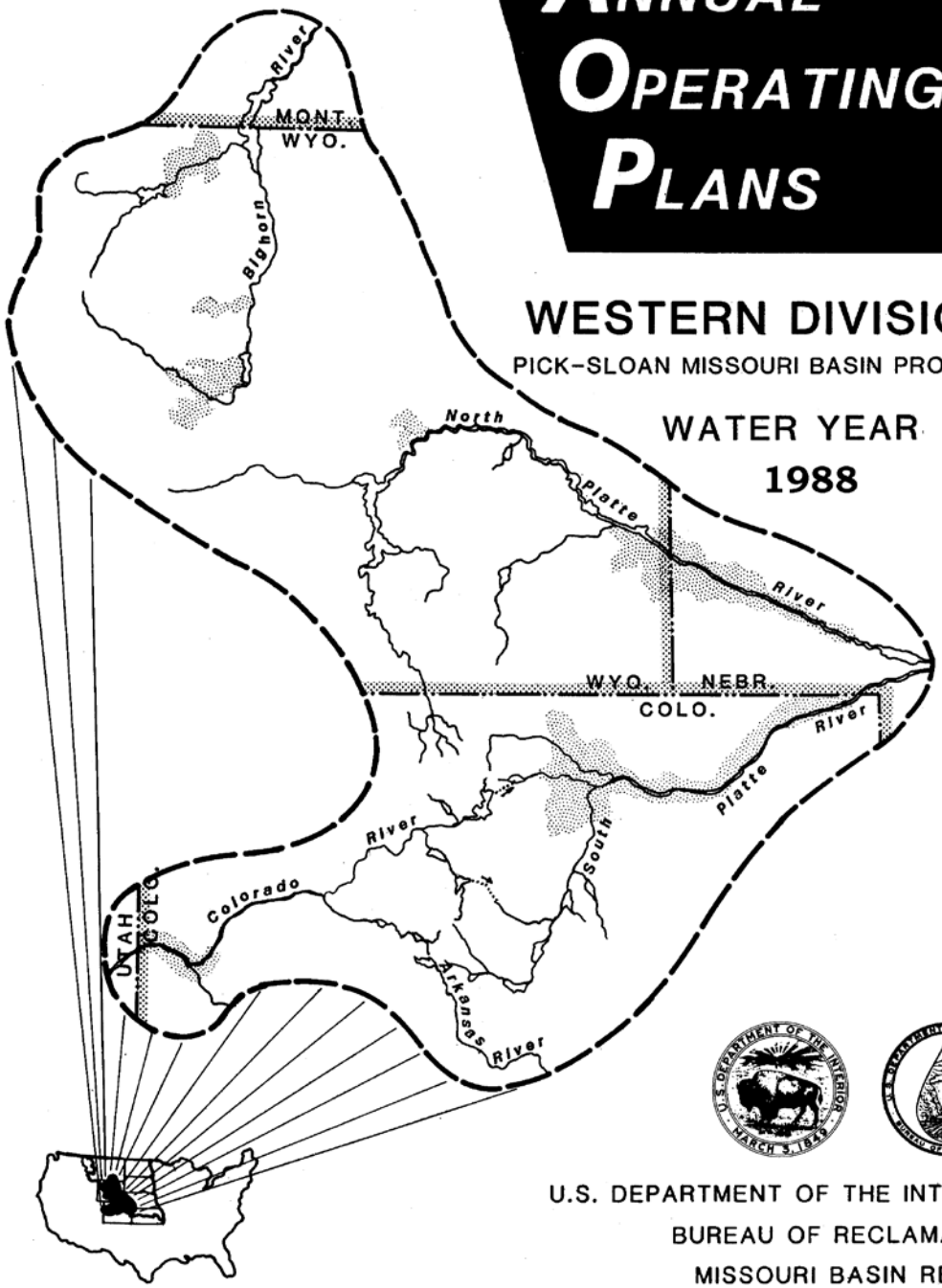
ANNUAL OPERATING PLANS



WESTERN DIVISION

PICK-SLOAN MISSOURI BASIN PROGRAM

WATER YEAR

1988

U.S. DEPARTMENT OF THE INTERIOR

BUREAU OF RECLAMATION

MISSOURI BASIN REGION

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HIGHLIGHTS OF l988 OPERATIONS

Water year 1988 runoff was below average throughout the Western Division System (System) varying from 64 percent of average for the river gain between Alcova and Glendo Reservoirs to 96 percent of average into Lake Granby. The North Platte Project has experienced two consecutive dry years now.

Peak inflows to reservoirs within the System occurred in late May and early June and were near normal. On May 19, inflow to Willow Creek Reservoir peaked at 820 cubic feet per second (cfs). The inflow to Seminoe Reservoir peaked on May 20 at 7,420 cfs. Lake Granby and Lake Estes inflows peaked on June 5 at 2,785 cfs and 725 cfs, respectively. The inflow to Green Mountain peaked on June 11 at 2,600 cfs.

River re1eases from Wi11ow Creek Reservoir and Lake Granby were made to meet only minimum required releases for fish habitat. The maximum release at Lake Estes for the water year was 638 cfs on June 23 to bypass inflow. Project deliveries peaked on August 1 at 636 cfs at Horsetooth Reservoir and 483 cfs at Carter Lake on August 5. The maximum release at Green Mountain Reservoir was 1,206 cfs on July 2.

Seminoe-Kortes releases were made only to meet power production as a spill condition did not occur. The maximum turbine release was 2,270 cfs on January 30. Irrigation demands were high from July through early September on the North Platte Project. This resulted in peak discharges of 3,670 cfs September 3 at Pathfinder Reservoir, 7,680 cfs July 26 at Glendo Reservoir, and 5,480 cfs on July 6 Guernsey Reservoir.

Water year precipitation totals for October-September varied from 60 percent of average on the Glendo watershed in Wyoming to 95 percent of average on the Willow Creek and Lake Granby watersheds in Colorado.

Significant rainfall occurred in the Seminoe Reservoir area on October 4 with 0.57 inches of precipitation recorded at Seminoe and 0.69 inches of precipitation recorded at Walden, Colorado. The first major snowstorm on the North Platte Project area was on November 15 in the Seminoe watershed with 0.73 inches of precipitation being recorded. The Glendo and Seminoe Reservoir areas received significant snowfall on December 23, as 0.53 inches and 0.70 inches of precipitation were recorded respectively. On December 27, the Guernsey Reservoir watershed recorded 0.57 inches of precipitation due to snow. March 10 through March 11 was a snowy period as the precipitation due to snowfall was 1.04 inches for the Seminoe Reservoir area, 0.35 inches for the Pathfinder Reservoir area, 0.47 inches for the Glendo Reservoir area and 0.85 inches for the Guernsey Reservoir area. Precipitation on the North Platte Project area was much below average in April. The Guernsey station recorded 0.24 inches for the month, the lowest of record. The Glendo station recorded the second lowest in 31 years, at 0.36 inches of precipitation.

Winter precipitation (October-January) was above average on the Colorado-Big Thompson (CBT) Project. The Lake Granby and Wi11ow Creek watersheds received the first significant snowfall of the water year on October 25 with 0.44 inches of precipitation being recorded. On November 14, the Green Mountain Dam station recorded 0.30 inches of precipitation due to snowfall. Heavy

snow occurred at Estes Park on November 15 and 1.12 inches of precipitation was recorded. A major snowstorm from December 22 through December 23 hit the project area with precipitation recorded at Lake Granby and Willow Creek 1.13 inches, Green Mountain 0.57 inches, and Estes Park 0.45 inches. Significant snowfall was also recorded on the west slope of the CBT Project in late December and early January. February and March were snowy months on the Lake Granby and Willow Creek watersheds with 122 percent and 138 percent of normal recorded each month, respectively. The Green Mountain watershed was below average for February through April, averaging 70 percent of normal precipitation. A total of only 0. 43 inches of precipitation was recorded for the Lake Estes watershed in April which was 24 percent of normal. The Allenspark station within the Lake Estes watershed recorded the third lowest April in 44 years.

The maximum snow-water accumulations for all watersheds on the System occurred on April 1. On the CBT Project, Green Mountain recorded 14.3 inches, Willow Creek 10.6 inches, Granby 13.7 inches, and Lake Estes 12.0 inches. Percent of normal ranged from 97 percent at the Green Mountain watershed to 113 percent at the Lake Estes watershed. The upper watersheds of the North Platte Project, Seminoe and Pathfinder, recorded 19.8 inches and 11.3 inches of snowpack water content on Apri1 1. This was 101 percent of average for the Seminoe watershed and 80 percent of average for the Pathfinder watershed.

Snow courses for watersheds within the System averaged 93 percent of normal snowpack water content on May 1. The Willow Creek and Lake Estes watersheds recorded snow-water accumulations on June 1 of 50 percent of normal and 52 percent of normal, respectively. The June 1 snow-water content for the Green Mountain watershed was 76 percent of normal and 87 percent of normal for the Seminoe watershed.

Significant rainfall occurred in early spring for most watersheds within the System. On May 19, the North Platte area received significant rainfall for a few days. Glendo Reservoir recorded 1.24 inches, Guernsey Reservoir 1.85 inches, and Seminoe Reservoir 0.59 inches. June and July were very dry months on the North Platte Project area. Precipitation recorded at Pathfinder Reservoir was only 9 percent of average in June. The only significant rainfall during June was 0.84 inches of precipitation recorded at the Guernsey station on June 12. Pathfinder Reservoir watershed remained dry in July as only 34 percent of average precipitation was recorded. On July 19, the Glendo Reservoir station recorded 0.65 inches of rainfall and 1.20 inches of precipitation was recorded at the Guernsey Reservoir station. The dry conditions continued in August and early September. A four day rainstorm from September 11 to September 14 eased the dry conditions. The precipitation recorded during this period for the Seminoe Reservoir station was 1.89 inches and 1.76 inches for the Pathfinder station. Another significant rainstorm occurred from September 28 to September 29 with 0.65 inches of precipitation recorded at the Glendo station and 0.56 inches of precipitation at the Guernsey station.

A major rainstorm occurred in the CBT Project area on May 19. Green Mountain Reservoir recorded 0.93 inches, Willow Creek and Lake Granby 1.15 inches, and Lake Estes 1.03 inches. Precipitation was varied over the Project area in June, with Willow Creek and Lake Granby 111 percent of average, Green Mountain 78 percent of average, and Lake Estes 68 percent of average. July through September precipitation was below normal on all watersheds. The Green Mountain watershed recorded 3.01 inches of precipitation during this period, which was only

54 percent of average. A total of only 3.63 inches of precipitation was recorded on the Willow Creek and Lake Granby watersheds from July through September and this was 69 percent of average. Precipitation in the Lake Estes area was below average for the three months, with August being the lowest at only 29 percent of average.

Temperatures were much above normal from June through early September at various stations throughout the System. Denver recorded the fifth hottest summer on record with an average temperature of 73. 20 degrees Fahrenheit for June through August.

For water year 1988, the minimum recorded temperatures were negative 12 degrees Fahrenheit at Casper, Wyoming, on December 23, negative 31 degrees Fahrenheit at Walden, Colorado, on January 20 (utilized for the Seminoe Reservoir watershed), negative 31 degrees Fahrenheit at Green Mountain Reservoir on January 20, and negative 27 degrees Fahrenheit at Lake Granby on January 2. Overall, winter temperatures were below normal for the water year.

Very warm summer temperatures were recorded over the entire System, with temperatures peaking from June through August. The maximum temperatures were 88 degrees Fahrenheit on June 19 at Walden, Colorado, 102 degrees Fahrenheit on June 24 at Casper, Wyoming, and 88 degrees Fahrenheit on June 13 and August 14 at Green Mountain Reservoir. The maximum temperature at Lake Granby occurred on August 15 and was 82 degrees Fahrenheit.

North Platte Guernsey and Glendo storage water ownerships were filled on April 20. The North Platte Pathfinder storage water ownership fi11ed on June 4. Maximum storage water ownership for the Kendrick Project was 1,188,654 acre-feet on June 21, which was 13,024 acre-feet below maximum ownership storage.

Alva B. Adams Tunnel (Adams Tunnel) diversions totaled 236,300 acre-feet (105 percent of average) for the water year.

Seasonal water deliveries (November 1987-September 1988) were 113 percent of average for the CBT Project. The North Platte System seasonal water deliveries (May 1988-September 1988) were the Kendrick Project at 132 percent of average, the North Platte Project at 106 percent of average, and the Glendo Unit at 361 percent of average.

System generation for the water year was below average at 91 percent of average.

DESCRIPTION OF THE WESTERN DIVISION SYSTEM

The System consists of a number of individual water resource projects that were planned and constructed by the Bureau of Reclamation (Reclamation). The individual projects were combined into an integrated system to achieve efficient operations and to produce increased multipurpose benefits. The System is located in northern Colorado, across much of Wyoming, and in western Nebraska as shown on the cover and exhibit 15. It encompasses part of the Upper Colorado and Missouri Basin Regions of Reclamation.

The major storage reservoirs are located at high elevations in the Rocky Mountains. In most areas of the system, 70 to 80 percent of the annual streamflow occurs from snowmelt runoff during the April-July period. The primary water use is irrigation, and the period of demand normally extends from May through September. The System furnishes irrigation water to over 1,200,000 acres of land in Colorado, Wyoming, and Nebraska.

The System includes the CBT Project in Colorado; the Kendrick, Riverton, and Shoshone Projects in Wyoming; the North Platte Project in Wyoming and Nebraska; and the Kortes, Glendo, and Boysen Units of the Pick-Sloan Missouri Basin Program in Wyoming. The four major rivers in the System are the South Platte and Colorado Rivers in Colorado; the North Platte River in Colorado, Wyoming, and Nebraska; and the Bighorn River in Wyoming.

The System has 20 reservoirs, 14 powerp1ants, and 3 pumping plants (tables 7 and 8). One-half of the installed capacity and power output of the Yellowtail Powerplant in Montana is also allocated to the System. The Department of Energy, by Executive order dated October 1, 1977, assumed the responsibility of marketing power from federal resources and operation and maintenance of federal transmission facilities.

The Western Area Power Administration (Western) of the Department of Energy, headquartered in Golden, Colorado, now operates and maintains the 3,500 miles of interconnected electrical transmission lines within the System. The power system is also interconnected with other federal, public, and private power systems. Bulk power from the System is marketed to about 40 preferred customers and results in annual revenues of about $10 million.

In addition to the power and energy available from the System, power and energy from the Colorado River Storage Project is also available to most of the customers, except those in Nebraska. Demand for power and energy in the area is exceeding the power and energy available from the System and the Colorado River Storage Project. Other projects are supplying this demand from non-federal thermal powerplants.

SYSTEM PLANNING AND CONTROL

The System is operated for municipal and industrial water supply, irrigation, hydroelectric power production, flood control, recreation, fish and wildlife preservation, and other purposes. Each project of the System must be operated under the purposes for which it was authorized and constructed. The objective of an integrated system is to obtain optimum benefits from the individual projects.

The System's integrated operation is planned and coordinated by Reclamation's Water and Power Control Division of the Eastern Colorado Projects Office in Loveland, Colorado. This office collects and analyzes information daily and makes the decisions necessary for successful operation of the System. This continuous water management function involves coordination between the Upper Colorado and Missouri Basin Regions of Reclamation, the Department of Energy, and many other local, state, and federal agencies. When reservoir levels rise into the exclusive flood control pools at Glendo or Boysen Reservoir, the flood control operation is directed by the Corps of Engineers, Omaha District, Omaha, Nebraska.

Experience has proven that proper utilization of the available water resource in a multi-purpose system such as this can be achieved only through careful budgeting of the anticipated water supply. The technical end product of this budgeting process is an Annual Operating Plan (AOP).

The System is operated on a water year basis (October 1 through September 30). The AOP is prepared in October or November of each year, following the plan's review and necessary public meetings.

AOPs are prepared for reasonable maximum and reasonable minimum conditions of water supply and requirements as well as for the most probable runoff conditions. The System is operated to optimize the most probable water supply without jeopardizing operational position should either reasonable maximum or reasonable minimum water supply conditions occur. When necessary, the plan is reviewed and revised during the year as new information or changing conditions occur.

Flexibility is a keynote of the plan. Computer programs are used by Reclamation to develop plans of operation and water supply forecasts.

Seminoe Reservoir

Seminoe Dam and Reservoir, on the North Platte River, is the main storage facility for the Kendrick Project. Construction of the dam was completed in 1939 and has a storage capacity of 1,017,300 acre-feet. The powerplant contains three units with a total installed capjcity of 45 megawatts and total release capability of about 4,000 cfs. The spillway consists of a concrete-lined tunnel through the right abutment controlled by three fixed-wheel gates with a release capability of close to 48,000 cfs.

Reservoir storage at the beginning of water year 1988 totaled 660,140 acre-feet, which was below normal by 118,060 acre-feet. Transfer of water downstream continued during the winter to generate power and to provide space for storage of spring runoff. Turbine releases were shaped to meet power loads increasing from an average of 860 cfs in October to 1,505 cfs in January. January inflow was 73 percent of average, as winter (October-January) inflow, to Seminoe remained below normal at 74 percent of average. Reservoir storage was near the most probable plan by the end of January, standing at 472,885 acre-feet.

Winter (October-January) precipitation was above average on the Seminoe watershed at 122 percent of average. However, snowpack content within the Seminoe watershed was 85 percent of average on February 1 which resulted in a below-average April through July water supply forecast of 810,000 acre-feet.

The snow-water accumulation dropped slightly to 92 percent of average within the Seminoe watershed during February. This was due to below normal precipitation of 66 percent of average for the month, which decreased the April-July water supply forecast to 795,000 acre-feet. Turbine releases were decreased to 1,280 cfs for the month.

March was a wet month, as precipitation in the Seminoe watershed was recorded at 128 percent of average. The April 1 snow-water content increased to 101 percent of average and the April-July runoff forecast increased to 895,000 acre-feet.

Conditions were extremely dry in April as precipitation was recorded at only 28 percent of average. Snow-water content within the Seminoe watershed was 88 percent of average on May 1, which resulted in a decreased April-July runoff forecast of 875,000 acre-feet (101 percent of average).

Turbine releases averaged 1,230 cfs for the month of March, and reduced to 1,020 cfs in April. Reservoir inflows rapidly increased in April to 4,300 cfs by April 17, and monthly inflow was 156 percent of average.

Turbine releases averaged 1,175 cfs during May. Reservoir inflows increased during mid-May and peaked at 7,420 cfs on May 20. Inflows then declined to average 4,800 cfs by the end of the month. The May inflow was 95 percent of average.

Precipitation continued to be below normal in June, at 85 percent of average. Reservoir inflows were below normal for June and July at 78 percent and only 38 percent of average, respectively. Reservoir storage reached a maximum content for the year of 876,760 acre-feet at elevation 6349.67 feet on July 3. Turbine releases averaged 1,100 cfs in June and most of July to meet power demands. In late July, turbine releases were reduced to 750 cfs.

Total April-July inflow volume from the Seminoe watershed was equal to 739,200 acre-feet, 86 percent of average. This was about 123,900 acre-feet lower than the 20-year average of 863,100 acre-feet.

July and August were very dry, as precipitation was recorded at only 54 percent of average and 32 percent of average, respectively. Turbine releases were adjusted to meet power loads during August and September, and averaged only 800 cfs. Inflows to Seminoe Reservoir continued to be low in August and September at 45 percent and 53 percent of average, respectively. Inflows averaged only 205 cfs in September. Precipitation increased to 137 percent of average in September.

Gross generation for the Seminoe Powerplant totaled 108,900,000 kilo-watt for the water year. This was 71 percent of average.

The end-of-water-year storage of 773,300 acre-feet was 4,900 acre-feet below average and 113,200 acre-feet more than last year.

Kortez Reservoir

Completed in 1951, Kartes Dam, Reservoir, and Powerplant of the Kortes Unit (a Pick-Sloan Missouri Basin Project) are located about 2 miles below Seminoe Dam. This 4,700 acre-foot reservoir serves as forebay for Kortes Powerplant which has three units with a total installed capacity of 36 megawatts and a release capability of 2,910 cfs.

The spillway on the right abutment consists of an uncontrolled crest with a concrete-lined tunnel and has a capacity of 50,000 cfs. A total of only 797 acre-feet was bypassed through the spillway during a few days in February, March, and April.

Gross generation for the water year totaled 122,200,000 kilowatt hours, 74 percent of average.

Pathfinder Reservoir

Pathfinder Dam and Reservoir, a major storage facility of the North Platte Project, has a total capacity of 1,016,507 acre-feet. Construction of the dam was completed in 1909. Operationally, this structure is a bottleneck in the system with its restricted release capability of only 5,000 cfs. The two jet flow valves can release 2,800 cfs, while Fremont Canyon turbine can normally release 2,200 cfs. The uncontrolled spillway is a fault-crested weir of natural rock over the left abutment of the dam. It has an estimated capacity of 65,000 cfs at water surface elevation 5858.10 feet or 8 feet above the spillway crest. Fremont Canyon Powerplant, 1ocated in the canyon below Pathfinder Dam, has a total installed capacity of 48 megawatts.

Upon entering water year 1988, storage in Pathfinder Reservoir was 220,170 acre-feet above normal at 721,870 acre-feet.

The October-January Kartes to Pathfinder river gains were much below normal with a loss of 9,000 acre-feet recorded. Winter transfer of water to Glendo Reservoir for power generation averaged 775 cfs from October through January. This was be1ow norma1 due to the high carryover storage in Glendo Reservoir.

The February 1 snow-water accumulation was recorded at 79 percent of average for the Pathfinder watershed, resulting in an April-July runoff forecast of 58,000 acre-feet for the Sweetwater River above Pathfinder Reservoir. Precipitation within the Pathfinder watershed continued below normal at 80 percent of average during February. The Kortes to Pathfinder river gains were high at 189 percent of average in February.

The April 1 snowpack water content continued below normal at 80 percent of average, but the Pathfinder watershed precipitation was high at 143 percent of average for March. The most probable April-July runoff forecast volume for the Sweetwater River above Pathfinder Reservoir was increased to 65,000 acre-feet, 86 percent of average.

The Sweetwater River inflows above Pathfinder Reservoir continued high at 153 percent of average, for the month of March. Due to the high storage position of Glendo Reservoir and above normal Alcova-Glendo river gains, the Fremont Canyon turbine releases were reduced to500 cfs by midmonth. Precipitation decreased sharply to 54 percent of average for April. River gains between Kortes and Pathfinder were 84 percent of average during April. The May 1 snow-water accumulation dropped to 70 percent of average and the April-July runoff forecast remained at 65,000 acre-feet. Turbine releases in April and May at Fremont Canyon Powerplant were adjusted to maintain Glendo Reservoir storage below the flood pool. Precipitation in the Pathfinder watershed continued below normal at 56 percent of average in May. The Kortes-Pathfinder River gains dropped sharply to only 34 percent of average for the month.

Pathfinder Reservoir storage reached a maximum content for the water year of 927,422 acre-feet at elevation 5845. 93 feet on June 3. As irrigation demands developed below, Guernsey Reservoir and Glendo Reservoir storage declined, turbine releases at Fremont Canyon Powerplant were increased to evacuate storage. A bypass release at Fremont Canyon was initiated on June 6. By the end of June, turbine re1eases were at capacity at 1,000 cfs, and bypass releases averaged 1,400 cfs. Fremont Canyon Unit 1 continued to be shutdown to upgrade the units. This maintenance would continue through the end of the water year. Precipitation for June was extremely low at 9 percent of average.

The Sweetwater River inflows continued to be very low at 27 percent of average for the month of June. Irrigation demands in the lower river basin continued to increase and the bypass releases were further increased to 2,400 cfs by mid-July, while turbine releases remained at capacity of 1,000 cfs. Fremont Canyon Powerplant releases remained at capacity of one unit until August 20.

July and August contined to be very dry, as precipitation was recorded at 34 percent and 63 percent of average, respectively. River gains from Kortes to Pathfinder continued to be below normal at 43 percent of average for July. Bypass releases peaked at 2,600 cfs by the end of August. The total amount of bypass release at Fremont Canyon Powerplant was 140,830 acre-feet in July and 140,950 acre-feet in August.

Due to crops maturing early as a result of above normal temperatures, irrigation water deliveries below Guernsey decreased in September. Therefore, the Fremont Canyon Powerp1ant releases were decreased to an average of 900 cfs by the end of the month. The bypass re1ease was shut down on August 20. Precipitation was above normal in September at 186 percent of average.

A tota1 of 406,518 acre-feet bypassed the turbines during the 1988 water year. Generation totaled 189,400,000 kilowatt hours which was only 69 percent of average.
The Pathfinder watershed runoff (river gains below Kortes Dam) during the April-July period was only 49 percent of average for a total of 56,610 acre-feet. This was 8,390 acre-feet less than the May 1 forecast of 65,000 acre-feet.

The reservoir ended the water year with 494,240 acre-feet in storage. This was the low storage for the year and 15,460 acre-feet below average.

Alcova and Gray Reef Reservoirs

Alcova Reservoir is part of the Kendrick Project, serving as a diversion dam for the Casper Canal and a forebay for the Alcova Powerplant. The dam, located about 10 miles below Pathfinder Dam, was completed in 1938. The reservoir has a total storage capacity of about 184,400 acre-feet, of which only the top 30,600 acre-feet is active capacity available for irrigation. The powerplant consists of two units with a total installed capacity of 36 megawatts. The reservoir is operated within a 2 foot range during summer and winter but at levels 10 feet apart. A higher operating level is maintained during the summer months to provide adequate head on the Casper Canal and accommodate recreation use, while the lower winter operating level reduces potential damage to canal gates and boat docks during the winter.

The annual drawdown of Alcova Reservoir began October 5. The normal winter operating level is 5488.00 feet plus or minus 1 foot. The reservoir water surface elevation had dropped to this level by October 28, with the elevation recorded at 5488.58 feet.

During early November, Alcova Reservoir was drafted to a new operating elevation range of 5484.5 to 5486.5 feet to accommodate maintenance on Casper Canal. The new operating range was maintained until December 8, when canal maintenance was completed.

The normal winter operating level of 5488.0 feet plus or minus 1 foot was reached again on December 30 and remained in this range until early April. As ice conditions permitted, the refill of Alcova Reservoir to the normal summer operating level was accomplished.

The normal summer operating water surface elevation of 5498.00 feet was reached on April 25. The reservoir remained within the plus or minus 1 foot summer operating range even during the Fremont Canyon bypass period.

Gray Reef release averaged near 905 cfs during most of October. By November 5, Gray Reef releases were reduced to 825 cfs. The planned winter release of 825 cfs was maintained until February 1, when the high storage position of Glendo Reservoir required a reduction in the release to 800 cfs. Turbine releases were further reduced to an average of 700 cfs by the end of the month.

Gray Reef turbine releases were again decreased in March due to the continued above norma1 storage 1evel of Glendo Reservoir. Re1eases averaged 565 cfs for March and ended the month at 500 cfs. The refill of Alcova Reservoir to the normal summer operating level was scheduled in April, which resulted in low average Gray Reef turbine releases of 450 cfs for the month. For a few days in early April, releases were at the minimum required release of 330 cfs for fishery purposes. In May, Gray Reef turbine releases were increased to 930 cfs as irrigation deliveries developed below Guernsey Reservoir and Glendo Reservoir storage was maintained below the flood pool level.

As irrigation demands continued below Guernsey Reservoir and Glendo Reservoir storage declined, Gray Reef releases were increased to 1,600 cfs by June 10. Releases for the remainder of the water year were adjusted to meet irrigation demands below Guernsey Reservoir. The maximum release of 3,210 cfs occurred on September 3. By the end of the water year, the Gray Reef turbine release was down to 900 cfs.

Kendrick Project irrigation deliveries from Alcova Reservoir via the Casper Canal, were 132 percent of average during the May-September period. Kendrick Project ownership peaked at a storage level of 1,188,650 acre-feet for the water year on June 21. This was 13,030 acre-feet below maximum ownership storage. Kendrick Project ownership ended the water year at 1,093,900 acre-feet, which was 161,700 acre-feet greater than the 20-year average.

Alcova Powerplant generated 119,400,000 kilowatt hours of energy during water year 1988. This was below average by 17,200,000 kilowatt hours.

Glendo Reservoir

Glendo Dam and Reservoir is the main regulation and storage facility for the Glendo Unit. The reservoir has a storage capacity of 789,400 acre-feet, including 271,900 acre-feet allocated to flood control. Glendo Powerplant consists of two units, with a total installed capacity of 24 megawatts. The uncontrolled spillway, located on the right abutment, has a crest elevation of 4653.00 feet and discharge capacity of about 10,000 cfs.

Reservoir storage of 108,286 acre-feet at the beginning of the water year was 30,990 acre-feet above average. January precipitation in the Glendo watershed was low at 47 percent of average. Winter inflows (October-January) were above normal at 107 percent of average. By the end of February, reservoir storage had increased to 419,790 acre-feet. Precipitation in February was high at 144 percent of average for the month.

Releases were initiated on March 14 in order to refi11 Guernsey Reservoir in preparation for summer operation. Inflow was above normal at 124 percent of average and Glendo Reservoir continued to increase in storage during March.

The river gains between Alcova and Glendo continued high during April at 158 percent of average. However, precipitation was only 22 percent of average for the month.

Releases were adjusted in April and May to meet project water deliveries and to minimize the amount of water stored in Glendo Reservoir. The reservoir reached maximum storage for the year of 490,020 acre-feet (elevation 4632.72 feet) on May 23. Glendo Reservoir remained at this storage level for three consecutive days, which was 2.28 feet below the flood pool. (The flood pool is from 517,485 acre-feet to 789,402 acre-feet.) The river gains between Alcova and Glendo Reservoirs rapidly decreased in May to only 64 percent of average.

Conditions continued to be dry in the Glendo watershed for June and July, as precipitation was 26 percent and 60 percent of average, respectively. River gains recorded a loss of 2,900 acre-feet for June and a loss of 13,100 acre-feet occurred in the Alcova to Glendo reach in July.

Precipitation was below normal again in August at 45 percent of average, and the Alcova to Glendo reach continued to record a loss, which equaled 10,100 acre-feet for the month. River gains sharply increased to 10,400 acre-feet for September, and this was above normal at 104 percent of average. Precipitation also increased and was 112 percent of average for the month. Glendo Reservoir releases during July through September were adjusted to meet project water delivery requirements below Guernsey Reservoir.

Reservoir storage reached a low of 78,430 acre-feet (water surface elevation 4574.59 feet) from September 11 through September15, and ended the water year at 89,675 acre-feet (water surface elevation 4577.66 feet).

Glendo Powerplant gross generation totaled 78,500,000 kilowatt hours for the year. This was 11,900,000 kilowatt hours below average. A total of 262,054 acre-feet of water bypassed the Glendo turbines during the year.

Guernsey Reservoir

The reservoir, located about 25 miles below Glendo, again stores and reregulates the flow of the river prior to delivery to project lands. Guernsey Powerplant located on the right abutment has two 2.4 megawatt units with a release capability of about 1,000 cfs. The original capacity of the reservoir was 73,800 acre-feet, but this has been greatly reduced by deposition of silt. Utilizing data from the 1980 Sedimentation Survey of Guernsey Reservoir, the March 1982 capacity tables show about 45,600 acre-feet of available storage.

Guernsey Reservoir storage of about 526 acre-feet at the beginning of water year 1988 was 13,875 acre-feet below normal. In early October, releases from Guernsey Reservoir were near 50 cfs to bypass inflow while the maintenance on the south spillway drum gates was being performed.

Guernsey Reservoir storage was drafted to only 4 acre-feet by October 7. The spillway gate maintenance was completed on October 13 and the releases from Guernsey Reservoir were shut off for the winter to store native inflow. Winter inflows (October-January Glendo-Guernsey river gains) were below normal at 85 percent of average. January precipitation in the Guernsey watershed was very low at only 33 percent of average. The Glendo-Guernsey River gains were average in February at 1,260 acre-feet and precipitation continued below normal at 77 percent of average.

Conditions were wet in the Glendo-Guernsey reach in March as the river gains were 482 percent of average. This was due to an above normal precipitation of 161 percent of average. By March 31, Guernsey Reservoir storage had steadily increased to 28,675 acre-feet, as a result of native inflow stored and releases from Glendo Reservoir that began on March 14.

Guernsey Reservoir releases were started on April 8 and gradually increased to 2,640 cfs by April 26. These releases were made to meet project water deliveries, to transfer water to Inland Lakes, and to accommodate the above normal inflow below Alcova Reservoir. Reservoir inflow was high again in April at 149 percent of average, but precipitation for the month was extremely low at 13 percent of average.

The Glendo-Guernsey river gains rapidly decreased to only 41 percent of average for May. As project water deliveries and inflows decreased during early May, releases were cut to 900 cfs. Irrigation demands increased by mid-May and releases were averaging 2,300 cfs by the end of the month. North Platte Project irrigation delivery totaled 133,380 acre-feet and the Glendo Unit delivery totaled 10,330 acre-feet for May. Deliveries were made totally from natural flow.

June was a dry month above Guernsey Reservoir, as precipitation was only 37 percent of average. The river reach between Glendo and Guernsey was much below normal with a loss of 7,440 acre-feet recorded. The North Platte Project irrigation delivery was 142,540 acre-feet for June and the Glendo Irrigation Project delivery totaled 10,100 acre-feet for the month. Deliveries were made from natural flow and reservoir storage. Releases from Guernsey Reservoir reached 5,130 cfs by June 30 which drafted the reservoir to 39,200 acre-feet.

The annual "silt run" from the reservoir was initiated on July 11 and continued for 14 days. Reservoir storage reached the minimum for the water year at 1,126 acre-feet on July 23. Following the "silt run, 11 the reservoir was refilled to 38,050 acre-feet by July 31 and remained near this content through mid-August.

Conditions remained dry between Glendo and Guernsey Reservoirs as losses of 1,745 acre-feet and 2,350 acre-feet were recorded for the river reach in July and August. Precipitation for the Guernsey watershed continued below normal at 60 percent of average during August. Irrigation releases from Guernsey Reservoir for July and August averaged 5,045 cfs and 4,830 cfs, respectively.

The Glendo-Guernsey gain rapidly increased in September to 3,910 acre-feet, and was probably due to return flows from irrigation. However, precipitation was below normal for the month at 76 percent of average. Due to late September precipitation and crops maturing earlier because of above normal temperatures, irrigation de1iveries be1ow Guernsey Reservoir were gradually decreased in September and total outflow was 1,050 cfs on September 30.

Reservoir storage was drafted to 13,830 acre-feet at the end of the irrigation season (September 30) in preparation for winter operation of storing native inflow.

The total water year release of about 1,092,320 acre-feet from Guernsey Reservoir included a near normal irrigation project delivery of 1,025,414 acre-feet, a transfer of 45,316 acre-feet to Inland Lakes north of Scottsbluff, Nebraska, a release of 20,790 acre-feet of annual operational water, and an excess river water release of 800 acre-feet. The project delivery to irrigation included 699,882 acre-feet of North Platte Project storage water, 21,913 acre-feet of Glendo Project storage 1ater, and 303,619 acre-feet of natural flow water.

The North Platte River System end-of-water-year storage totaled 1,550,200 acre-feet. This was 7,100 acre-feet below average.

Gross generation for the water year totaled 20,800,000 kilowatt hours which was 83 percent of average.

Flood Benefits

During the 1988 runoff, the System prevented $0.00 in flood damages as estimated by the Corps of Engineers, Omaha District (table 1).

Since construction, the System has prevented flood damages totaling $75,738,800.

TABLE 1

WESTERN DIVISION SYSTEM

FLOOD DAMAGE PREVENTED IN 1988[1/]

Dam	Accumulated total prior to 1988	1988	Accumulated total current
Seminoe	$ 9,837,000	$ 0	$ 9,837,000
Pathfinder	5,229,000	0	5,229,000
Alcova	193,000	0	193,000
Glendo	30,012,800	0	30,012,800
Guernsey	439,000	0	439,000
Boysen	26,636,000	0	26,636,000
Buffalo Bill	3,189,000	0	3,189,000
Granby	181,000	0	181,000
Green Mountain	22,000	0	22,000
Total	$75,738,800	$ 0	$75,738,800

1/ Corps of Engineer's data as revised October 1988.

PICK-SLOAN MISSOURI BASIN PROGRAM
WESTERN DIVISION WATER AND POWER SYSTEM
WATER SCHEDULING DIVISION
LOVELAND, COLORADO

PAGE 1 OF TABLE 2

1988 ACTUAL SYSTEM OPERATIONS

WATER IN 1000 ACRE FEET * * * * * * * * * * ENERGY IN G W H

	INI-SUM	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
SEMINOE RESERVOIR													
INFLOW	938.0	20.4	26.8	22.8	20.9	24.6	51.2	176.7	253.4	258.0	51.1	19.9	12.2
TURBINE RELEASE	775.0	52.3	61.1	65.4	92.6	73.7	75.5	60.8	72.1	63.9	64.0	49.0	44.6
BYPASS OR SPILL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
EVAPORATION SEMINOE	49.9	3.8	1.6	0.7	0.6	0.8	0.5	3.5	4.5	8.7	9.9	9.2	6.1
SEMINOE END OF MONTH CONTENT	660.1	624.4	588.5	545.2	472.9	423.0	398.2	510.6	687.4	872.8	850.0	811.8	773.3
KWH / AF		146.4	150.2	150.5	149.0	138.8	136.6	117.0	136.8	133.0	137.7	143.4	149.1
GENERATION GWH	108.9	7.7	9.2	9.8	13.8	10.2	10.3	7.1	9.9	8.5	8.8	7.0	6.6
KORTES RESERVOIR													
INFLOW	775.0	52.3	61.1	65.4	92.6	73.7	75.5	60.8	72.1	63.9	64.0	49.0	44.6
TURBINE RELEASE	773.8	52.2	61.0	65.5	92.5	73.4	75.4	60.4	72.2	63.8	63.9	49.0	44.5
BYPASS OR SPILL	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0
EVAPORATION AND SEEPAGE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
END OF MONTH CONTENT	4.5	4.5	4.6	4.5	4.6	4.7	4.7	4.6	4.5	4.6	4.6	4.6	4.6
KWH / AF		158.3	153.6	156.1	165.1	164.3	169.8	149.2	155.4	147.8	150.9	154.5	163.9
GENERATION GWH	122.2	8.3	9.4	10.2	15.3	12.1	12.8	9.0	11.2	9.4	9.6	7.6	7.3
PATHFINDER RESERVOIR													
GAIN KORTES TO PATHFINDER	86.0	0.3	-3.5	-6.5	0.6	3.8	14.5	25.3	15.0	9.1	7.2	13.9	6.3
TOTAL INFLOW	860.6	52.5	57.5	59.0	93.1	77.4	90.0	86.1	87.2	73.0	71.1	62.9	50.8
FREMONT CANYON TURBINE WATER	609.3	32.9	45.4	55.7	54.3	41.8	35.0	52.1	56.3	62.0	60.0	57.5	56.3
BYPASS OR SPILL	406.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	51.0	140.8	140.9	73.7
EVAPORATION AND SEEPAGE	72.5	4.9	2.1	1.0	0.9	1.4	0.9	6.7	8.5	16.0	13.8	10.6	5.7
END OF MONTH CONTENT	721.9	736.6	746.6	748.9	786.8	821.1	875.2	902.6	924.9	868.9	725.3	579.2	494.2
KWH / AF		297.8	330.6	343.8	313.1	301.2	273.8	289.2	304.2	307.5	327.4	317.3	304.2
GENERATION FREMONT CANYON	179.4	9.8	15.0	19.2	17.0	12.6	9.6	15.1	17.1	19.1	9.6	18.2	17.1

PICK-SLOAN MISSOURI BASIN PROGRAM
WESTERN DIVISION WATER AND POWER SYSTEM
WATER SCHEDULING DIVISION
LOVELAND, COLORADO

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1988 ACTUAL SYSTEM OPERATIONS

WATER IN 1000 ACRE FEET * * * * * * * * * * ENERGY IN G W H

	INI-SUM	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
ALCOVA RESERVOIR													
INFLOW	1016.0	32.9	45.4	55.7	54.3	41.8	35.0	52.1	56.3	113.0	200.9	198.5	130.1
RELEASE TO CASPER CANAL	85.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	9.1	24.5	25.1	19.3	7.3
TURBINE RELEASE	919.6	55.7	50.3	50.1	51.6	41.9	34.7	26.8	50.3	85.2	171.2	179.3	122.5
BYPASS OR SPILL	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.0	0.0
EVAPORATION AND SEEPAGE	9.0	0.7	0.2	0.2	0.1	0.2	0.1	0.8	1.0	1.7	1.3	1.6	1.1
END OF MONTH CONTENT	177.3	178.9	148.7	154.2	156.8	156.4	156.6	181.1	177.1	178.8	181.7	179.9	179.2
KWH / AF		131.8	136.8	141.2	128.1	128.4	117.1	115.6	128.2	127.7	130.1	126.5	135.3
GENERATION GWH	119.4	7.3	6.9	7.1	6.6	5.4	4.1	3.1	6.4	10.9	22.3	22.7	16.6
GLENDO RESERVOIR													
ALCOVA TO GLENDO GAIN	204.6	9.0	17.0	10.2	12.9	15.4	23.6	63.7	68.7	-2.9	-13.1	-10.3	10.4
TOTAL INFLOW	1116.7	72.3	68.6	57.2	63.1	57.1	59.2	87.5	121.1	79.5	152.3	158.4	140.4
TURBINE RELEASE	837.2	0.0	0.0	0.0	0.0	0.0	18.5	62.9	111.8	129.8	184.2	198.0	132.0
BYPASS OR SPILL	261.9	0.4	0.5	0.5	0.6	0.7	0.3	0.0	0.0	22.3	127.2	94.2	15.2
EVAPORATION AND SEEPAGE	36.1	1.3	0.6	0.9	0.5	0.7	2.0	3.8	6.0	8.6	6.5	3.6	1.6
END OF MONTH CONTENT	108.3	178.9	246.4	302.2	364.2	419.8	458.3	479.0	482.2	401.0	235.5	98.2	89.7
KWH / AF		0.0	0.0	0.0	0.0	0.0	81.7	94.2	109.4	109.1	110.0	81.4	63.0
GENERATION GWH	78.5	0.0	0.0	0.0	0.0	0.0	1.5	5.9	12.2	14.2	20.3	16.1	8.3
GUERNSEY RESERVOIR													
GLENDO TO GUERNSEY GAIN	15.2	2.3	1.9	1.5	1.4	1.3	1.5	6.6	6.2	-7.4	-1.7	-2.3	3.9
TOTAL INFLOW	1114.4	2.8	2.5	2.0	2.0	2.0	20.2	69.5	118.0	144.7	309.6	289.9	151.2
NORTH PLATTE REQUIREMENT	1089.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	133.4	142.5	313.8	309.1	190.3
NORTH PLATTE DELIVERY	1089.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	133.4	142.5	313.8	309.1	190.3
GLENDO IRRIGATION DELIVERY	85.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	9.1	24.5	25.1	19.3	7.3
TOTAL OUTFLOW	1092.4	1.3	0.4	0.2	0.2	0.3	0.5	56.7	113.9	145.4	310.1	296.8	166.6
TURBINE RELEASE	293.3	0.0	0.0	0.0	0.0	0.0	0.0	39.1	55.3	54.4	29.4	58.6	56.5
EVAPORATION	8.8	0.0	0.0	0.1	0.0	0.1	0.3	0.8	3.4	1.5	0.7	1.2	0.7
END OF MONTH CONTENT	0.5	2.0	4.0	5.8	7.6	9.2	28.7	40.7	41.4	39.2	38.1	29.9	13.8
KWH / AF		0.0	0.0	0.0	0.0	0.0	0.0	71.9	75.7	72.4	65.2	69.3	68.3
GENERATION GWH	20.8	0.0	0.0	0.0	0.0	0.0	0.0	2.8	4.2	3.9	1.9	4.1	3.9

TABLE 6 - SUMMARY OF NORTH PLATTE STORAGE OWNERSHIP FOR WATER YEAR 1988 (ACRE-FEET)

MONTHS	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	TOTAL
PATHFINDER OWNERSHIP														
ACCRUAL		27810	24167	12480	20417	26656	67233	197897	239705	25809	0	0	0	642174
EVAPORATION		2940	1169	737	538	554	992	4927	8236	14747	14598	10363	4786	64587
DELIVERY		0	0	0	0	0	0	0	0	0	264857	277596	113705	656158
OWNERSHIP	395307	420177	443175	454918	474797	500899	567140	760110	991579	1002641	723106	435227	316736	
KENDRICK OWNERSHIP														
ACCURAL		0	0	0	0	0	0	0	0	113384	0	0	0	113384
EVAPORATION		6083	2339	1399	1041	1003	1651	6770	7506	11754	12467	11849	8185	72047
DELIVERY		0	0	0	0	0	0	12	9061	6800	25130	19335	7289	67627
OWNERSHIP	1119914	1113831	1111492	1110093	1109052	1108049	1106398	1099616	1083049	1177879	1140282	1109098	1093624	
GLENDO OWNERSHIP														
ACCRUAL		0	0	0	0	0	20792	20527	0	0	0	0	0	41319
EVAPORATION		1875	728	561	511	283	1759	1969	2002	5994	4933	4345	2863	27823
DELIVERY		23	4	1	500	0	0	2	0	284	3841	7362	9896	21913
OWNERSHIP	150135	148237	147505	146943	145932	145649	164682	183238	181236	174958	166184	154477	141718	
PACIFIC POWER & LIGHT														
ACCRUAL		0	0	0	167	0	0	0	1258	33	4	17	93	1572
DELIVERY		259	155	303	0	270	261	134	0	0	0	0	0	1382
EVAPORATION		14	0	2	1	0	1	0	25	35	34	42	36	190
IN STORAGE	2000	1727	1572	1267	1433	1163	901	767	2000	1998	1968	1943	2000	

TABLE 6 - SUMMARY OF NORTH PLATTE STORAGE OWNERSHIP FOR WATER YEAR 1988 (ACRE-FEET)

MONTHS	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	TOTAL
GUERNSEY OWNERSHIP														
ACCRUAL		0	0	11648	14076	16366	3010	1096	0	0	0	0	0	46196
EVAPORATION		0	0	39	70	72	453	746	456	1432	0	0	0	3268
DELIVERY		0	0	0	0	0	0	0	0	43724	0	0	0	43724
OWNERSHIP	0	0	796	12405	26411	42705	45262	45612	45156	0	0	0	0	
INLAND LAKES OWNERSHIP														
ACCRUAL		9981	18456	0	0	0	0	17563	0	0	0	0	0	46000
EVAPORATION		58	83	77	53	34	145	234	0	0	0	0	0	684
OWNERSHIP	0	9923	28296	28219	28166	28132	27987	6853	0	0	0	0	0	
TRANSFER		0	0	0	0	0	0	38463	6853	0	0	0	0	45316
CITY OF CHEYENNE														
ACCRUAL		970	946	779	576	699	796	310	93	122	627	941	805	7664
EVAPORATION		36	12	5	0	1	7	73	63	8	0	3	14	222
OWNERSHIP	5545	6460	7313	7934	8457	9035	9754	9774	4241	19	522	1460	2251	
TRANSFER		19	81	153	53	120	70	217	5563	4336	124	0	0	10136
EXCESS WATER														
ACCRUAL		0	0	0	0	0	0	0	0	0	0	0	0	0
OWNERSHIP	804	796	0	0	0	0	0	0	0	0	0	0	0	
RELEASE		0	796	0	0	0	0	0	0	0	0	0	0	796

WESTERN DIVISION - PICK-SLOAN MISSOURI BASIN PROGRAM

RESERVOIR DATA

(Data in Acre-feet)

Reservoir	Dead storage[1]	Active storage[2]	Total storage	Normal minimum storage	Limitation on normal minimum storage
Green Mountain	6,860	146,779	153,639	47,684	Minimum elevation for rated power output
Willow Creek	1,486	9,067	10,553	6,675	Elevation of pump canal headworks
Lake Granby	74,190	465,568	539,758	74,190	Lowest outlet elevation
Shadow Mountain	506	16,848	17,354	16,026	Minimum permissible Grand Lake elevation 8366
Grand Lake	[3]	511	1,015	504	Legislation limits fluctuation
Marys Lake	42	885	927	308	Minimum elevation for power generation
Lake Estes	409	2,659	3,068	740	Minimum elevation to release 550 ft^3/s
Pinewood Lake	416	1,765	2,181	613	Minimum elevation for power generation
Flatiron	125	635	760	324	Minimum elevation to release 550 ft^3/s
Carter Lake	3,306	108,924	112,230	3,306	Lowest outlet elevation
Horsetooth	7,003	149,732	156,735	17,600	Elevation on highest delivery works
Seminoe	556	1,016,717	1,017,273	31,670	Minimum elevation for power generation
Kortes	151	4,588	4,739	1,666	Minimum elevation for power generation
Pathfinder	7	1,016,500	1,016,507	31,405	Minimum elevation for power generation
Alcova	91	184,314	184,405	153,802	Minimum elevation for power generation
Gray Reef	56	1,744	1,800	56	Lowest outlet elevation
Glendo	11,033	506,452	517,485[4]	63,148	Minimum elevation for power generation
Guernsey	0	45,612	45,612	0	Lowest outlet elevation
Boysen	59,875	742,129	802,004[5]	252,137	Minimum elevation for power generation
Buffalo Bill	4	423,970	423,974	90,790	Operating limitation for irrigation
Total	166,116	4,845,399	5,012,019	792,716	

[1] Storage capacity below elevation of lowest outlet
[2] Total storage minus dead storage
[3] Not determined
[4] An additional 271,917 acre-feet allocated to flood control
[5] An additional 150,428 acre-feet allocated to flood control

TABLE 7

Table 8

WESTERN DIVISION - PICK-SLOAN MISSOURI BASIN PROGRAM

POWERPLANT DATA

Powerplant	Number of units	Capacity each Unit (kW)	Total installed Capacity (kW)	Normal operating Head (ft)	Output at rated Head (ft^3/s)	20-Year Average[1] (KWh/Acre-ft)	Generation GWh 20-year average[1]	Generation GWh Water year (1987)
Green Mountain	2	12,900	25,800	192-262	1,660	189.8	59.8	53.6
Marys Lake	1	8,100	8,100	202-217	550	173.3	38.6	44.0
Estes	3	16,500	49,500	551-571	1,300	453.9	102.6	109.0
Pole Hill	1	33,250	33,250	830-838	550	718.2	192.8	86.4
Flatiron	2	31,500	63,000	1,096-1,118	960	895.9	244.8	224.8
(Flatiron[2])	1	8,500	8,500	158-287	440	209.7	0.5	0.7
Big Thompson	1	4,500	4,500	183-184	350	145.2	13.1	11.9
Seminoe	3	15,000	45,000	97-227	2,850	155.1	154.0	112.8
Kortes	3	12,000	36,000	192-204	2,700	168.6	165.1	120.5
Fremont Canyon	2	24,000	48,000	247-363	2,200	282.7	272.7	239.4
Alcova	2	18,000	36,000	153-165	2,800	132.3	136.8	108.5
Glendo	2	19,000	38,000	73-156	2,800	97.6	90.5	87.7
Guernsey	2	2,400	4,800	89-91	820	69.1	25.0	27.7
Boysen	2	7,500	15,000	72-112	2,415	86.7	87.5	84.9
Heart Mountain	1	5,000	5,000	265-275	355	229.1	42.4	34.6
Total	28	------	420,450		-----	4007.2	1626.2	1346.5

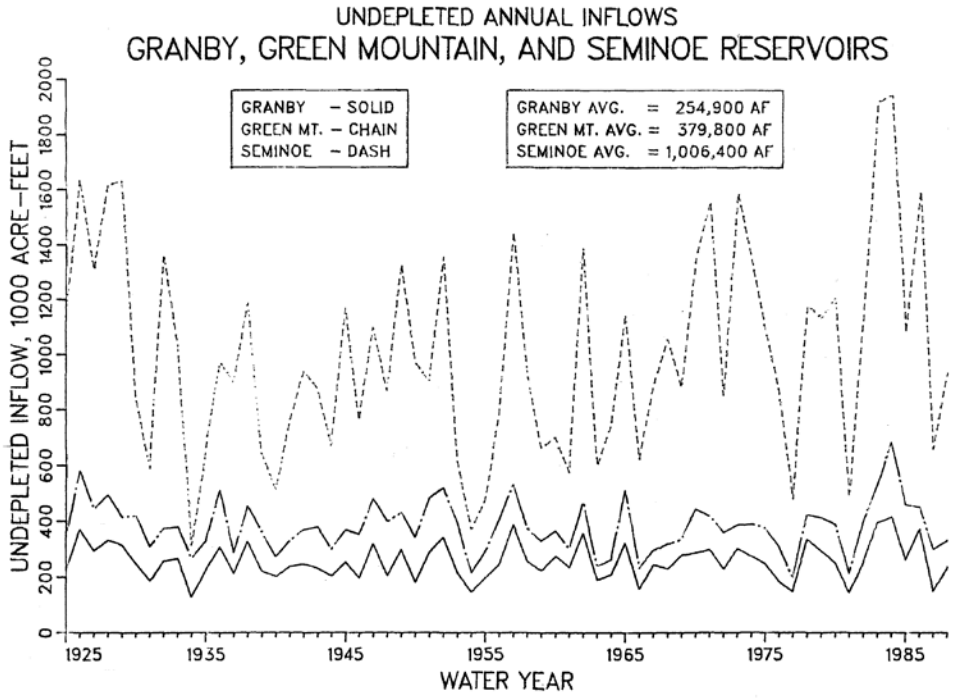

EXHIBIT 12

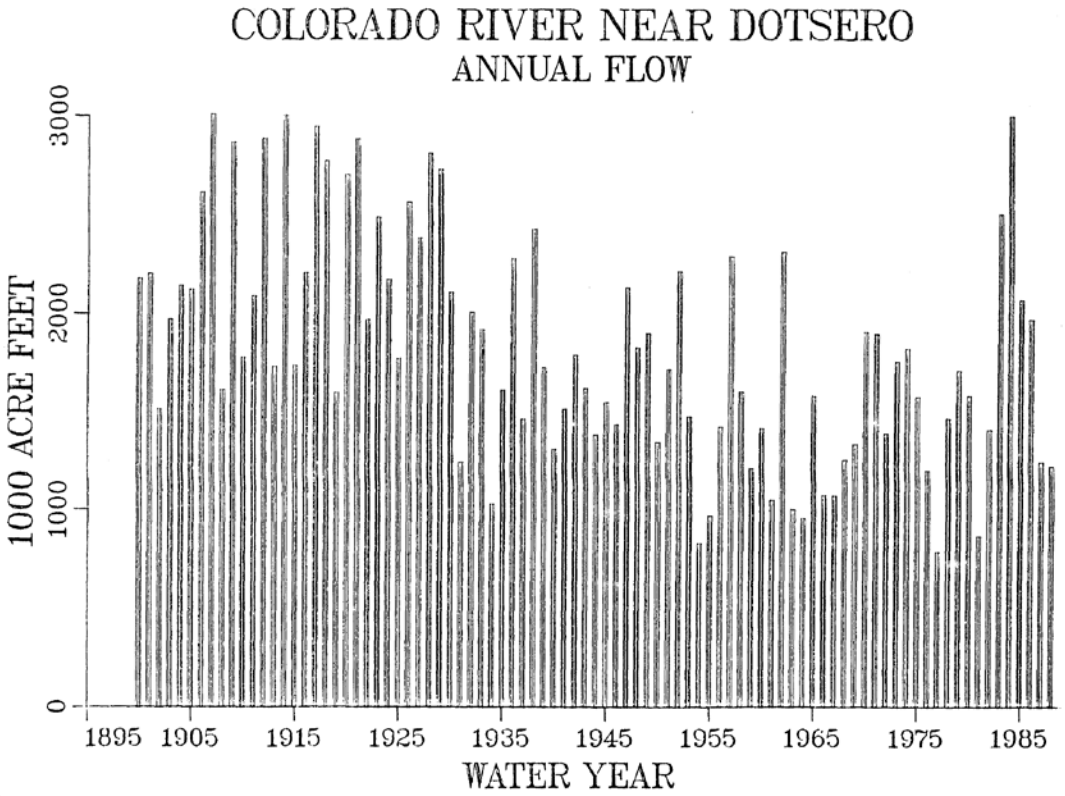

EXHIBIT 13