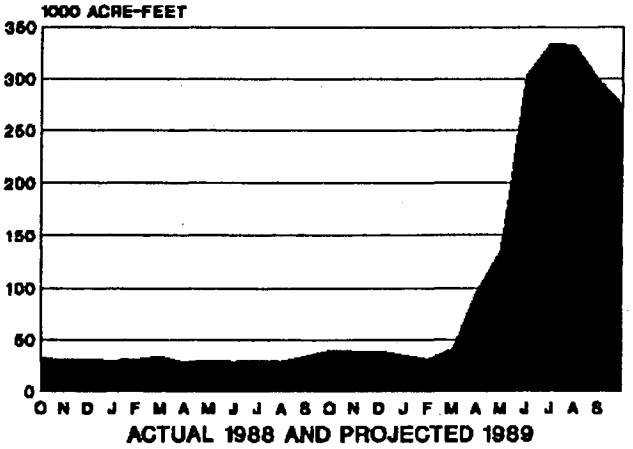
Based on reasonable maximum inflows, releases will average about 550 cfs until the spring runoff when releases are expected to peak between 4,500 and 5,000 cfs. Assuming average inflows, releases will range from 400 cfs to peak flows of 2,500 cfs during maximum inflows. Under minimum inflows, releases will be 400 cfs for October through April, and 800 cfs for the remainder of the water year. Fontenelle Reservoir is expected to fill under the first two monthly inflow scenarios, and fill up to 75 percent under the last scenario.

PROJECTED OPERATION 1989
REASONABLE MAXIMUM RELEASES

MOST PROBABLE RELEASES

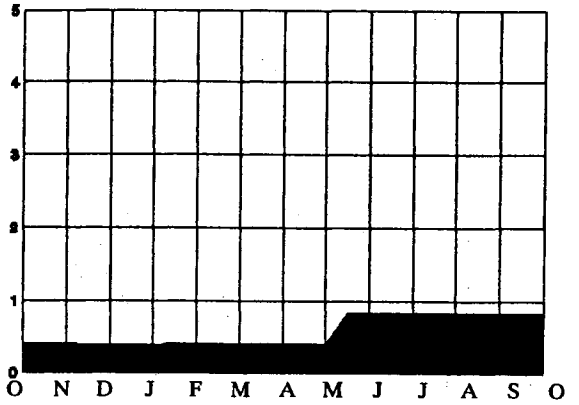


FONTENELLE STORAGE

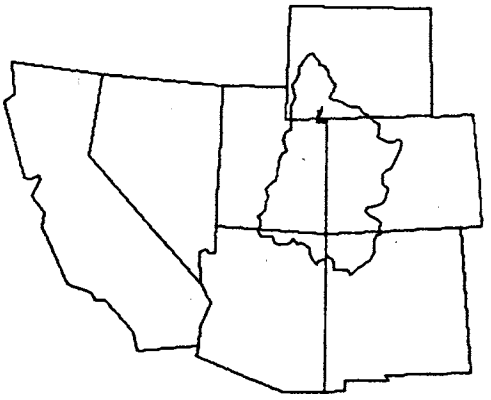


ACTUAL 1988 AND PROJECTED 1989

REASONABLE MINIMUM RELEASES



FLAMING GORGE RESERVOIR (GREEN RIVER)



Water Year 1988

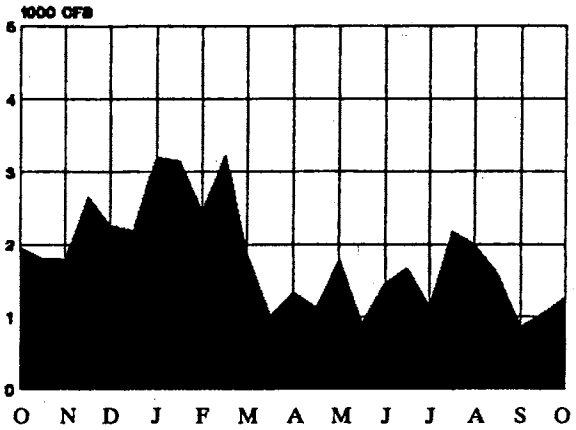
Flaming Gorge Reservoir started water year 1988 at elevation 6,033.5 feet with an active storage of 3,483,000 acre-feet. Releases from Flaming Gorge Dam for water year 1988 were projected to be 1.50 MAF for the most probable operating plan based on the October forecast of an unregulated inflow of 1.66 MAF.

Flaming Gorge Reservoir was gradually drawn down to elevation 6,026.45 feet by January 1, 1988. The forecast of April through July runoff made on January 1, 1988, was 1.10 MAF or 91 percent of the long-term average. Powerplant releases for January and February averaged 2,200 cfs. On March 1, 1988, the April through July forecast had decreased to 900,000 acre-feet, or 75 percent of average; subsequently powerplant releases were decreased to an average release of 1,300 cfs for the months of March and April. The May 1, forecast was for 850,000 acre-feet and with continued dry weather the releases were decreased slightly to an average of 1,200 cfs. Inflows started to increase during mid April as the lower elevation snowpack melted. The main spring runoff occurred during the last of May and early June with powerplant releases increased to average about 1,500 cfs for June and July. As a result of decreasing inflows during the end of June, Flaming Gorge reached a maximum elevation of 6,027.5 on July 6, with a storage of approximately 3.25 MAF.

Releases from Flaming Gorge Dam were constrained to a maximum of 2,600 cfs during the months of August and September to provide interim protection to the endangered Colorado Squawfish. This species is currently being studied as part of the Recovery Implementation Program in the Upper Colorado River Basin and the restricted summer flows are thought to enhance the downstream habitat of the fish.

The actual April through July unregulated runoff into Flaming Gorge Reservoir was 546,000 acre-feet or 45 percent of average. The peak inflow during the runoff was 5,900 cfs on May 31, and the peak total discharge was 2,800 cfs on June 7, 1988. The total inflow for water year 1988 was 885,000 acre-feet, or 54 percent of average. Total releases for the water year was 1,190,000 acre-feet, all of which was passed through the powerplant. The spillway was not used during the water year.

ACTUAL RELEASES **WY 1988**



FLAMING GORGE RESERVOIR

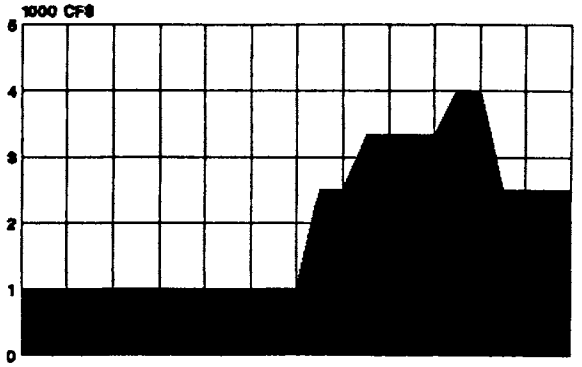
Reservoir	Acre-feet	Elevation, feet
Maximum Storage	3,749,000	6,040
Rated Head	1,062,000	5,946
Minimum Power	233,000	5,871
Surface Area, full		42,020 Acres
Reservoir Length, full		91 Miles
Powerplant		
Number of Units		3
Total Capacity		108,000 KW

Water Year 1989

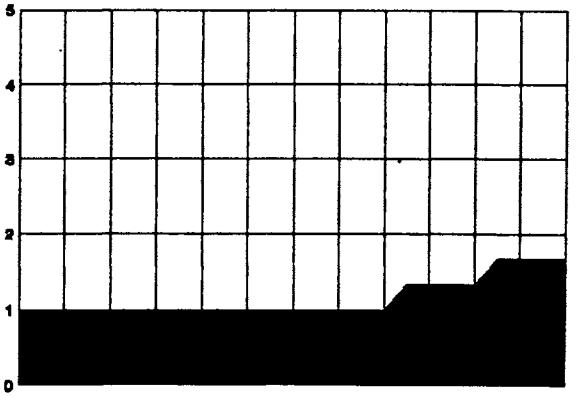
It is projected that the water surface at Flaming Gorge will be drawn down to about elevation 6,020 feet before the 1989 spring runoff. This lower elevation drawdown is a result of continued below average inflows.

Under a reasonable maximum inflow for the 1989 water year, releases from Flaming Gorge will be maintained near 25 percent of maximum powerplant capacity during the fall and winter months with releases being increased to about 75 percent for the remaining water year. Assuming the most probable and minimum inflow conditions, releases will average 25 percent of powerplant capacity for the majority of the year in order to accommodate the expected inflow and filling of the reservoir. Under the most probable operation the total water year 1989 releases will be 840,000 acre-feet with a total unregulated inflow of 1,380,000 acre-feet.

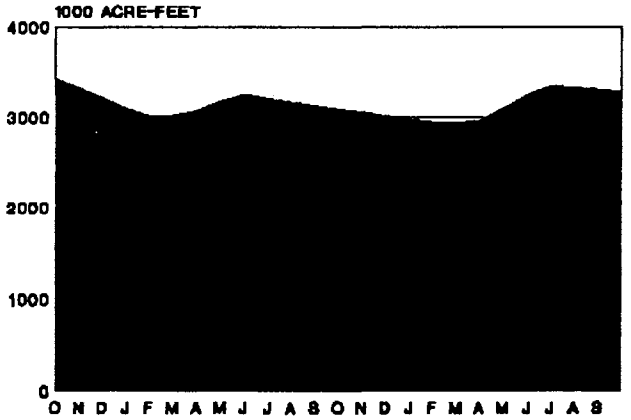
PROJECTED OPERATION 1989
REASONABLE MAXIMUM RELEASES



MOST PROBABLE RELEASES

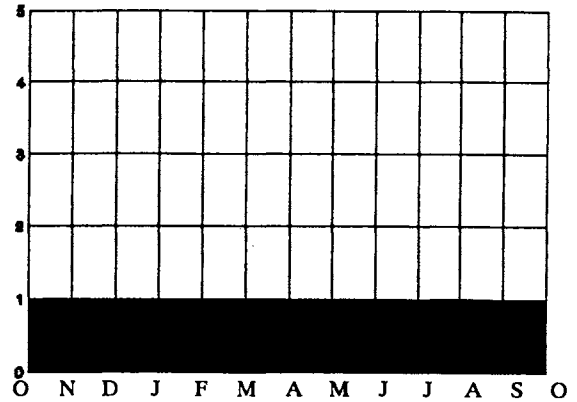


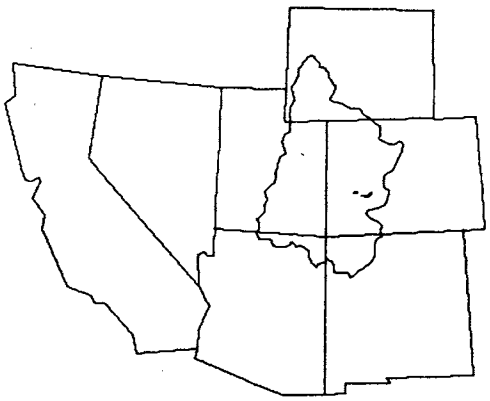
FLAMING GORGE STORAGE



ACTUAL 1988 AND PROJECTED 1989

REASONABLE MINIMUM RELEASES





WAYNE N. ASPINALL UNIT
BLUE MESA, MORROW POINT, AND CRYSTAL RESERVOIRS
(GUNNISON RIVER)

Water Year 1988

The Wayne N. Aspinall Unit, is comprised of Blue Mesa, Morrow Point, and Crystal Reservoirs. Blue Mesa provides nearly all of the long term storage and regulation for all three powerplants. Morrow Point provides peaking power, and thus has highly variable releases. The primary function of the Crystal Reservoir is to regulate the variable Morrow Point releases.

Blue Mesa Reservoir began water year 1988 at elevation 7,504.0 feet with a storage of 694,200 acre-feet. Releases from Blue Mesa for water year 1988 were projected to be 957,000 acre-feet based on the October most probable unregulated inflow of 1,067,000 acre-feet.

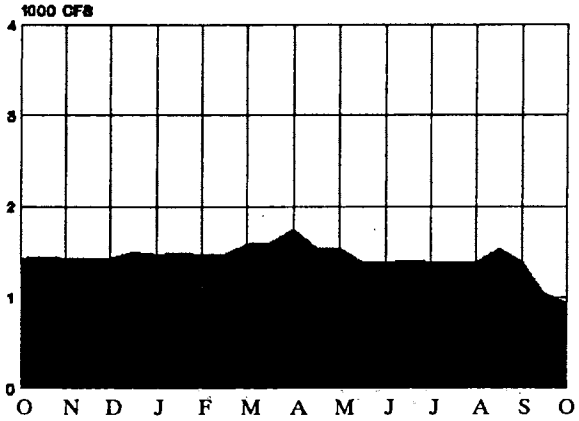
By January 1, 1988, Blue Mesa Reservoir had been gradually lowered to elevation 7,485 feet. The January 1, 1988, forecast of April through July runoff was 650,000 acre-feet or 85 percent of the long-term average. The April through July runoff forecast for Blue Mesa continued to decline for each month's forecast through the entire runoff season. On June 1, the forecast had decreased to 360,000 acre-feet or 47 percent of average. Due to these below average forecasts, releases from Blue Mesa Powerplant were reduced to an average of 1,350 cfs or 45 percent of maximum powerplant capacity for January through March. Power releases were decreased in April through June, averaging 950 cfs for each month. These reductions in power releases were prompted by concern over filling the reservoir. By July 11, 1988, Blue Mesa Reservoir reached a maximum elevation of 7,482.1 feet with a storage of 520,900 acre-feet (63 percent full). The maximum peak inflow to the reservoir was 3,740 cfs which occurred on June 7, 1988.

The actual April through July unregulated runoff into Blue Mesa Reservoir was 390,000 acre-feet or 51 percent of average. The total water year 1988 inflow was 623,000 acre-feet or 57 percent of average. Releases from Blue Mesa Dam totaled 875,000 acre-feet for the water year of which 58,000 acre-feet was passed through the powerplant.

Morrow Point Reservoir operated at or near capacity between elevations 7,150 and 7,160 feet. The April through July side inflow into Morrow Point Reservoir was 43,000 acre-feet; or 74 percent of average. A total of 935,000 acre-feet was released during the water year, all of which was passed through the powerplant.

Crystal Reservoir was also operated at or near its capacity during water year 1988, fluctuating between elevations 6,750 and 6,754 feet. The April through July side inflow to Crystal was 56,000 acre-feet which was 64 percent of average. A total of 1,035,000 acre-feet was released during the water year of which 86,000 acre-feet bypassed the powerplant. During water year 1988 the maximum total release from Crystal Reservoir was 1,750 cfs from March 28 through April 4, 1988.

ACTUAL CRYSTAL RELEASES WY 1988



BLUE MESA RESERVOIR

Reservoir	Acre-feet	Elevation, feet
Maximum Storage	829,523	7,519
Rated Head	249,395	7,438
Minimum Power	81,070	7,393
Surface Area, full		9,180 Acres
Reservoir Length, full		24 Miles

Powerplants (Blue Mesa, Morrow Point, & Crystal)

Number of Units	5
Total Capacity	208,000 KW

Water Year 1989

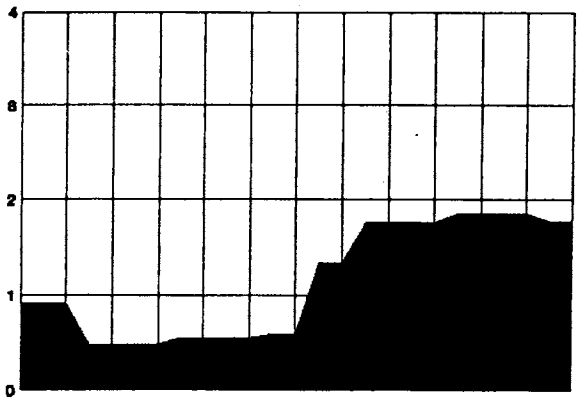
Blue Mesa powerplant will be operated during the water year to minimize powerplant bypasses at Crystal Dam. Assuming near average inflow, a low water elevation of 7,463 feet is expected by the end of March with a maximum elevation of 7,513 feet in July.

Morrow Point Reservoir will fluctuate up to capacity during the coming year. Crystal Reservoir will operate at full capacity to regulate the releases from Morrow Point and to meet downstream requirements for fish habitat and diversions through the Gunnison Tunnel.

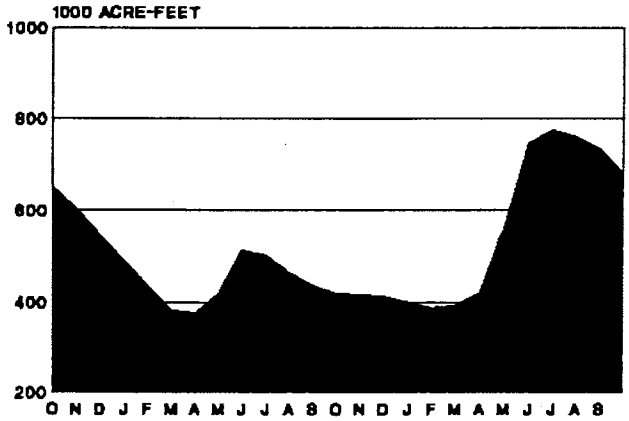
With reasonable maximum inflows, releases from Crystal Dam will be at least 3,000 cfs and possibly higher. Assuming near average inflow conditions, releases from Crystal Reservoir will be at maximum powerplant capacity of 1,700 cfs in addition to scheduled bypasses of up to 1,000 cfs. Under reasonable minimum inflow conditions, releases will range from 400 cfs to 1,700 cfs.

PROJECTED OPERATION 1989
REASONABLE MAXIMUM CRYSTAL RELEASES

MOST PROBABLE RELEASES

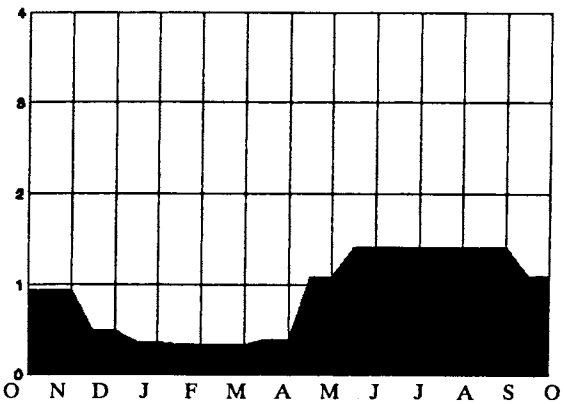


BLUE MESA STORAGE

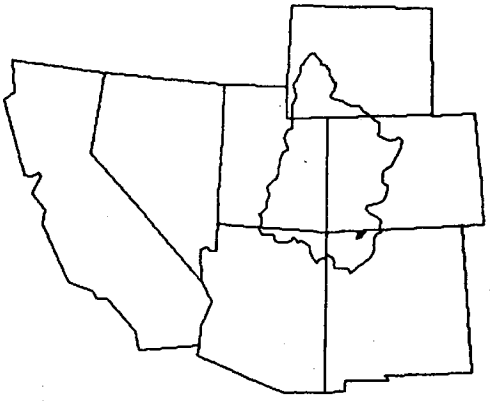


ACTUAL 1988 AND PROJECTED 1989

REASONABLE MINIMUM RELEASES



NAVAJO RESERVOIR
(SAN JUAN RIVER)



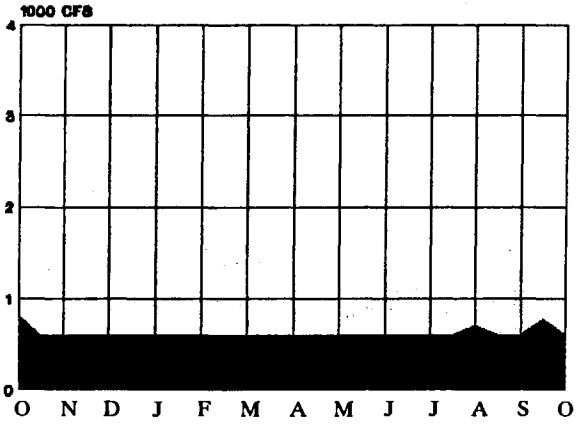
Water Year 1988

The elevation of Navajo Reservoir at the beginning of the water year was 6,038.5 feet with 1,094,000 acre-feet of active storage. Based on the October most probable inflow of 877,000 acre-feet it was projected that Navajo Reservoir would fill to elevation 6,061 feet by July 1988.

Navajo Reservoir was gradually drawn down to elevation 6,036.6 feet by January 1, 1988, and the April through July runoff forecast at this time was 700,000 acre-feet or 110 percent of the long-term average. On February 1, the April through July forecast increased to 800,000 acre-feet, then dropped each month until on June 1, it was 370,000 acre-feet, or 58 percent of average. Since Navajo Reservoir was being refilled during this time period, releases were kept at a constant 600 cfs for most of the 1988 water year.

The actual April through July 1988 runoff volume into Navajo Reservoir was 382,000 acre-feet, or 60 percent of average. The total water year 1988 inflow was 651,000 acre-feet which was 68 percent of average. Peak inflow to Navajo reservoir occurred on May 17, at 3,600 cfs and the peak releases were 740 cfs on July 19. The reservoir reached a peak elevation of 6,051.2 feet July 4 through July 6, 1988.

ACTUAL RELEASES WY 1988



NAVAJO RESERVOIR

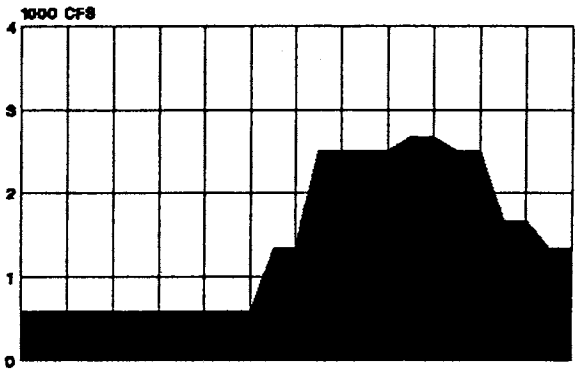
Reservoir	Acre-feet	Elevation, feet
Maximum Storage	1,696,400	6,085
Inactive Storage	660,500	5,990
Surface Area, full		15,610 Acres
Reservoir Length, full		33 Miles

Water Year 1989

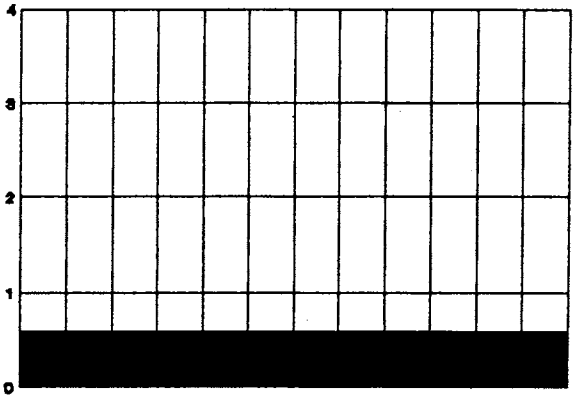
Navajo Reservoir is scheduled to start refilling during water year 1989. It is projected that the reservoir will be drawn down to near elevation 6,035 by February 1989, in preparation for the most probable spring inflow. Constant releases averaging 600 cfs per month over the entire water year are projected to increase the reservoir elevation to 6,067 feet, (85 percent full) by July 1989.

With a probable maximum runoff water year, Navajo Reservoir is expected to fill with maximum releases of 2,700 cfs during the month of June. A reasonable minimum level of inflow would cause releases to be held at a constant 600 cfs per month through the entire 1989 water year.

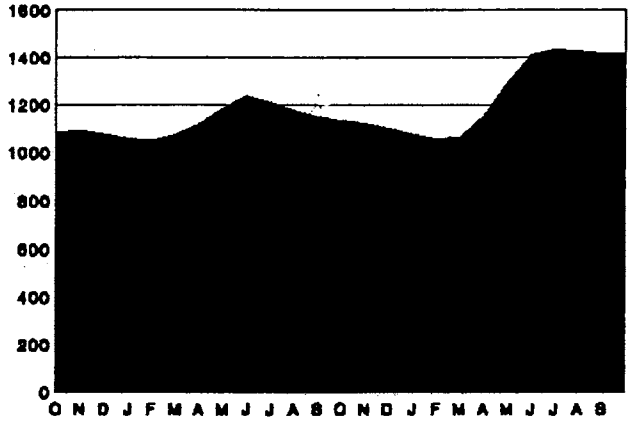
PROJECTED OPERATION 1989
REASONABLE MAXIMUM RELEASES



MOST PROBABLE RELEASES

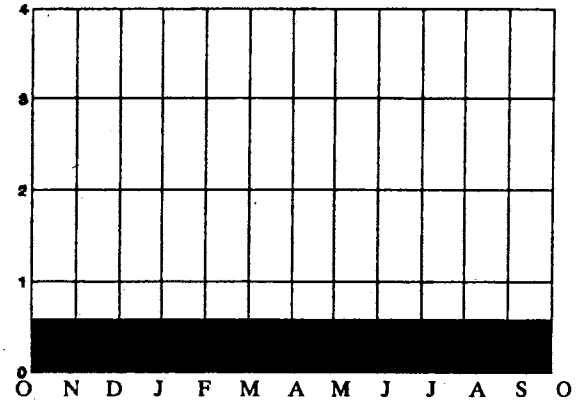


NAVAJO STORAGE

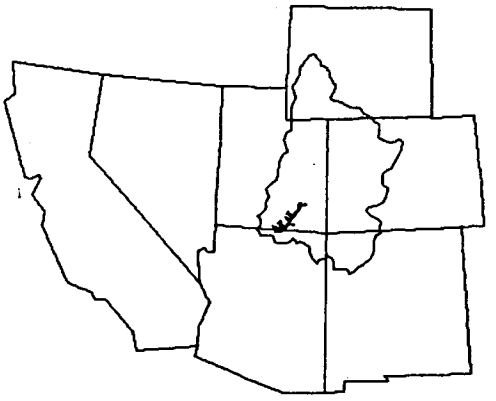


ACTUAL 1988 AND PROJECTED 1989

REASONABLE MINIMUM RELEASES



LAKE POWELL
(COLORADO RIVER)



Water Year 1988

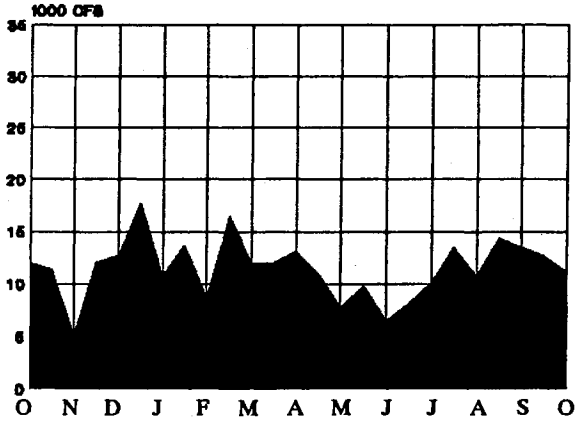
Lake Powell, which is impounded by Glen Canyon Dam, was operated as part of the Colorado River Storage Project (CRSP) in accordance with governing contracts and laws to provide conservation storage, river regulation, power generation, recreation, and fish and wildlife enhancement during water year 1988.

At the start of water year 1988, Lake Powell was 92 percent full with an active storage content of 23.1 MAF at elevation 3,687.9 feet. The most probable operating plan based on the October forecast called for total water year releases of 10.5 MAF based on an unregulated inflow of 11.6 MAF. The reasonable maximum (upper decile) water supply had scheduled water year releases of 15.5 MAF based on an unregulated inflow of 17.7 MAF.

On January 1, 1988, Lake Powell was at elevation 3,685.2 with an active content of 22.7 MAF. The January 1 forecast of April through July runoff for Lake Powell was 6.8 MAF or 83 percent of the long-term average. Discharges from Glen Canyon powerplant averaged 13,800 cfs (42 percent of maximum capacity) for January and February. The runoff forecast on March 1, was 7.2 MAF or 88 percent of average, and releases from the powerplant averaged 11,400 cfs for the month. Subsequent monthly forecasts continued to decline until on June 1, the forecast was 5.1 MAF or 63 percent of average. To insure filing Lake Powell as full as possible by the end of June, powerplant releases were reduced to an average 28 percent of capacity for April through June. The maximum lake elevation of 3,693.1 feet (96 percent full) was reached on July 5, with an active content of 23.9 MAF. Lake Powell recorded a peak regulated inflow of 34,900 cfs on May 22. Maximum releases from the powerplant during the spring runoff period averaged daily peaks of 9,000 to 12,000 cfs.

The total 1988 water year unregulated inflow to Lake Powell was 8.16 MAF which is equivalent to 68 percent of the long-term average yearly supply. Total 1988 water year releases below Glen Canyon were 8.23 MAF which is the minimum volume release. All releases were passed through the powerplant. The spillways at Glen Canyon were not used.

ACTUAL RELEASES **WY 1988**



LAKE POWELL

Reservoir	Acre-feet	Elevation, feet
Maximum Storage	25,002,000	3,700
Rated Head	9,428,000	3,570
Minimum Power	4,126,000	3,490
Surface Area, full		161,390 Acres
Reservoir Length, full		186 Miles
Powerplant		
Number of Units		8
Total Capacity		1,247,000 KW

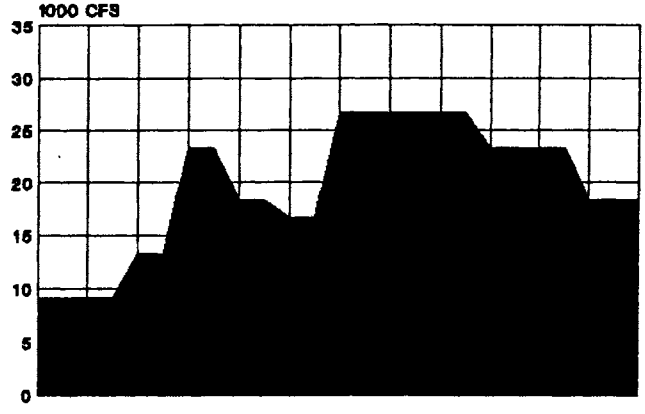
Water Year 1989

Lake Powell began water year 1989 at elevation 3,685.6 feet with an active content of 22.7 MAF (91 percent full). The plan of operation through December is to maintain releases at about 32 percent of powerplant capacity. Beginning in January, assuming a most probable unregulated runoff water year of 10.7 MAF, discharges from the powerplant would be increased to average 42 percent of capacity through February and lowering to about 30 percent of capacity during the months of March through June. During the months of July through September; the reservoir would be operated for power and recreation demands with discharges at about 42 percent of powerplant capacity. Total discharges for the water year would be 8.45 MAF.

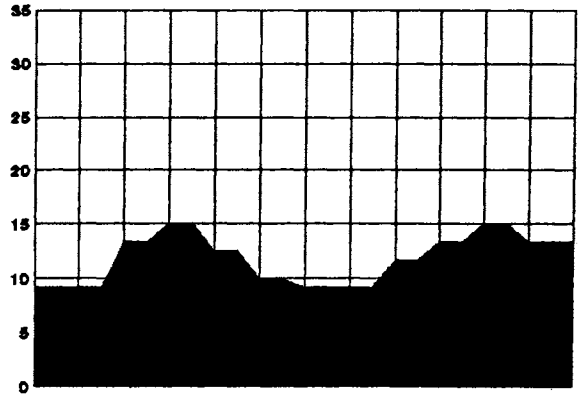
The operation plan for the probable maximum inflow (upper decile) is the same as the most probable inflow from October through December. For January through March, releases would average 60 percent of powerplant capacity, increase to 82 percent of capacity for April through June, and then lowering to 70 percent capacity for the remaining of the water year. Total water year releases of 14.1 MAF based on a unregulated inflow of 16.8 MAF would fill Lake Powell during the month of July. A reasonable minimum level of inflow would produce an annual release of 8.23 MAF based on a unregulated inflow volume of 6.6 MAF.

The actual releases from Lake Powell after January 1, 1989, will be reevaluated based upon runoff forecasts reflecting current hydrologic conditions. It is expected that powerplant bypasses will be avoided in all three operating plans.

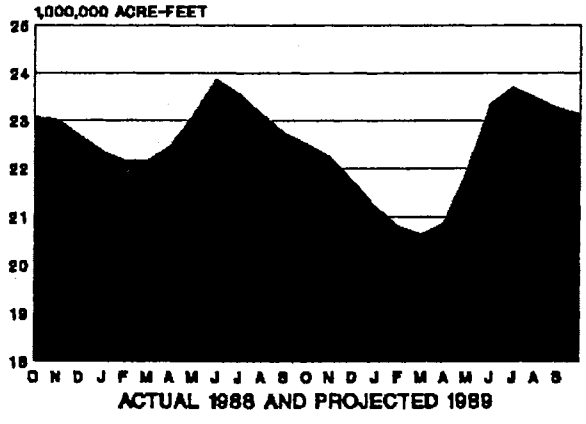
PROJECTED OPERATION 1989
REASONABLE MAXIMUM RELEASES



MOST PROBABLE RELEASES

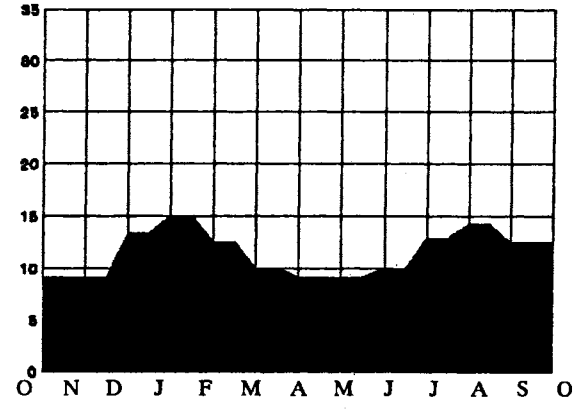


LAKE POWELL STORAGE



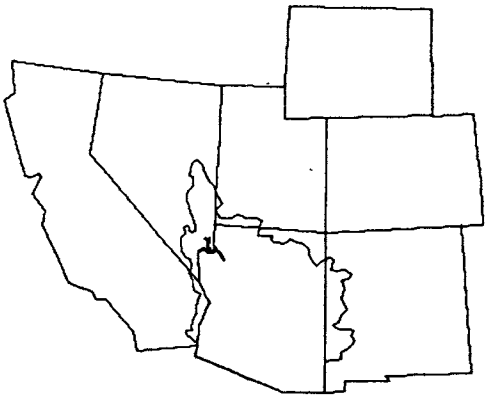
ACTUAL 1988 AND PROJECTED 1989

REASONABLE MINIMUM RELEASES



LOWER BASIN RESERVOIRS

LAKE MEAD
(COLORADO RIVER)

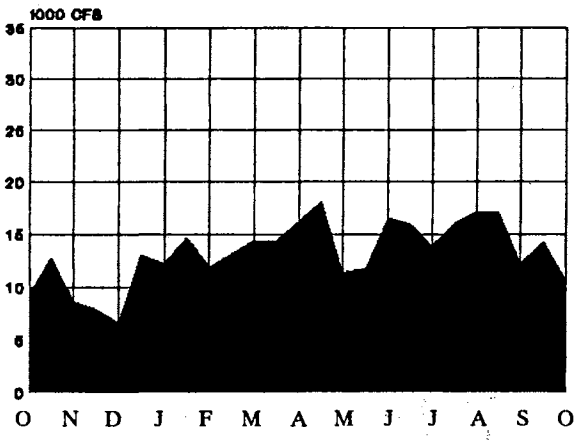


Water Year 1988

At the beginning of water year 1988, Lake Mead, impounded by Hoover Dam, had a water surface elevation of 1,210 feet and an active storage of 24,360,000 acre-feet. During the winter months, the water level gradually rose to about 1,212 feet near the end of February 1988 and then gradually declined to 1206 by the end of May 1988. During June, July, and August, Lake Mead continued to drop, reaching a low elevation of approximately 1199 feet during the last week of September with a corresponding active storage of 22,792,000 acre-feet.

During the water year, releases were made to meet downstream water use requirements in the United States and Mexico, flood control requirements, programmed levels of Lakes Mohave and Havasu, and transit losses which include river and reservoir evaporation, uses by phreatophytes, changes in bank storage, unmeasured inflows, and diversions to the Las Vegas, Nevada, area via the Robert B. Griffith Water Project (Project). The total release from Lake Mead through Hoover Dam during water year 1988 was approximately 9,688,000 acre-feet, all of which passed through the turbines for power production. In addition, 199,000 acre-feet were diverted from Lake Mead by the Project. At the end of the water year, Lake Mead had a water surface elevation of 1199 feet and an active storage of 22,795,000 acre-feet which reflects a decrease in storage during the water year of 1,570,000 acre-feet. On September 30, 1988, the active storage of Lake Mead was 42,000 acre-feet greater than the active storage in Lake Powell.

ACTUAL RELEASES WY 1988



LAKE MEAD

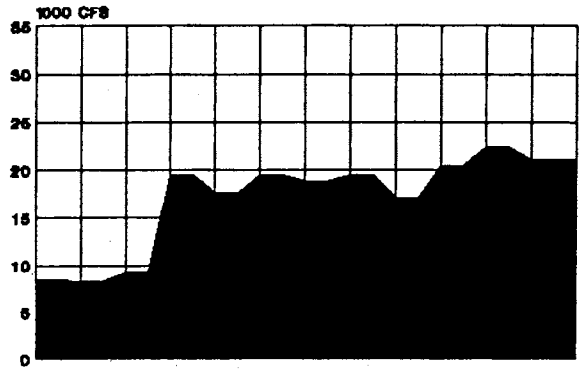
Reservoir	Acre-feet	Elevation, feet
Maximum Storage	27,377,000	1,229
Rated Head	13,653,000	1,123
Minimum Power	10,024,000	1,083
Surface Area, full		162,700 Acres
Reservoir Length, full		115 Miles

Powerplant	
Number of Units	17
Total Capacity	1,619,000 KW

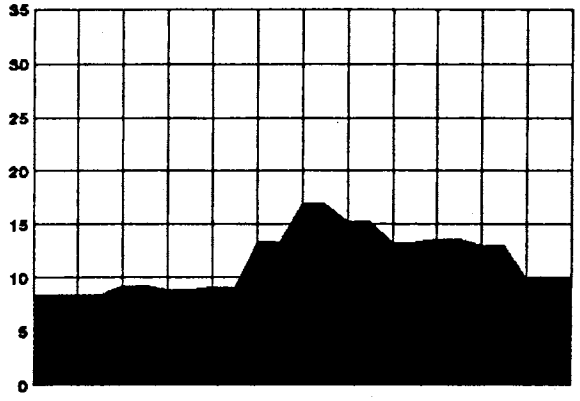
Water Year 1989

Under most probable inflow conditions during the 1989 water year, the Lake Mead water level is scheduled to be drawn down to elevation 1197 feet by the end of June 1989. At that level, the lake will have in active storage approximately 22.5 MAF. During water year 1989, approximately 8.2 MAF is scheduled to be released from Lake Mead under most probable conditions, all passing through the powerplant.

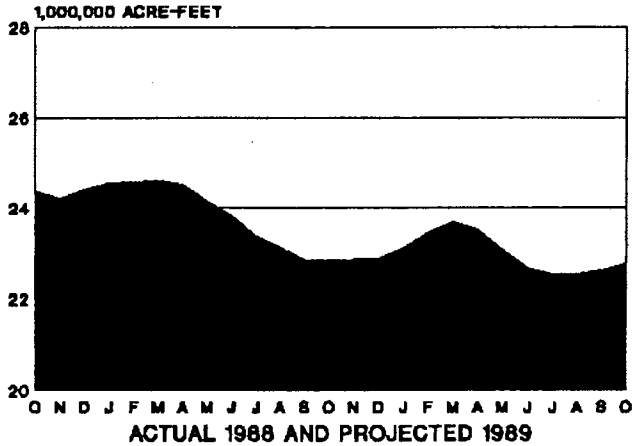
PROJECTED OPERATION 1989
REASONABLE MAXIMUM RELEASES



MOST PROBABLE RELEASES

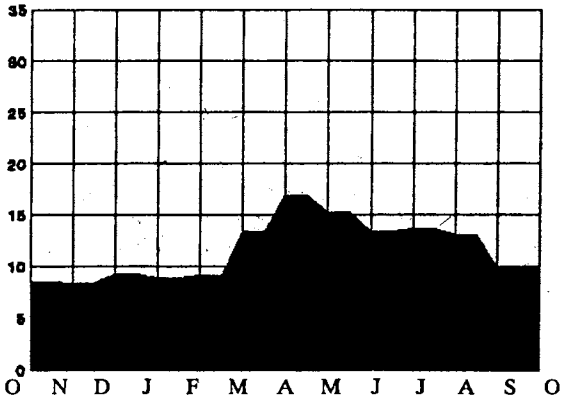


LAKE MEAD STORAGE

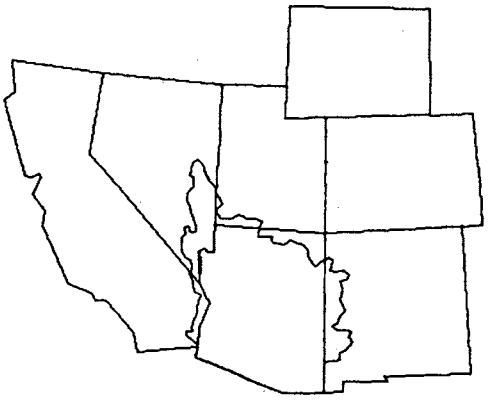


ACTUAL 1988 AND PROJECTED 1989

REASONABLE MINIMUM RELEASES



LAKE MOHAVE
(COLORADO RIVER)



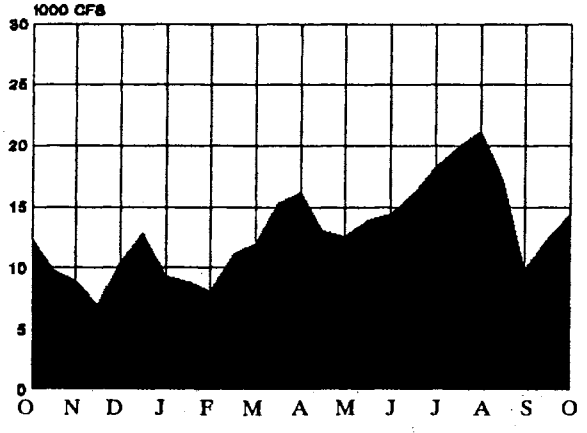
Water Year 1988

At the beginning of water year 1988, the water surface elevation of Lake Mohave, which is impounded by Davis Dam, was 633.1 feet, with an active storage of approximately 1,436,000 acre-feet.

During the winter months, the water level was gradually raised to approximately 646 feet, with an active storage of about 1,785,000 acre-feet in the first part of March 1988. The water level then gradually lowered during the remainder of March and part of April. The reservoir reached elevation 642.4 feet during the first part of April 1988. During the remainder of April and May, Lake Mohave fluctuated between an elevation of 642 and 646 feet, with an active storage of approximately 1,754,000 acre-feet at the end of May. Lake Mohave was at an elevation of about 643 feet at the end of June and at approximately 635 feet by the end of July 1988. The reservoir ended the water year at an elevation of 635.8 feet with 1,505,000 acre-feet in active storage.

Lake Mohave releases were made to satisfy flood control requirements and downstream water use requirements, including diversions by The Metropolitan Water District of Southern California (MWD) and by the Central Arizona Project (CAP). A small amount of reregulation occurred at Lake Havasu. During the water year, approximately 9,714,000 acre-feet was released at Davis Dam, all of which passed through the turbines for power production. Of that amount, 1,207,000 acre-feet was then pumped from Lake Havasu by MWD and 490,000 acre-feet was pumped for the CAP.

ACTUAL RELEASES WY 1988



LAKE MOHAVE

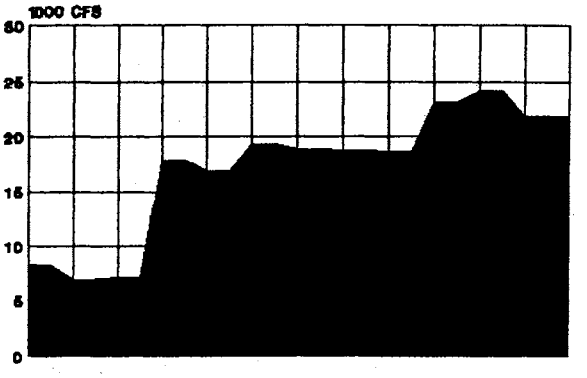
Reservoir	Acre-feet	Elevation, feet
Maximum Storage	1,810,000	647
Rated Head	1,188,000	623
Minimum Power	217,500	570
Surface Area, full		28,200 Acres
Reservoir Length, full		67 Miles

Powerplant	
Number of Units	5
Total Capacity	240,000 KW

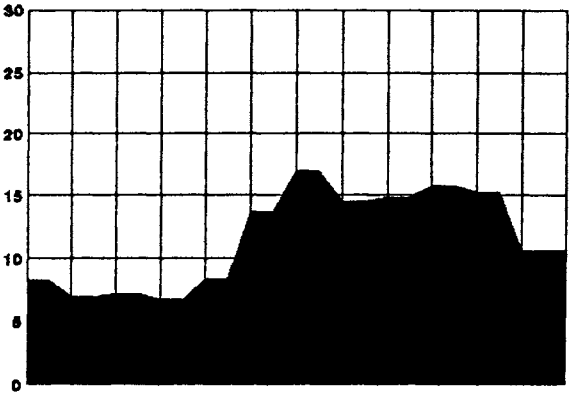
Water Year 1989

Under most probable inflow conditions, the water level of Lake Mohave is scheduled to reach an elevation of about 643 feet by the end of January 1989 and then rise to elevation 645 feet by the end of May. The reservoir will gradually drop to an elevation of 631 feet by the end of the water year. During the water year, a total of 8.4 MAF is scheduled to be released from Lake Mohave to meet all downstream requirements. All of that total is scheduled to pass through the powerplant.

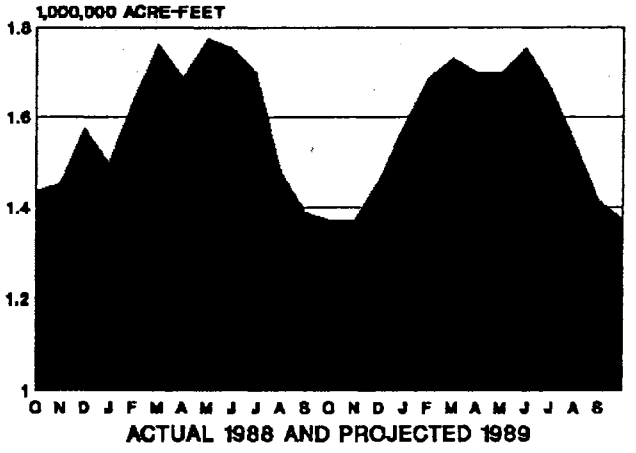
PROJECTED OPERATION 1989
REASONABLE MAXIMUM RELEASES



MOST PROBABLE RELEASES

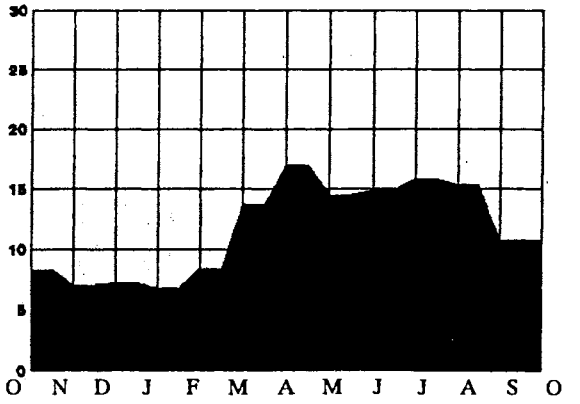


LAKE MOHAVE STORAGE

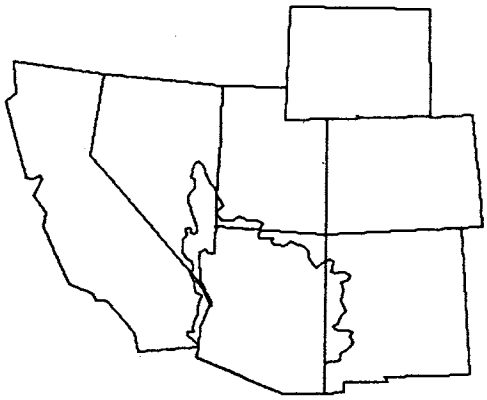


ACTUAL 1988 AND PROJECTED 1989

REASONABLE MINIMUM RELEASES



LAKE HAVASU
(COLORADO RIVER)



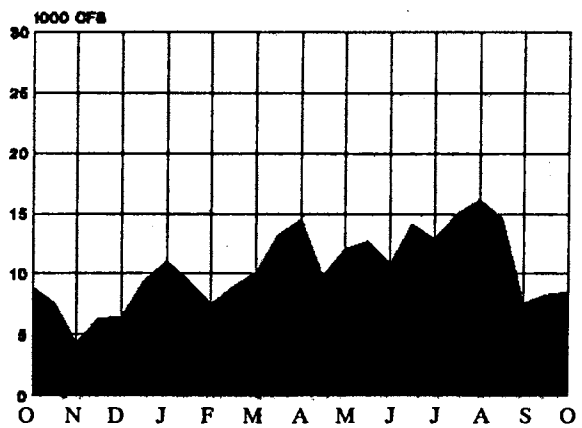
Water Year 1988

At the beginning of water year 1988, the water level of Lake Havasu, impounded by Parker Dam, was at an elevation of about 448 feet with an active storage of about 570,000 acre-feet. During October, November, and December 1987, the reservoir fluctuated between elevation 446 feet and 448 feet. By mid-March 1988, the reservoir was at an approximate elevation of 446 feet to provide vacant space for runoff from the drainage area between Davis and Parker Dams. The water level was then raised to an elevation of 450 feet near the end of April, with an active storage of about 615,000 acre-feet. At the end of the water year, Lake Havasu was at an elevation of approximately 447 feet with an active storage of 565,000 acre-feet.

During the water year, approximately 7,840,000 acre-feet was released at Parker Dam, all of which passed through the turbines for power production. That total release amount included releases from Alamo Dam on the Bill Williams River. In addition to the releases from Parker Dam, approximately 1,207,000 acre-feet was diverted from Lake Havasu by MWD. Diversions from Lake Havasu for the CAP were 490,000 acre-feet during the water year.

Space in the top 10 feet of Lake Havasu (about 180,000 acre-feet) is reserved by the United States for flood control and other uses, including river regulation. Normally, only about the top 4 feet, or 77,000 acre-feet of space, have been used for this purpose since the Alamo Reservoir on the Bill Williams River has been in operation.

ACTUAL RELEASES **WY 1988**



LAKE HAVASU

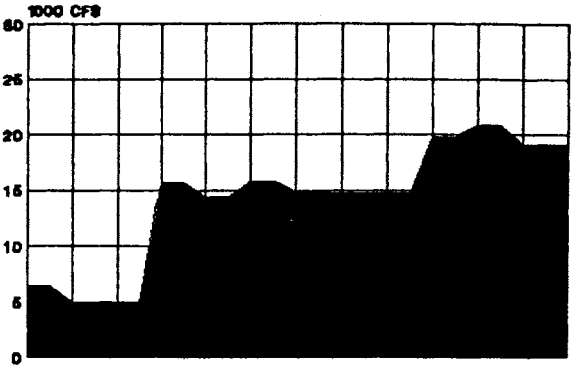
Reservoir	Acre-feet	Elevation, feet
Maximum Storage	619,400	450
Rated Head	619,400	450
Minimum Power	439,400	440
Surface Area, full		20,400 Acres
Reservoir Length, full		35 Miles

Powerplant	
Number of Units	4
Total Capacity	120,000 KW

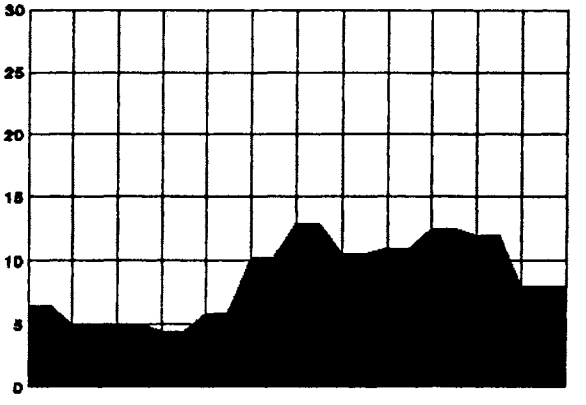
Water Year 1989

Lake Havasu is scheduled to be operated at the highest levels consistent with requirements for maintaining reservoir regulation space. The yearly low elevation of approximately 446 feet is scheduled for the October through February high flood hazard period. The yearly high of about 450 feet is scheduled for the low flood hazard months of May and June. During water year 1989, a total of approximately 6.2 MAF is scheduled to be released from Lake Havasu to meet all downstream and flood control requirements. All of that amount is expected to pass through the Parker Powerplant.

PROJECTED OPERATION 1989
REASONABLE MAXIMUM RELEASES



MOST PROBABLE RELEASES



LAKE HAVASU STORAGE

ACTUAL 1988 AND PROJECTED 1989

REASONABLE MINIMUM RELEASES

River Regulation

Daily releases are made from the storage reservoirs in the Lower Basin to meet the incoming orders of the water user agencies or for the regulation of flood control space and releases of excess water. When possible, all water passes through the powerplant units. The daily releases are regulated on an hourly basis to meet, as nearly as possible the peaking power needs of the hydroelectric power customers. Minimum daily flow objectives are provided in the river to maintain fishery habitat.

The combination of high reservoir conditions and river regulation below Hoover Dam resulted in a total water year 1988 delivery to Mexico of approximately 1.0 MAF in excess of the scheduled treaty deliveries (1,700,000 acre-feet per calendar year). Of that amount, 97,000 acre-feet of drainage waters were bypassed to the Gulf of California via the Bypass Drain during water year 1988. This bypass channel was constructed pursuant to provisions of Minute No. 242 of the International Boundary and Water Commission.

Flood Control

Lake Mead is operated in accordance with flood control regulations specified in the Field Working Agreement between Reclamation and the Corps of Engineers, signed in 1982. The regulations stipulate minimum release levels from Lake Mead to route the reasonable maximum inflow. The reasonable maximum inflow is the estimated inflow volume that, on the average, will not be exceeded 19 out of 20 times. This volume is derived by adding an "uncertainty" term to the most probable runoff forecast. In 1983, unusual hydrometeorological events resulted in unprecedented large forecasting errors. Subsequent reassessment of the estimate of the "uncertainty" term led to adoption of larger values for use in determining the probable maximum inflow in 1984 and thereafter.

Routine maintenance and repair of bankline damage was carried out during water year 1988. As in the previous year, some bankline erosion was experienced in the Lower Basin of the Colorado River. In some river reaches, especially the Mohave Valley, greater than normal bankline erosion was caused in part by increased wave action from boating and other recreational river traffic.

Degradation in some reaches of the river channel has continued, resulting in a lowering of the river water surface elevation for any given discharge. In a few areas, however, the river channel has aggraded due to heavy sediment loads.

Total Colorado River reservoir system storage at the start of water year 1988 was approximately 54,921,000 acre-feet and about 52,404,000 acre-feet at the end of the water year, representing a 2,517,000 acre-foot increase in total remaining available reservoir space.

In addition to the mainstem structures, Alamo Dam on the Bill Williams River (in the Lower Basin) received minor flood inflow during water year 1988. During water year 1989, Painted Rock and Alamo Reservoirs are scheduled to be operated in accordance with established flood control criteria to maximize the available flood control space in their respective reservoirs.

Water Quality Operation

In recognizing the need to manage the water quality of the Colorado River, it was recommended that long-term salinity increases in the river be controlled through a water quality improvement program as described in the report "Colorado River Water Quality Improvement Program" dated February 1972. The program called for a basin-wide approach to salinity control while the Upper Basin continues to develop its compact-apportioned waters.

The initial step toward improvement of the future water quality in the basin was the passage by Congress in the Colorado River Basin Salinity Control Act of 1974 (Act) (Public Law 93-320) on June 24, 1974, authorizing the construction of various features for the enhancement and protection of the quality of water available in the Colorado River for use in the United States and the Republic of Mexico.

Title I of the Act enables the United States to comply with its obligation under the agreement with Mexico of August 30, 1973 (Minute No. 242 of the International Boundary and Water Commission, United States and Mexico), which was concluded pursuant to the Treaty of February 3, 1944 (TS994). Title I authorized the construction of the Yuma Desalting Plant and a bypass drain to ultimately discharge the plant's brine. These facilities, and others, will enable the delivery of water at Morelos Dam, for subsequent use in Mexico, having an average annual salinity no greater than 115 parts per million (ppm) plus or minus 30 ppm (United States count) higher than the annual average salinity of the Colorado River water at Imperial Dam.

Title II of the Act authorized the Secretary to construct a number of units in the basin above Imperial Dam, as well as the investigation of several other potential salinity control units.

The Act, and its amendment by Public Law 98-569 of October 30, 1985, directs the Secretary to submit a biennial report to the President, the Congress, and the Colorado River Basin Salinity Control Advisory Council. The water quality aspects of Colorado River operations are extensively described in that biennial series, the latest of which is Report No. 13 entitled, "Quality of Water, Colorado River Basin," dated January 1987, only minimal discussion of this aspect of the operation below Imperial Dam is presented in this report.

During all of water year 1988, the United States bypassed a total of 97,000 acre-feet through the bypass drain near Yuma. There were excess water conditions through February, 1988, and during that time replacement of bypass waters was not required. During March through September of water year 1988, the United States bypassed a total of 75,000 acre-feet through the bypass drain. This water was replaced with a like amount of other water, pursuant to Minute No. 242 of the International Boundary and Water Commission.

During water year 1988, the average annual salinity of the Colorado River water arriving at Imperial Dam was 650 ppm. During this same period, the salinity of the waters arriving at Morelos Dam was 723 ppm, resulting in an annual average salinity differential of only 73 ppm, well within the requirement of Minute 242 of the International Boundary and Water Commission.

While no flows are scheduled in the bypass drain during water year 1989, it is possible that about 100,000 acre-feet of such discharges could occur, as in previous years. A minor amount of drainage water also could be returned to the Colorado River below Morelos Dam during 1989. Since excess flow conditions are not expected, it will be necessary to provide replacement water to Mexico for any bypassed flows.

Beneficial Consumptive Uses

An extensive discussion of consumptive uses is treated in detail in Reclamation's "Colorado River System Consumptive Uses and Losses Report, 1981-1985." That report was prepared jointly by the Upper and Lower Colorado Regional Offices and was scheduled for release in 1988, but has not yet been published due to technical review questions. The report presents estimates of the consumptive uses and losses from the Colorado River System for each year from 1981 through 1985. The table on the following page was created by the provisional data from that report, which summarizes annual water use from the system by States, including water use supplied by ground-water overdraft. The next report, 1986-1990, is expected to be available in 1992.

Upper Basin Uses and Losses

The three largest categories of consumptive use and losses in the Upper Colorado River Basin are agricultural uses within the basin, transbasin diversions to adjacent drainages, and evaporation losses from the major reservoirs of the Colorado River System. During water year 1988, the estimated use for municipal, industrial and agriculture supplies in the Upper Basin was about 2.950 MAF. Estimated evaporation losses were about 720,000 acre-feet from mainstem reservoirs. Approximately 680,000 acre-feet was diverted for use in adjacent drainages. Total estimated consumptive use amounted to about 3.85 MAF. Storage in the Upper Basin mainstem reservoirs decreased by 870,000 acre-feet during water year 1988.

Lower Basin Uses and Losses

During water year 1988, an estimated 5.1 MAF of water were released from Lake Havasu to meet the requirements for water deliveries at Imperial Dam as well as those of the Colorado River Indian Reservation near Parker, Arizona, the Palo Verde Irrigation District near Blythe, California, other miscellaneous users along the river, and transit losses between Parker Dam and Imperial Dam.

The major water diversions above Parker Dam were by MWD and the CAP. MWD pumped approximately 1.207 MAF from Lake Havasu during water year 1988 and approximately 490,000 acre-feet were pumped for the CAP.

Releases of approximately 6.8 MAF were made from Lake Mohave during water year 1988, to provide for releases to meet minimum downstream needs in the United States at Parker Dam; to supply diversion requirements of MWD and CAP, miscellaneous contractors, and other users; to offset evaporation and other transit losses between Davis and Parker dams; and to maintain the scheduled levels of Lake Havasu.

During water year 1988, releases of approximately 6.7 MAF were made from Lake Mead at Hoover Dam to regulate the levels of Lake Mohave, to provide for the small users from that reservoir, and to provide for releases at Davis Dam to meet needs in the United States. In addition, 199,000 acre-feet were diverted from Lake Mead for use by the Lake Mead National Recreation Area, Boulder City; Basic Management, Inc.; and contractors of the Colorado River Commission of Nevada. Total releases and diversions from Lake Mead during water year 1988 were an estimated 9.887 MAF.

For water year 1989, a total release of 6.2 MAF from Lake Havasu is projected, including consumptive use requirements in the United States below Parker Dam, transit losses and regulation in the river between Parker Dam and the Mexican Border, and treaty deliveries to Mexico.

During water year 1989, MWD is expected to divert 1,334,000 acre-feet by pumping from Lake Havasu. The CAP is expected to pump approximately 741,000 acre-feet. Consumptive uses by small users, river losses or gains, and reservoir losses between Davis Dam and Parker Dam are projected to be a net loss of 46,000 acre-feet.

There are no major users between Hoover Dam and Davis Dam. During water year 1989 the net diversions from Lake Mead are projected at 191,000 acre-feet. Evaporation from Lake Mead is projected to be about 940,000 acre-feet and net gain between Glen Canyon Dam and Lake Mead is expected to be about 950,000 acre-feet.

Water Use by States

(Provisonal)*

1981-1985

(1,000 acre-feet)

State	1981	1982	1983	1984	1985	Average 1981-85
Arizona	6,896	5,609	4,533	5,508	5398	5,589
Californa	4,836	4,346	3,950	4,676	4,707	4,503
Colorado	2,235	2,227	2,043	1,973	2,113	2,118
Nevada	212	212	195	206	209	207
New Mexico	345	477	477	444	440	437
Utah	836	795	762	810	933	827
Wyoming	327	316	331	289	320	317
Other	1,548	1,483	1,716	1,657	1,713	1,623
Total Colorado River Basin	17,235	15,465	14,007	15,563	15,833	15,621
Water Passing to Mexico						
Treaty	1,751	1,495	1,646	1,694	1,671	1,651
Minute 242	131	146	166	138	131	142
Excess Releases	2,115	176	7,970	15,160	11,594	7,403
Total Water Passing to Mexico	3,997	1,817	9,782	16,992	13,396	9,196
Total - Colorado River System and Water Passing to Mexico	21,232	17,282	23,789	32,555	29,229	24,817

NOTE:

Onsite consumptive uses and losses; includes water uses satisfied by groundwater overdrafts. "Other" water uses represents mainstem reservoir evaporation in the Upper Basin and mainstem reservoir evaporation below Lee Ferry in the Lower Basin.

* Source - Draft Report "Colorado River System Consumptive Uses and Losses Report, 1981-1985"

Power Operations and Major Maintenance Activities

Upper Basin - Colorado River Storage Project

During water year 1988 work was started to uprate the generators at Blue Mesa Powerplant. Siemans-Allis Corporation began contract work on unit 1 early in the fall of 1987. Uprating is scheduled for completion by January 1989 for both units 1 and 2.

The following table summarizes CRSP generation, purchases, disposition, and revenues from power operations for fiscal year 1988, and present projections for fiscal year 1989. A breakdown by percent of power sources, disposition, and revenues for the fiscal year is shown on the opposite page. The total revenue from power operations in fiscal year 1988 was $88,423,442.

CRSP Power Generation

Water Year 1988

Sources of Energy	**Kilowatt-hours**
Net Generation	
Blue Mesa	214,466,090
Crystal	194,284,644
Flaming Gorge	427,714,000
Fontenelle	-335,300
Glen Canyon	4,036,920,974
Morrow Point	322,290,696
Sub-total-Net Generation	5,195,341,104

Miscellaneous	**Kilowatt-hours**
Purchases	1,388,699,622
Interchange Receipts	1,164,000,000
Energy Charges to Transmission Service Customers	196,519,000
Sub-total-Miscellaneous	2,749,218,622
Total Energy From All Sources	7,944,559,726

Disposition of Energy	**Kilowatt-hours**
Firm Energy Sales	5,768,130,717
Nonfirm Energy Sales	965,021,684
Emergency Fuel Replacement (Oil Conservation)	-0-
Interchange Deliveries	636,000,000
System Losses	575,407,325
Total Energy Distributed	7,944,559,726

Revenue	**Dollars**
Firm Power Sales	$64,808,599
Non Firm Power Sales	18,501,091
Emergency Fuel Replacement (Oil Conservation)	-0-
Reserve Capacity	-0-
Parker-Davis Project Firming	-0-
Transmission Service	3,144,962
Rental of Substation Facilities	-0-
Miscellaneous Revenue	1,968,790
Total Gross Revenue	$ 88,423,442

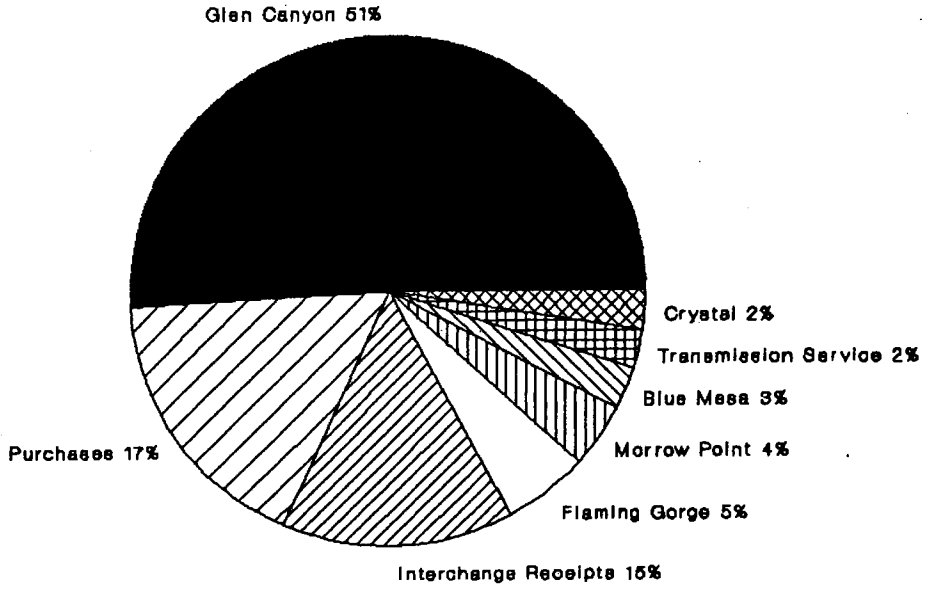
Water Year 1989

(Projected)	**Kilowatt-hours**
Estimated Firm Energy Sales	6,200,000,000
Estimated Nonfirm Sales	1,840,000,000
Estimated Purchases	1,550,000,000
Estimated Peaking Capacity Sales (Per Month)	
Winter 1988-89	100,000
Summer 1989	40,000
Estimated Revenue	$ 104,000,000

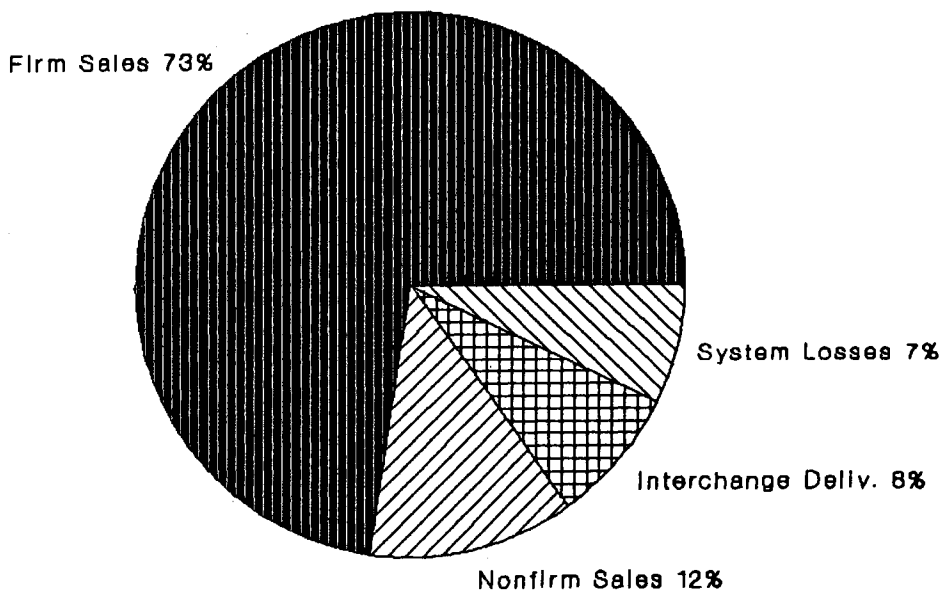
Colorado River Storage Project Power Operations

(Water Year 1988)

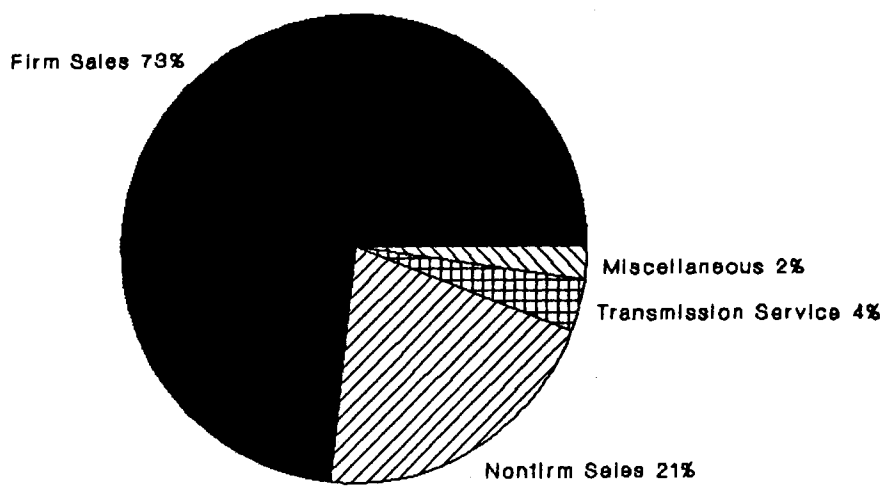
Energy Sources



Energy Disposition



Revenue



Power Operations [Cont.]
Lower Basin

Water Year 1988

On June 1, 1987, the United States assumed operation and maintenance responsibility of Hoover Powerplant and associated switching stations, after the 50-year contract with operating agents (The City of Los Angeles and its Department of Water and Power, and Southern California Edision Company, Ltd.) expired.

The "General Regulations for Generation and Sale of Power in Accordance with the Boulder Canyon Project Adjustment Act," promulgated on May 20, 1941, provided the basis for computation of charges for electrical energy generated at Hoover Dam through May 31, 1987. The Department of Energy Organizational Act of 1977 transferred the responsibility for the power marketing and transmission functions of the Boulder Canyon Project from the Bureau of Reclamation (Reclamation) to the Western Area Power Administration (Western). The power marketing functions of Western include the responsibility for promulgating charges for the sale of power. The construction, power generation, operation, maintenance, and replacement responsibilities associated with the Hoover Powerplant and appurtenant works remained with Reclamation. Marketing Parker-Davis power and operating the transmission system are the responsibility of Western. Reclamation continues to operate and maintain the dams and their powerplants, a function of the Lower Colorado Dams Project Office.

Davis and Parker powerplants continue to be operated by remote control from Western's Supervisory Control and Data Acquisition (SCADA) computer system located at their Phoenix District Office. The SCADA system monitors and remotely controls the generating units to adhere to water schedules provided by Reclamation's water scheduling branch located at the Lower Colorado Dams Project, Hoover Dam.

Along with normal scheduled electrical and hydroelectrical maintenance, the uprating of Hoover units A5, A7, N1, N3, N4, and N7 from 100 megawatts (MW) to 130 MW, including the replacement of the associated power transformers and main bus work, was installed and placed in operation to bring the total installed capability as of January 1, 1989, to 1,619 MW. Scheduled maintenance at Hoover Dam for water year 1988 included normal replacements of stators, rotator components, piping, and transformers with associated bus work.

The total gross energy generated at the Hoover Powerplant during water year 1988 was 4,661,316,000 kilowatt-hours.

The Parker Powerplant generated gross energy of 531,267,428 kilowatt-hours during water year 1988. Davis Powerplant generated gross energy of 1,160,280,000 kilowatt-hours during water year 1988.

Water Year 1989

In operation studies of Lake Mead and Lake Powell for the Hoover operating year, which ends September 30, 1989, the amounts released at Hoover Dam have been projected to satisfy both downstream water requirements, including diversions by MWD and CAP, while also complying with the overall requirements to meet Compact, flood control, and operating criteria release provisions. The water scheduled to be released will generate Schedules A and B energy and in some months excess energy. The estimated monthly Hoover releases during Water Year 1989 total 8.2 MAF. It is estimated that generation from these Hoover releases, along with the Hoover to Parker-Davis interchange, will result in delivery to the approved contractors of about 4.0 billion kWh of electrical energy.

A $7,637,385 Reclamation contract was awarded for uprating generators N-3 and N-4 at Hoover Dam in Nevada to General Electric Company of Denver, Colorado. Work began in 1987 and was completed in 1988.

Principal work under the contract included conducting a study of the existing generator design, furnishing and installing necessary new components, and modifying the two generators, as required to accomplish the proposed uprating. The objective was to uprate the generators by the optimum amount, based on water availability and economic feasibility. Studies show that sufficient water, head, and turbine capacity are available to produce significantly more generator output than the existing generator ratings will allow. The original generators were manufactured and installed by Westinghouse. Generator N-3 was installed in 1937 and generator N-4 in 1936.

An additional $10,620,722 contract has been awarded, also to the General Electric Company of Denver, Colorado, to uprate generating units A1, A2, A6, and A7 at Hoover Dam in Arizona. After starting work on those units, the contractor will have 2 years to complete the job. Upon completion of this contract, eight of the 17 generating units in the powerplant will have been uprated. Work on A7 was completed in October, 1988 and A6 is scheduled to be completed in February, 1989.

The Hoover Uprating Program was authorized by the Hoover Powerplant Act of 1984 (Act), which finalized a historic three-State agreement on the marketing of Hoover power after the original contracts terminated on May 31, 1987. The Act also requires that the Hoover Uprating Program be undertaken with funds advanced by the non-Federal purchasers of Hoover power.

Scheduled for completion in 1992, the Hoover Uprating Program will be funded with an estimated $126 million from non-Federal sources in Arizona, California, and Nevada. Arizona and Nevada will each fund about 37 percent of the costs, with the remainder being financed by nine municipalities in southern California.

The Hoover Uprating Program will result in a generation increase to an anticipated output exceeding 2,000 megawatts.