US Army Corps
of Engineers

Northwestern Division
Missouri River Region
Reservoir Control Center

Missouri River Region
RCC
Since 1953
Reservoir Control Center

Missouri River Main Stem Reservoirs

1998 - 1999 Annual Operating Plan

1998 - 1999
AOP

January 1999

DEPARTMENT OF THE ARMY
NORTHWESTERN DIVISION, CORPS OF ENGINEERS
12565 WEST CENTER ROAD
OMAHA, NEBRASKA 68144-3869

REPLY TO
ATTENTION OF

This Annual Operating Plan (AOP) for the Missouri River system was prepared by the Corps of Engineers' Reservoir Control Center (RCC), Missouri River Region, Northwestern Division. The plan outlines the operating objectives of the Missouri River main stem reservoirs for the coming year (August 1998 through July 1999). In addition, two sets of 5-year extensions to the AOP, through March 2005, are presented to serve as guides for longer range planning.

This year we have shortened the AOP to include only the plan for future operation. Previous AOP's have included a System description and discussion of the typical operation to meet authorized purposes and a historic summary of the previous year's operation. Although not included in this AOP, they are available as separate reports upon request. To receive a copy of either the "System Description and Operation" or the "Summary of Actual 1997-98 Operations," contact the Reservoir Control Center at 12565 West Center Road, Omaha, Nebraska 68144-3869, phone (402) 697-2676. Both reports are also available at the "Reports and Publications" link on our web site at: **www.nwd-mr.usace.army.mil/rcc**.

The development of this year's Draft AOP was coordinated with the Missouri River Basin Association (MRBA), the Missouri River Natural Resources Committee (MRNRC), and the general public. This year the MRBA did not call together a technical committee or provide pre-draft AOP recommendations (see Exhibit 1). The MRNRC recommendations for the 1998-99 AOP were discussed at its September 8, 1998 meeting at St. Joseph, Missouri, and are shown as Exhibit 2.

The Draft AOP also received review at two fall public meetings held at Sioux City, Iowa, on October 26, 1998 and at Nebraska City, Nebraska, on October 27, 1998. The primary purpose of these meetings was to present the Draft AOP and receive comments from all concerned. Private citizens and representatives of public and industry interest groups and Missouri River basin states attended the meetings.

The final plan presented in this report is approved as the framework within which the Missouri River Region will schedule detailed daily, weekly, and monthly regulation of the individual main stem reservoirs for the period August 1998 through 1999. No significant changes were made to the draft plan as a result of comments received during the review period. A number of clarifications and word changes were made to the draft to improve readability. The press release announcing the adopted plan for next year is shown on Exhibit 3.

[redacted]

Michael S. Meuleners
Colonel, Corps of Engineers
Deputy Division Engineer

MISSOURI RIVER MAIN STEM RESERVOIRS

Annual Operating Plan
1998 - 1999

TABLES

PLATES

EXHIBITS

ABBREVIATIONS

AOP	-	annual operating plan
ac.ft.	-	acre-feet
AF	-	acre-feet
B	-	Billion
cfs	-	cubic feet per second
COE	-	Corps of Engineers
CY	-	calendar year (January 1 to December 31)
elev	-	elevation
ft	-	feet
FY	-	fiscal year (October 1 to September 30)
GIS	-	Geographic Information System
GWh	-	gigawatt hour
KAF	-	1,000 acre-feet
Kcfs	-	1,000 cubic feet per second
kW	-	kilowatt
kWh	-	kilowatt hour
M	-	million
MAF	-	million acre-feet
MRBA	-	Missouri River Basin Association
MRD	-	Missouri River Division
MRNRC	-	Missouri River Natural Resources Committee
msl	-	mean sea level
MW	-	megawatt
MWh	-	megawatt hour
plover	-	piping plover
pp	-	powerplant
RCC	-	Reservoir Control Center
RM	-	river mile
tern	-	interior least tern
tw	-	tailwater
USGS	-	United States Geological Survey
yr	-	year

DEFINITION OF TERMS

Acre-foot (AF, ac-ft) is the quantity of water required to cover 1 acre to a depth of 1 foot and is equivalent to 43,560 cubic feet or 325,850 gallons.

Cubic foot per second (cfs) is the rate of discharge representing a volume of 1 cubic foot passing a given point during 1 second and is equivalent to approximately 7.48 gallons per second or 448.8 gallons per minute. The volume of water represented by a flow of 1 cubic foot per second for 24 hours is equivalent to 86,400 cubic feet, approximately 1.983 acre-feet, or 646,272 gallons.

Discharge is the volume of water (or more broadly, volume of fluid plus suspended sediment) that passes a given point within a given period of time.

Drainage area of a stream at a specific location is that area, measured in a horizontal plane, enclosed by a topographic divide from which direct surface runoff from precipitation normally drains by gravity into the river above the specified point. Figures of drainage area given herein include all closed basins, or noncontributing areas, within the area unless otherwise noted.

Drainage basin is a part of the surface of the earth that is occupied by drainage system, which consists of a surface stream or body of impounded surface water together with all tributary surface streams and bodies of impounded water.

Gaging station is a particular site on a stream, canal, lake, or reservoir where systematic observations of hydrologic data are obtained.

Runoff in inches shows the depth to which the drainage area would be covered if all the runoff for a given time period were uniformly distributed on it.

Streamflow is the discharge that occurs in a natural channel. Although the term "discharge" can be applied to the flow of a canal, the word "streamflow" uniquely describes the discharge in a surface stream course. The term "streamflow" is more general than "runoff" as streamflow may be applied to discharge whether or not it is affected by diversion or regulation.

MISSOURI RIVER MAIN STEM RESERVOIRS

Annual Operating Plan
1998 - 1999

I. FOREWORD

This Annual Operating Plan (AOP) presents pertinent information and tentative plans for operating the Missouri River Main Stem Reservoir System (System) for the remainder of 1998 through December 1999 under widely varying water supply conditions. It provides a framework for the development of detailed monthly, weekly, and daily regulation schedules for the System's six individual dams during the upcoming year to serve the Congressionally authorized project purposes. Regulation is directed by the Reservoir Control Center, Missouri River Region, Northwestern Division, U.S. Army Corps of Engineers (Corps). A map of the Missouri River basin is shown on ***Plate 1*** and the summary of engineering data for the six main stem reservoirs is shown on ***Plate 2***.

This plan may require adjustments when substantial departures from expected runoff occur. Results of a 5-year extension to the AOP studies (March 2000-March 2005) are presented to serve as a guide for Western Area Power Administration's power marketing activities and those other interests that require reservoir conditions for long term planning.

This year we have shortened the AOP to include only the plan for future operation. Previous AOP's have included a System description and discussion of the typical operation to meet authorized purposes and a historic summary of the previous year's operation. Although not included in this AOP, they are available as separate reports upon request. To receive a copy of either the "System Description and Operation" or the "Summary of Actual 1997-98 Operations," contact the Reservoir Control Center at 12565 West Center Road, Omaha, Nebraska 68144-3869, phone (402) 697-2676. Both reports are also available at the "Reports and Publications" link on our web site at: **www.nwd-mr.usace.army.mil/rcc**.

II. PURPOSE AND SCOPE

Beginning in 1953, projected System operation for the year ahead was developed annually as a basis for advance coordination with the various interested Federal, state, and local agencies and private citizens. Also beginning in 1953, a coordinating committee was organized to make recommendations on each upcoming year's System operation. The Coordinating Committee on Missouri River Main Stem Reservoir Operations held meetings semiannually until 1981 and provided recommendations to the Corps. In 1982 the committee was dissolved because it did not conform to the provisions of the Federal Advisory Committee Act. Since 1982, to continue providing a forum for public participation, one or more open public meetings are held semiannually in the spring and fall. The fall public meeting is conducted to take public input on a draft of the Annual Operating Plan, which is typically published in early October each year.

The spring meetings are conducted to update the public on the runoff forecast and projected System operation for the remainder of the year.

The spring public meetings were held in Pierre, South Dakota, on April 15, 1998, and in Omaha, Nebraska, on April 16, 1998. The attendees were given an update regarding the outlook for 1998 runoff and projected operation for the remainder of 1998. Two fall public meetings on the Draft AOP were held, one at Sioux City, Iowa, on October 26, 1998, and another at Nebraska City, Nebraska, on October 27, 1998.

For the last 7 years we have conducted pre-draft AOP coordination with the Missouri River Natural Resources Committee (MRNRC) and the Missouri River Basin Association (MRBA). In several of those years, the MRBA formed a technical committee to review operational options. In recent years, the MRNRC has been represented on the MRBA technical committee. This year the MRBA did not call together a technical committee or provide pre-draft AOP recommendations (see Exhibit 1). The MRNRC recommendations for the 1999 AOP were discussed at its September 8, 1998, meeting at St. Joseph, Missouri, and are shown as Exhibit 2.

III. FUTURE WATER SUPPLY - AUGUST 1998 - DECEMBER 1999

To develop the forecast studies for the 1998-1999 AOP, it was necessary to estimate the appropriate water supplies to the reservoirs for the period August 1998 to December 1999. The period August through February is normally one of relatively low and stable inflows and can be forecast with reasonable reliability. Therefore, a Basic Forecast (most likely for current runoff conditions) of monthly inflows to the river reaches above the six reservoirs and the river reach from Gavins Point to Sioux City was prepared for the period August 1998-February 1999. Forecasts of the Lower Quartile and Lower Decile using 80 percent and Upper Quartile and Upper Decile using 120 percent of the Basic Forecast are also used to give a range of monthly inflows leading up to March 1, 1999, the beginning of next year's runoff season. Inflows to the System after March 1, 1999, are dependent upon many hydrological factors which are impossible to forecast at the time the AOP is prepared. Therefore, in lieu of utilizing forecasted inflows to the Missouri River above Sioux City for the period March 1999-December 1999, inflows were based on analyses of the past water supply records extending from 1898 through 1997. Runoff conditions selected for use in the AOP were the Upper Decile with a runoff of 34.5 MAF having 1 chance in 10 of being exceeded, the Upper Quartile with a runoff of 30.6 MAF having 1 chance in 4 of being exceeded, and the Median (most likely) with a runoff of 24.6 MAF having 1 chance in 2 of being exceeded. The lower range of System inflows used for the analyses in the AOP, the Lower Quartile with a runoff of 19.5 MAF having 1 chance in 4 of occurrence of less runoff and the Lower Decile with a runoff of 15.5 MAF having 1 chance in 10 of occurrence of less runoff, complete the range of inflows into the System.

The range between the AOP forecasts for Lower Decile (15.5 MAF with a 90 percent exceedence) and the Upper Decile (34.5 MAF with a 10 percent exceedence) simulates 80 percent of the historic runoffs. There is still a 20 percent chance that a runoff condition may occur that has not been simulated; i.e., 10 percent chance a runoff event could be lower than the 15.5 MAF

(Lower Decile) and a 10 percent chance a runoff event could be greater than the 34.5 MAF (Upper Decile).

The estimated natural flow 1/ at Sioux City, the corresponding post-1949 water use effects, and the net flow 2/ available above Sioux City are shown in ***Table I,*** where several water supply conditions are quantified for the periods August-December 1998, CY 1998, and CY 1999. The natural water supply for CY 1998 (actual January 1998-July 1998 runoff plus Basic Forecast for the August 1998-December 1998 period) is estimated to total about 25.4 MAF, utilizing the Basic Forecast flows for the forecasted August-December 1998 period.

TABLE I
NATURAL AND GROSS WATER SUPPLY AT SIOUX CITY

	Natural 1/	**Post-1949 Depletions**	**Net 2/**
		(Volumes in 1,000 Acre-Feet)	
August-December 1998 (Basic Forecast)			
Basic	5,500	+300	5,800
120% Basic	6,600	+300	6,900
80% Basic	4,400	+400	4,800
Calendar Year 1998 (January-July Actual; August-December Basic Forecast)			
Basic	25,400	-1,800	23,600
120% Basic	26,500	-1,900	24,600
80% Basic	24,300	-1,700	22,600
Calendar Year 1999 (Extended Forecast - Statistical Analysis of Past Records)			
Upper Decile	34,500	-1,700	32,800
Upper Quartile	30,600	-1,700	28,900
Median	24,600	-1,800	22,800
Lower Quartile	19,500	-1,600	17,900
Lower Decile	15,500	-1,600	13,900

1/ The word "natural" is used to designate flows adjusted to the 1949 level of basin development, except that regulation and evaporation effects of the Fort Peck Reservoir have also been eliminated during its period of operation prior to 1949. 2/ The word "net" represents the total streamflow before deduction of the post-1949 irrigation, upstream storage, and other use effects.

IV. ANNUAL OPERATING PLAN FOR 1998-1999

A. General. The anticipated operation described in this AOP is designed to meet the operational objectives documented in the current Master Manual. Consideration has been given to all of the authorized project purposes including the needs of endangered species. It incorporates the lessons learned during the 6 consecutive years of drought of the mid-1980's through 1992 as well as the dramatic turnaround in runoff that caused the Great Flood of 1993, the near-record flooding repeated in both 1995 and 1996, and the unprecedented record runoff of 1997 with the first occurrence of coincident heavy plains and mountain snowpacks since the System filled. During CY 1993, the basin above Sioux City experienced 36.2 MAF of runoff, the sixth highest in 100 years of record, bringing an abrupt end to the 6 consecutive years of the worst drought the basin had experienced since the main stem System of reservoirs first filled to normal operating levels in 1967. This was followed by a near normal year with 23.9 MAF during CY 1994, a near repeat of 1993 with 37.2 MAF for CY 1995 (the third highest runoff since 1898), CY 1996 runoff of 35.6 MAF (the seventh greatest since 1898), and the CY 1997 runoff of 49.0 MAF, which is the greatest since record-keeping began in 1898.

This 1998-1999 AOP, developed for all five runoff scenarios, follows the March 15, July 1, and September 1 water-in-storage (storage) checks contained in the current Missouri River Master Water Control Manual (Master Manual) used to determine navigation flow service level, navigation season length, and the winter multipurpose System releases. Adjusted regulations for fish spawning and endangered species nesting habitat have been adopted for the three scenarios of Median, Lower Quartile, and Lower Decile runoffs with no peaking cycle at Gavins Point Dam as was implemented to conserve water during the recent drought years. For Upper Quartile and Upper Decile, other avenues of conservation and regulation will be considered to try to avoid moving and collecting eggs and/or chicks, as had to be done in 1995, 1996, and 1997.

In summary, the Upper Quartile and Upper Decile runoff scenarios follow the Master Manual exclusively with much above normal runoff requiring release increases early in the year to evacuate floodwater from the reservoirs. The Median, Lower Quartile, and Lower Decile runoffs follow the System storage checks contained in the Master Manual. In addition, the Median runoff also includes releases that provide a steady to rising lake level in the upper two large reservoirs during the spring fish spawn period. Similar regulations have resulted in a higher fish reproduction success. Gavins Point releases will not be cycled to conserve water under any of the five studied runoff levels but may be necessary for flood control operations during the endangered species nesting period or should significant drought conditions return.

The lowest runoff scenario presented in this year’s AOP is Lower Decile. Runoff less than Lower Decile is possible, as was experienced in 1988 (12.4 MAF). One of the operational objectives of the current Master Manual is to provide for water supply requirements in the open Missouri River reaches between the reservoirs and below the System. Recent experience has shown that these water supply requirements are greater than was anticipated during the development of the guidelines documented in the current Master Manual. Also, operation to limit impacts to threatened and endangered species has resulted in higher releases during low runoff periods. Therefore, in order to meet the operational objectives of the current Master Manual, we would need to adjust the water conservation guidelines published in the Master Manual. These water conservation guidelines apply during drought periods and present criteria for season length, service level, minimum navigation season length, and nonnavigation season minimum releases. Recent studies have indicated that to meet the operational objectives of the current Master Manual, adjustments to drought water conservation guidelines would need to occur when total System storage is at or below 52 MAF on July 1. It is important to note that there are many possible combinations of potential adjustments that would result in attainment of the current

Master Manual operational objectives. This year's Lower Decile studies do not show a decline of total System storage below the 52 MAF level by July 1, 1999. If future AOP studies indicate a return to significant drought conditions (i.e., 52 MAF - July 1 level or less) we would ask the MRBA, MRNRC, and other interested parties for adjustment recommendations that would best meet the operational objectives of the current Master Manual. We would facilitate discussion by providing studies to the aforementioned groups which outline the effects of the various adjustment options. If a general agreement on reasonable adjustments cannot be attained, we will determine which adjustments best meet the current Master Manual operational objectives.

Regulation studies developed for the AOP are based on guidelines specified in the current Master Manual. Navigation flow support and winter releases from Gavins Point are determined by the volume of water in storage in the System on specified dates of March 15 and July 1. Intrasystem releases are adjusted to best serve the multiple-purpose functions of the projects with special emphasis placed on regulation for fisheries starting in early April and for endangered species beginning in early May and continuing through August.

Background information available for preparation of the 1998-1999 AOP includes 13 years of operation at Fort Peck Reservoir (1940) by itself plus 45 years of System experience as Fort Randall (1953), Garrison (1955), Gavins Point (1955), Oahe (1962), and Big Bend (1964) have been brought progressively into operation. In addition to the long period of actual regulation experience, many background operational studies for the completed System are available for guidance.

Actual System operation from January 1 to August 1, 1998, and the operating plans for each project for the remainder of 1998 with the Basic Forecast and for CY 1999 using the five alternate levels of estimated runoff described on page 2 are presented on ***Plates 3 through 8***, inclusive. An exception is the omission of Big Bend, since storage at that project is relatively constant and average monthly releases are essentially the same as those at Oahe. These plates also show, on a condensed scale, actual operations during the period 1953 through 1997.

Plate 9 illustrates for Fort Peck, Garrison, Oahe, and Gavins Point Dams the actual reservoir releases (Regulated Flow) as well as the Missouri River flows (Unregulated Flow) that would have resulted if the reservoirs were not in place during the period January 1997 through July 1998. ***Plate 10*** presents past and forecasted gross monthly, average power generation, and gross peaking capability for the main stem System.

B. Operating Plans for the Balance of the 1998 Navigation Season. Plans for the remainder of the 1998 navigation season include Gavins Point releases in the 31,000 to 32,000 cubic feet per second (cfs) range to evacuate a small amount of accumulated flood control storage and a 10-day extension of the navigation season, closing on December 11, 1998, at the mouth as a further storage evacuation measure. The other main stem project flows will be near average since the amount of flood control storage that needs to be evacuated is relatively small. This will be the fourth consecutive season that a 10-day extension has been provided as a flood storage evacuation measure. The scheduling of a full 8-month season with a 10-day extension resulted from the July 1, 1998, System storage being at 61.0 MAF, slightly greater than the 59.0 MAF required to provide full service flows for the remainder of the season. The extra storage accumulation occurred because of higher than expected downstream flows during the summer months and greater than forecast runoff during July 1998.

This past year's near normal reservoir storage accumulation began with runoff from a below normal mountain snowpack and a small amount of plains snow accumulation. The record CY 1997 runoff left much of the upper basin in a moist condition but there were also areas where moisture was much below normal. The total runoff for this year is expected to be very near normal but there has been a great deal of variability by reach and month in the way the runoff occurred. February was 191 percent of normal while March was only 75 percent of normal without a plains snowpack accumulation. Then May and June were well below normal with 83 and 94 percent of normal, respectively. The month of July was 147 percent of normal and August was also much above normal. So, even though the year will look very much like a normal year, the individual months exhibited a great deal of variance from normal. All this follows 1997 which was a record runoff year, much greater than even the previous record runoff and the highest in 100 years of record keeping. Gavins Point releases have been in the normal range to meet downstream navigation targets early in the year and are expected to continue in the normal range through the remainder of the season in order to vacate accumulated flood control storage prior to the start of the next runoff season on March 1, 1999. The closing dates for ending the 1998 navigation season are December 2 at Sioux City, December 4 at Omaha, December 5 at Nebraska City, December 7 at Kansas City, and December 11 at the mouth of the Missouri River near St. Louis.

Forecasts for the August 1 to December 1 period indicate that 3.3 billion kilowatt hours (kWh) of energy will be generated by the main stem powerplants, 0.5 billion kWh less than normal and 2.5 billion kWh less than in 1997.

<u>Fort Peck</u> releases are expected to range from 6,200 to 12,000 cfs, for the most likely (Basic Forecast), throughout the remainder of the 1998 navigation season. The Basic Forecast indicates the level of Fort Peck Lake is expected to decline steadily by 3.0 feet from elevation 2240.2 feet above mean sea level (msl) to 2237.2 feet msl by the end of the navigation season, 2.4 feet higher than the 1967-1997 long term average.

<u>Garrison</u> releases are expected to range from 14,000 to 24,000 cfs throughout the remainder of the 1998 navigation season. The level of Lake Sakakawea is expected to decline steadily by 2.1 feet from elevation 1843.1 feet msl to 1841.0 feet msl by the end of the navigation season, 2.6 feet above the long term average.

<u>Oahe</u> releases during August through November will be just slightly in excess of navigation requirements in order to provide the required backup to System release requirements for some minor flood storage evacuation. Releases will be adjusted to serve the variable power loads. The releases will achieve the scheduled Fort Randall drawdown to elevation 1337.5 feet msl by the end of the navigation season. The Lake Oahe level will fall steadily by 5.8 feet throughout the period from elevation 1612.4 to elevation 1606.6 feet msl by the close of the navigation season, 5.0 feet higher than the long term average.

Big Bend releases will generally parallel those from Oahe. Lake Sharpe will fluctuate between 1420.0 and 1421.0 feet msl for weekly cycling during high power load periods. Reservoir fluctuations of a foot are expected during the course of most weeks in order to follow peaking power demands. This year will represent a more normal runoff year operation of Big Bend and, as such, generation will normally be less on weekends due to lower power demands, which permits the refilling of Lake Sharpe over the weekend.

Fort Randall releases will generally parallel those from Gavins Point. Lake Francis Case is expected to fall steadily during the August-through-November period from the 1355.1 feet msl end-of-July elevation to 1337.5 feet msl. This drawdown elevation will provide sufficient capacity to store a reasonably high level of power releases from Oahe and Big Bend during the coming winter season.

Gavins Point releases will be in the range of 31,000 to 32,000 cfs to near 20,000 cfs by the end of the extended navigation season. Lewis and Clark Lake will rise about 1 foot from elevation 1206.0 to near elevation 1207.0 feet msl throughout the remainder of the 1998 navigation season that ends on December 11. The lake level in previous years was increased to 1208.0 feet msl at the end of August after the endangered species nesting season but this year, as during the last 6 years, is being maintained 1 foot lower at 1207.0 feet msl to help reduce shoreline erosion.

C. Operating Plan for the Winter of 1998-1999. In accordance with guidelines presented in the Master Manual, winter releases from the System are based on the amount of water in storage on September 1. A storage level of 58.0 MAF on this date indicates a release rate will be made to meet full service requirements the following winter and a System storage of 43.0 MAF indicates minimum service releases. Full and minimum service releases call for an average winter Fort Randall release of 15,000 and 5,000 cfs, respectively. The storage on September 1, 1998, based upon the Basic Forecast, would be 61.2 MAF, slightly in excess of the 58.0 MAF required to provide a full service release of 15,000 cfs from Fort Randall Dam. Therefore, the Fort Randall winter release will be near or slightly above full service in the range of 15,000 to 20,000 cfs to back up the required Gavins Point release. The Gavins Point release will be maintained in a range from 16,000 to 20,000 cfs, near the 20,000 cfs release rate that is normally the maximum allowable during a winter ice jam flood potential period. In recent years release rates near 24,000 cfs have been attempted to evacuate accumulated flood control storage; however, this year the excess storage accumulation is anticipated to be very small and the increased risk associated with the higher flows appears unwarranted. The higher release rates will be dependent upon downstream ice conditions and will require increased vigilance to minimize downstream flooding during cold periods. This will be the fourth consecutive winter that the System storage has required an above normal winter release to continue the evacuation of stored floodwaters. It is anticipated that this year's winter release will be adequate to serve all downstream water intakes except for very short periods that may be impacted below rapidly forming ice jams.

For the winter period from the close of the 1998 navigation season on December 11, 1998, until the opening of the 1999 navigation season on April 1, 1999, operations are expected to be as follows:

Fort Peck releases are expected to be decreased to 10,000 cfs before the beginning of the winter period to prevent ice-jam flooding during the winter freeze-in period on the reach of the Missouri River from the dam to the Williston, North Dakota, area. Releases will then be gradually increased to 12,000 cfs for the remainder of the winter period to meet critical winter hydropower demands. Fort Peck Lake with the Basic Forecast is expected to fall steadily by 3.2 feet to the base of the flood control zone at elevation 2234.0 by March 1, the beginning of next year's runoff season. The lake would then rise to near elevation 2235.4 feet msl by the end of the winter period on March 31, which would be 2.6 feet above normal.

Garrison releases will be adjusted to serve winter power loads and balance System storage. Releases will follow a typical pattern similar to those of previous winters with lower releases early in the winter and increased releases after the threat of flooding diminishes as the Missouri River ice conditions stabilize from the Washburn to Bismarck, North Dakota, area. Releases are scheduled at 20,000 cfs at the time of normal freeze-in in December and likely will have to be reduced for a short period to 18,000 cfs during the freeze-in in the Bismarck area in an attempt to not exceed the target 13-foot stage at the Bismarck gage. Flood stage is 16 feet. Garrison releases are expected to be decreased from 24,000 to 15,000 cfs at the beginning of the winter period and gradually increased to 25,000 cfs during the remainder of the winter. Lake Sakakawea is expected to lower from near elevation 1841.0 feet msl to the base of the flood control storage zone at elevation 1837.5 feet msl by March 1, then rise to elevation 1838.4 by March 31, which would be 2.9 feet above normal.

Oahe releases for the winter season will provide backup for the Fort Randall and Gavins Point releases plus fill the recapture space available at Fort Randall consistent with anticipated winter power loads. Monthly average releases may vary substantially with fluctuations in power loads occasioned by weather conditions but, in general, are expected to average between 23,000 and 16,000 cfs. Daily releases will vary widely to best meet power loads. Peak hourly releases as well as daily energy generation will be constrained to prevent urban flooding in the Pierre and Fort Pierre areas if severe ice problems develop downstream of Oahe Dam. This potential reduction has been coordinated with the Western Area Power Administration.

The Lake Oahe level is expected to rise gradually from elevation 1606.6 feet msl at the end of the 1998 navigation season to elevation 1607.5 by March 1, then rise to elevation 1608.8 feet msl by the end of March, 2.2 feet above normal.

Lake Sharpe will be maintained in the normal 1420.0 to 1421.0 feet msl range during the winter.

Fort Randall releases will vary from 16,000 to 17,000 cfs, consistent with both the forecasted September 1, 1998, System storage of 61.2 MAF and the need to evacuate a small amount of stored floodwaters from the System of reservoirs by the beginning of next year's runoff season on March 1, 1999. Lake Francis Case is expected to rise from a low of about 1337.5 feet msl at the end of the 1998 navigation season to near elevation 1350.0, the seasonal base of flood control, by March 1. However, if the plains snowpack flood potential below Oahe is quite low at that time, measures will be taken to raise Lake Francis Case to near elevation 1353.0 by March 1. It is likely that a Lake Francis Case level above elevation 1353 feet msl, to as high as 1355.2, will be reached by the end of the winter period on March 31 if runoff conditions permit. It is anticipated that the level of Lake Francis Case above the White River delta near Chamberlain, South Dakota, will remain at a higher elevation than the lake below the delta from late October through December, due to the damming effect of this delta area.

Gavins Point releases will be reduced gradually beginning in early December to near a winter level ranging from 18,000 to 20,000 cfs, near the 20,000 cfs which is normally the maximum allowable during a winter ice jam flood potential period. It may be necessary to reduce these releases to the 15,000 to 16,000 cfs range if extremely cold temperatures result in significant ice jam problems. These releases should be adequate to maintain water levels necessary during freeze-in for downstream water intakes; releases may be reduced if localized ice bridging would result in a flood threat. Lewis and Clark Lake generally will be near elevation 1207 feet msl until late February when it will be lowered to elevation 1206 feet msl for controlling spring floods, primarily from the Niobrara River and Ponca Creek along the Fort Randall to Gavins Point reach.

System storage, for all runoff conditions, is expected to be near 57.1 MAF by March 1, 1999, the beginning of next year's runoff season. This is the base of the flood control zone and the top of the multipurpose carryover storage zone.

D. Operations During the 1999 Navigation Season. All of the five runoff scenarios studied for this year's AOP follow the guidelines presented in the Master Manual for navigation service flow support and season length. Steady System releases or repetitive daily project patterns will be held from early May at the beginning of the endangered species nesting season to the end of the nesting in late August. All runoff scenarios except Lower Decile would provide rising pool levels in the spring fish spawn period.

All five runoff scenarios studied for this year's AOP are based on gradually increasing System releases to provide navigation season flow rates at the mouth of the Missouri near St. Louis by April 1, 1999, the normal navigation season opening date. The corresponding dates at upstream locations are: Sioux City, Iowa, March 23; Omaha, Nebraska, March 25; Nebraska City, Nebraska, March 26; and Kansas City, Missouri, March 28. The studies illustrated on ***Plates 3 through 8*** and summarized in ***Table II*** are based on providing greater than full service flows and a full 8-month season extended by 10 days as a reservoir flood storage evacuation measure for both the Upper Quartile and Upper Decile runoff scenarios. The normal runoff scenario characterized by the Median study indicates full service flows with a full 8-month season. Lower Quartile and the Lower Decile would have flows of about 400 and 1,800 cfs below full service, respectively, beginning on July 1 for the full 8-month season.

TABLE II
NAVIGATION SERVICE SUPPORT
FOR THE 1999 SEASON

	Runoff Scenario (MAF)	1999 System Storage March 15 (MAF)	July 1 (MAF)	Flow Level Above or Below Full Service (in cfs) Spring	Fall	Length of Season (Months)
U.D.	34.5	58.2	64.1	+8,200	+17,500	8 + 10 days
U.Q.	30.6	58.0	62.9	+6,200	+9,000	8 + 10 days
Med	24.6	57.9	61.7	0	0	8
L.Q.	19.5	56.4	58.5	0	-400	8
L.D.	15.5	56.3	56.4	0	-1,800	8

Navigation flow support for the 1999 season will be determined by actual reservoir System storage on March 15 and July 1 following the Master Manual guidelines. Gavins Point releases may be quite variable during the 1999 navigation season but, for Median, Lower Quartile, and Lower Decile, are expected to range from 28,800 to 34,500 cfs. For Upper Quartile, release increases result in a range from 35,000 to 42,500 cfs; for the Upper Decile, Gavins Point releases would range from a minimum 37,000 cfs to a maximum 51,000 cfs. Release reductions necessary to minimize downstream flooding are not reflected in these monthly averages but will be instituted as conditions warrant.

Planned storages and releases for the System and individual reservoirs within the System are shown on ***Plates 3 through 8***. Ample regulatory storage space exists in the System to control flood inflows under all conditions studied. ***Table II*** summarizes the navigation service support projected for the 1999 navigation season.

Summary of Reservoir Regulation Activities for Endangered Species and Fish Propagation Enhancement

The 1998-1999 AOP forecast releases from the main stem reservoirs during the 1999 endangered bird nesting season are similar to those in last year's AOP. Releases from Gavins Point will be near 34,000 cfs mid-May through August under Median and Lower Quartile inflows. Lower Decile flows for this period will be near 32,500 cfs. Spilling will be required beginning in the spring through fall under Upper Quartile and Upper Decile inflow.

Assuming the System storage starts near 57.1 MAF on March 1, 1999, the 1998-1999 AOP Upper Quartile and Upper Decile inflows would provide System storage increases that would necessitate beginning evacuation of stored water in the spring even before the traditional bird nesting season. The AOP Upper Decile and Upper Quartile plans show that a further increase in System release, involving spills, may be possible beginning in May when birds start to nest. This action could be done to provide safe nesting habitat through August. If an Upper Decile year or greater occurs, the Corps will work closely with the Service, as was done during 1995 through 1997, to ensure the best possible outcome for the birds without jeopardizing flood control.

Fort Peck releases, which will be in the 6,500 to 11,000 cfs range in April 1999, will be increased to a 9,500 to 15,000 cfs average in May. Areas of clean sand habitat should still be available from the high 1997 flows. Should greater than Upper Decile inflows appear likely, project releases may be increased above those flows shown in June or July as the need to evacuate floodwater will be imperative.

The Median, Lower Quartile, and Lower Decile AOP plans show daily releases will be in the 10,500 to 11,000 cfs range from June through August to enhance bird nesting. The Upper Quartile plan has the June through August release rate at 14,000 cfs. Hourly peaking restrictions of no more than 6 hours of 14,000 cfs will be in place during the nesting season unless inflows are Upper Quartile or greater.

If flood flows enter the Missouri River below the project during nesting, hourly releases will be lowered to no less than 3,000 cfs in order to keep traditional riverine fish rearing areas continuously inundated while helping to lower river stages at downstream nesting sites. April releases will aid trout spawning below the project. A rising pool in the April to May sport fish spawn season will be dependent upon the ever changing daily inflow pattern to the reservoir but appears possible with all AOP plans.

Garrison daily average releases will be increased in May 1999 to prevent birds from nesting on low sandbar areas below the project. The increase will be to 34,500 cfs with the Upper Quartile plan and 26,000 to 23,000 cfs with plans showing Median to Lower Decile. Should Upper Decile or greater inflows appear likely, project releases will be at high levels for birds in mid-May as evacuation of floodwater will be necessary. Hourly peaking will be limited to no more than 30,000 cfs for 6 hours if the daily average release is lower than 29,000 cfs. This will limit peak stages below the project for nesting birds.

A Lake Sakakawea elevation rise in the spring conducive to successful sport fish spawn will be dependent upon the pattern of inflow at the time. A significant establishment of vegetative cover is also a prerequisite. It appears from the current AOP forecast that a near constant or rising pool into critical spawning areas might be possible from April through June with Median or greater inflows. Only very large spring inflows and/or low releases will put water in the vegetative spawning zone during the upcoming year.

Oahe releases in the spring and summer will back up those from Gavins Point. Because Garrison's releases will be adjusted for endangered bird reproduction, this could be a determining factor in whether the Oahe pool rises or falls. If flows into the System are greater than Upper Quartile, Oahe's elevation in the spring will likely be steady or rising. The Upper Decile plan shows April-May elevations barely above the 1612.9 msl crest reached in 1998. Under all AOP plans, the Oahe pool will fall during the summer.

Fort Randall will be operated to provide for a pool elevation near 1355 during the fish spawn period and not draw the lake below elevation 1337.5 feet msl in the fall for water intakes. At Fort Randall, hourly releases during the 1999 nesting season will be limited to 37,000 cfs, except for Upper Quartile and Upper Decile runoff. Daily average flows may be increased every third day to preserve the capability of sustaining this third-day release later in the summer if conditions turn dry.

Gavins Point will be operated to enhance tern and plover productivity in the Fort Randall to Gavins Point reach as well as below the project. The Gavins Point pool will be operated near 1206 feet msl in the spring and early summer with variations day to day due to rainfall runoff. Greater fluctuations occur in the river, increasing the risk of nest inundation in the upper end of the Gavins Point pool. Several factors contribute to the increased risk: Gavins Point release restrictions, because there are greater numbers of endangered species nesting below the Gavins Point project which must be preserved; unexpected incremental rainfall runoff between Fort Randall and Gavins Point, which results in sudden pool rises because the Gavins Point project has a smaller storage capacity than the other System reservoirs; the operation of Gavins Point for flood control which necessitates sudden release reductions to prevent downstream bird losses; and very large release years. All these factors when combined make it difficult and sometimes impossible to prevent inundation of nests in the upper end of Lewis and Clark Lake. The pool will be increased to elevation 1207.0 feet msl following the nesting season. The System support for the 1999 navigation season is summarized in ***Table II***.

Included in the 1999 operational plan for Median, Lower Quartile, and Lower Decile runoff is an adjusted release regulation at Gavins Point to increase the release by early May when the birds arrive to provide the System flexibility necessary to meet navigation target flows later in the nesting season when downstream tributary flows begin their normal decline in July and August. An increase followed by more constant flows out of Gavins Point should help minimize taking of nests, eggs, or chicks. Cycling up releases every third day is not planned during the 1999 nesting season, except during downstream flood control operations. The Lower Quartile plan shows slightly less than full service navigation flows in August. The U.S. Fish and Wildlife Service 1989 Biological Opinion on System operations calls for providing created habitat for the birds below Gavins Point in the summer of 1999 for monthly operating plan releases which average greater than 30,000 cfs but less than 39,000 cfs. The upper three projects will be operated to best meet authorized purposes while enhancing fish reproduction to the extent possible.

Summary of Habitat Activities

The Omaha District is developing an Interim Habitat Conservation Plan, scheduled to be available by November 1, 1998, which will discuss habitat conservation activities to be undertaken in 1999. Habitat conservation measures to be undertaken in future years will be discussed in Omaha District's Long Term Habitat Conservation Plan which will be available in September 1999.

V. SUMMARY OF RESULTS EXPECTED IN 1998-1999

With System operations in accordance with the 1998-1999 AOP outlined in the preceding pages, the following results can be expected.

A. Flood Control. All runoff scenarios studied will begin next year's runoff season on March 1, 1999, near the desired 57.1 MAF base of annual flood control and multiple use zone. Therefore, the entire System flood control zone will be available to store flood runoffs. The System will be available to significantly reduce peak discharges for all floods that may originate above the System.

In addition, the entire carryover multiple use conservation storage will be filled and available to provide support for all of the other multiple purposes of the System.

B. Water Supply and Water Quality Control. With above normal winter releases being provided for all five runoff scenarios, all water supply and water quality requirements on the Missouri River both below Gavins Point Dam and between System reservoirs should be met for all flow conditions studied. It is anticipated that during severe cold spells it will not be necessary to increase Gavins Point releases as was required during the recent drought years to help alleviate water supply problems created by ice jamming downstream. In fact, it may be necessary to reduce releases during periods of downstream ice formation to prevent flooding.

In addition, all minimum water quality and water supply requirements downstream of the System dams will be met under the above normal releases for all flow conditions.

C. Irrigation. Scheduled releases from the System reservoirs will be more than ample to meet the volumes of flow required for irrigation diversions from the Missouri River. Tributary irrigation water usage is fully accounted for in the estimates of water supply.

D. Navigation. Service to navigation in 1999 would be scheduled at full service or greater flow support for the three studies of Median, Upper Quartile, and Upper Decile. After July 1 the Lower Quartile and Lower Decile runoff conditions have slightly reduced flow support for the remainder of the 8-month season. Although these studies, as shown in ***Table II***, provide a comparison of typical flow support under varying runoff conditions that cover 80 percent of the historic runoff conditions, the actual rate of flow support for the 1999 navigation season will be based on actual System storage on March 15 and July 1, 1999.

The 1999 navigation season would have full service flow targets for the Median runoff scenario and greater than full service flows for both the Upper Quartile and Upper Decile runoff conditions with a full 8-month season for Median and Lower Quartile runoff and an 8-month season with 10-day extensions for both Upper Quartile and Upper Decile runoffs. For Lower Quartile and Lower Decile runoff conditions, reduced flow support would be provided for the remainder of the 8-month navigation season after the July 1 storage check. The anticipated service level and season length for all runoff conditions studied are shown in ***Table II***.

E. **Power.** ***Tables III*** and ***IV*** give the estimated monthly System load requirements and hydropower supply of the Eastern Division, P-S MBP, from August 1998 through December 1999. Estimates of monthly peak demands and energy include customer requirements for firm, short-term firm, summer firm, peaking, and various other types of power sales, System losses, and the effects of diversity. Also included in the estimated requirements are deliveries of power to the Western Division, P-S MBP, to help meet its firm power commitments.

F. **Recreation, Fish and Wildlife.** The basic operations of the System will continue to provide recreation and fish and wildlife opportunities in the project areas and along the Missouri River as well as other benefits of a controlled river. Special operational adjustments incorporating specific objectives for these purposes will be accomplished whenever possible. Conditions should be favorable for the many visitors who enjoy the camping, boating, fishing, hunting, swimming, picnicking, and other recreational activities associated with the System reservoirs and for increasing usage of the regulated reaches of the Missouri River downstream of the reservoirs. Boat ramps that were lowered during the recent drought should be adequate to provide lake access next year even under the Lower Decile runoff scenario.

G. **System Storage.** If presently anticipated runoff estimates based upon normal precipitation materialize, System storage will total about 57.3 MAF by the close of CY 1998. This year-end storage would be 1.6 MAF less than the 58.9 MAF experienced on December 31, 1997, but 1.7 MAF above the 1967 to 1997 average. Since the System first filled to normal operating levels in 1967, the lowest end-of-December storage was 40.9 MAF in 1990. The previous lowest storage prior to the recent 6 consecutive years of drought was 50.9 MAF in 1981. The end-of-year storages have ranged from a maximum of 60.9 MAF, which occurred in 1975, to the 1990 minimum of 40.9 MAF. Under the five runoff conditions of inflow analyzed for this AOP, the total System storage at the end of next year on December 31, 1999, would be approximately as shown on ***Table V***.

H. **Summary of Water Use by Functions.** Anticipated water use in CY 1998, under the plan of operation with the Basic Forecast of water supply, is shown in ***Table VI***. Actual water use data for CY 1997 are included for information and comparison.

Under the planned operations, estimated water use in CY 1999, which will be subject to reappraisal next year, also is shown in ***Table VI*** for the various levels of water supply.

VI. TENTATIVE PROJECTION OF OPERATIONS THROUGH MARCH 2005

The 5-year extension to the Annual Operating Plan (March 2000-March 2005) has been prepared to serve as a guide for Western Area Power Administration's power marketing activities. As discussed in Section IV, Chapter A, adjustments to the drought water conservation guidelines are necessary to continue to meet the operational objectives of the current Master Manual during drought periods. This is due to increased release requirements for water supply and endangered

TABLE III
PEAKING CAPABILITY AND SALES
(1,000 kW at plant)

	Estimated Committed Sales*	Expected C of E Capability					Expected Bureau Capability					Expected Total System Capability				
1998			120%	Basic	80%			120%	Basic	80%			120%	Basic	80%	
Aug	2168		2403	2400	2396			202	202	202			2605	2602	2598	
Sep	1514		2390	2390	2382			203	202	201			2593	2592	2583	
Oct	1529		2366	2367	2354			203	202	202			2569	2569	2556	
Nov	1800		2323	2324	2311			202	202	201			2525	2526	2512	
Dec	1904		2302	2304	2292			199	201	199			2501	2505	2491	
1999																
Jan	2209		2316	2317	2306			194	197	197			2510	2514	2503	
Feb	1975		2321	2321	2307			189	194	195			2510	2515	2502	
		U.D.	U.Q.	Med.	L.Q.	L.D.	U.D.	U.Q.	Med.	L.Q.	L.D.	U.D.	U.Q.	Med	L.Q.	L.D.
Mar	1675	2382	2376	2370	2348	2345	191	191	191	194	194	2573	2567	2561	2542	2539
Apr	1442	2394	2385	2372	2344	2339	191	191	194	191	191	2585	2576	2566	2535	2530
May	1375	2403	2390	2374	2342	2331	191	191	200	193	193	2594	2581	2574	2535	2524
Jun	1821	2420	2415	2399	2361	2337	203	203	204	195	195	2623	2618	2603	2556	2532
Jul	2264	2419	2419	2399	2355	2325	204	204	204	193	193	2623	2623	2603	2548	2518
Aug	2153	2410	2407	2387	2336	2304	202	202	201	192	192	2612	2609	2588	2528	2496
Sep	1566	2397	2393	2375	2320	2286	200	200	199	192	192	2597	2593	2574	2512	2478
Oct	1527	2370	2370	2353	2295	2259	200	200	199	193	189	2570	2570	2552	2488	2448
Nov	1753	2320	2324	2314	2254	2218	199	199	199	192	185	2519	2523	2513	2446	2403
Dec	1834	2299	2302	2296	2234	2198	196	196	195	188	182	2495	2498	2491	2422	2380

* Estimated sales, including system reserves. Power in addition to hydro production needed for these load requirements wil be obtained from other power systems by interchange or purchase.

** Total output of Canyon Ferry and 1/2 of the output of Yellowtail powerplant.

TABLE IV
ENERGY GENERATION AND SALES
(Million kWh at plant)

	Estimated Committed Sales*	Expected C of E Generation					Expected Bureau Generation **					Expected Total System Generation				
1998			120%	Basic	80%			120%	Basic	80%			120%	Basic	80%	
Aug	834		957	972	988			97	90	72			1054	1062	1060	
Sep	716		1085	886	854			86	78	68			1171	964	922	
Oct	709		995	724	709			86	74	64			1081	798	773	
Nov	774		955	749	668			82	75	72			1037	824	740	
Dec	902		787	735	690			85	77	73			872	812	763	
1999																
Jan	903		795	776	688			91	84	70			886	860	758	
Feb	860		707	643	616			81	76	58			788	719	674	
		U.D.	U.Q.	Med.	L.Q.	L.D.	U.D.	U.Q.	Med.	L.Q.	L.D.	U.D.	U.Q.	Med	L.Q.	L.D.
Mar	782	838	867	700	702	598	89	89	84	64	64	927	956	784	766	662
Apr	735	995	967	787	799	781	101	101	69	56	56	1096	1068	856	855	837
May	681	1279	1211	954	957	936	134	134	76	61	61	1413	1345	1030	1018	997
Jun	740	1397	1216	982	972	920	138	138	105	62	62	1535	1354	1087	1034	982
Jul	799	1445	1313	1079	1060	1003	104	104	104	58	58	1549	1417	1183	1118	1061
Aug	834	1468	1326	1075	1054	995	88	87	84	57	57	1556	1413	1159	1111	1052
Sep	716	1381	1141	993	969	911	87	87	80	54	54	1468	1228	1073	1023	965
Oct	709	1248	1067	857	934	773	87	86	79	54	54	1335	1153	936	988	827
Nov	774	1177	1016	775	746	688	83	83	75	51	51	1260	1099	850	797	739
Dec	902	838	802	690	657	610	87	87	85	57	56	925	889	775	714	666
CY TOT	9435	13568	12428	10311	10154	9519	1170	1168	1001	702	701	14738	13596	11312	10856	10220

* Estimated sales including system reserves and losses. Power in addition to hydro production needed for these load requirements will be obtained from other systems by interchange or purchase.

** Total output Canyon Ferry and 1/2 output of Yellowtail powerplant.

TABLE V
ANTICIPATED DECEMBER 31, 1999 STORAGE IN MAIN STEM SYSTEM

Water Supply Condition	Total (12/31/99)	Above Minimum Pools 1/	Unfilled Carryover Storage 2/	Total Change CY 1999
		(Volumes in 1,000 Acre-Feet)		
Upper Decile	57,100	39,000	0	-100
Upper Quartile	57,400	39,300	0	200
Median	56,900	38,800	200	- 400
Lower Quartile	51,800	33,700	5,300	- 4,500
Lower Decile	49,000	30,900	8,100	- 7,300

1/ Net usable storage above 18.1 million-acre-foot System minimum pool level established for power, recreation, irrigation diversions, and other purposes.
2/ System base of flood control zone containing 57.1 million acre-feet.

species during low runoff periods. The specific details of these adjustments are not certain, absent the completion of review of possible options by the MRBA, the MRNRC, and any other interested parties. However, for the 5-year extension studies, for planning purposes, we have included projections that utilize two different sets of drought water conservation guidelines.

The first set of projections presented uses drought water conservation guidelines that call for a 2-week shortening of the navigation season length if system storage falls to 52 MAF by July 1 of any year, and progressive shortening up to 4 weeks at 44 MAF on any July 1. These studies utilize the service level guidelines published in the current Master Manual which call for full service flows if system storage is 54.5 MAF or more on March 15 or 59 MAF or more on July 1 of any year. They also call for minimum service flows if system storage falls to 46 MAF by March 15 or 50.5 MAF by July 1 of any year.

The second set of results presented uses drought water conservation guidelines identical to those published in the current Master Manual. These guidelines call for a 1-week shortening of the navigation season if system storage falls to 40 MAF by any July 1 and would result in a progressive shortening up to 10 weeks at 25 MAF or less on any July 1. This set of guidelines calls for full service flows if system storage is 54.5 MAF or more on March 15 or 59 MAF or more on July 1 of any year. It also calls for minimum service flows if system storage falls to 46 MAF by March 15 or 50.5 MAF by July 1 of any year.

Only one set of Median and Lower Quartile runs is presented since system storage would not fall below the drought water conservation trigger points under either set of guidelines during the study period assuming those two runoff scenarios. For all scenarios, from mid-May through

TABLE VI
MISSOURI RIVER MAIN STEM
WATER USE FOR CALENDAR YEARS 1997, 1998, AND 1999 ABOVE SIOUX CITY, IOWA
in Million Acre-Feet (MAF)

		CY 1997 Actual	CY 1998 Basic Forecast	Forecast for Calendar Year 1999 Upper Decile	Upper Quartile	Median	Lower Quartile	Lower Decile
Upstream Depletions	(1)							
Irrigation, Tributary Reservoir Evaporation & Other Uses		1.6	1.6					
Tributary Reservoir Storage Changes		0.2	- 0.1					
Total Upstream Depletions		1.8	1.5	1.7	1.7	1.8	1.5	1.6
Main Stem Reservoir Evaporation	(2)	2.6	2.4	1.2	1.4	1.8	2.1	2.0
Sioux City Flows								
Navigation Season								
Unregulated Flood Inflows Between Gavins Point & Sioux City	(3)	0.8	0.0					
Navigation Service Requirement		15.0	15.2	18.6	18.1	16.6	16.0	15.5
Supplementary Releases								
Endangered Species	(4)	0.0	0.4	0.0	0.0	0.4	0.4	0.3
Flood Evacuation	(5)	20.2	0.6	7.9	4.6	0.0	0.0	0.0
Nonnavigation Season								
Flows		4.3	4.0	4.3	3.9	4.4	4.0	3.5
Flood Evacuation Releases	(6)	3.2	1.8	0.8	0.7	0.0	0.0	0.0
Main Stem System Storage Change		1.1	-1.6	0.0	0.2	- 0.4	- 4.5	- 7.4
Total		49.0	24.3	34.5	30.6	24.6	19.5	15.5
Project Releases								
Fort Peck		9.6	6.4	9.4	8.6	7.0	6.8	6.7
Garrison		25.2	15.2	22.1	20.1	16.7	16.1	14.9
Oahe		31.1	16.7	25.5	22.6	18.5	18.6	18.2
Big Bend		31.6	16.8	25.4	22.5	18.4	18.5	18.1
Fort Randall		34.5	17.6	26.8	23.6	19.1	18.8	18.2
Gavins Point		37.9	20.3	28.8	25.4	20.4	19.9	19.2

(1) Tributary uses, above the 1949 level of development including agricultural depletions and tributary storage effects.
(2) Net Evaporation is shown for 1999.
(3) Incremental inflows to reach which exceed those usable in support of navigation at the target level, even if Gavins Point releases were held to as low as 6,000 cfs.
(4) Increased releases required to maintain navigation release flexibility during the endangered species nesting season.
(5) Includes flood control releases for flood control storage evacuation and releases used to extend the navigation season beyond the normal December 1 closing date at the mouth of the Missouri River.
(6) Releases for flood control storage evacuation in excess of a 15,000 cfs Fort Randall release.

July, Gavins Point releases are set to the anticipated August release required to meet downstream flow targets, to minimize inundation of interior least tern and piping plover nests.

A. <u>Median Runoff</u>. System storage would begin in March 2000 at 56.7 MAF and would decline to 52.9 MAF by March 2005. An 8-month navigation season would be provided through the entire study period. Full service flows and winter power releases would be maintained through 2002 with only modest reductions in 2003 and 2004.

B. <u>Lower Quartile Runoff</u>. System storage would begin the period at 51.2 MAF and fall to 48.8 MAF by March 2005. An 8-month navigation season would be provided through 2004. Service level would vary from 1,900 cfs and 3,200 cfs below full service in the spring and summer of 2000 to 3,600 and 4,200 cfs below full service in the spring and summer of 2004.

C. <u>Lower Decile Runoff - Navigation Season Shortened at 52 MAF on July 1</u>. System storage would begin the period at 48.5 MAF and fall to 39.8 MAF by March 2005. The navigation season would be shortened by 2 weeks in 2000, by 3 weeks in 2001 - 2003, and by 4 weeks in 2004. Service level would vary from 3,900 cfs below full service and minimum service (6,000 cfs below full service) in the spring and summer of 2000, to minimum service for the remainder of the study period (2001 - 2004).

D. <u>Lower Decile Runoff - Navigation Season Shortened at 40 MAF on July 1</u>. System storage would begin the period at 48.5 MAF and fall to 35.9 MAF by March 2005. An 8-month navigation season would be provided through 2004. Service level would vary from 3,300 cfs below full service and minimum service in the spring and summer of 2000 to minimum service for the remainder of the period (2001-2004).

Plate 11 presents system storage, Gavins Point regulated flow, and system peaking capability for Median, Lower Quartile, and Lower Decile for both sets of guidelines, for the period 2000 - March 2005. Peak power, or peaking capability, is the amount of power available when all powerplants are operating at maximum.

Plate 12 presents reservoir elevations for Fort Peck, Garrison, Oahe, and Fort Randall for Median, Lower Quartile, and Lower Decile for both sets of guidelines, for the period 2000 - March 2005.

A summary of Engineering Data for the main stem reservoir system is shown on **Plate 2**.

Missouri River Basin

Plate 1

Item No.	Subject	Fort Peck Lake	Garrison Dam - Lake Sakakawea	Oahe Dam - Lake Oahe
	Summary of Engineering Data -- Missouri River Main Stem Reservoirs			
1	Location of Dam	Near Glasgow, Montana	Near Garrison, ND	Near Pierre, SD
2	River Mile - 1960 Mileage	Mile 1771.5	Mile 1389.9	Mile 1072.3
3	Total & incremental drainage areas in square miles	57,500	181,400 (2) 123,900	243,490 (1) 62,090
4	Approximate length of full reservoir (in valley miles)	134, ending near Zortman, MT	178, ending near Trenton, ND	231, ending near Bismarck, ND
5	Shoreline in miles (3)	1520 (elevation 2234)	1340 (elevation 1837.5)	2250 (elevation 1607.5)
6	Average total & incremental inflow in cfs	10,200	25,600 15,400	28,900 3,300
7	Max. discharge of record near damsite in cfs	137,000 (June 1953)	348,000 (April 1952)	440,000 (April 1952)
8	Construction started - calendar yr.	1933	1946	1948
9	In operation (4) calendar yr.	1940	1955	1962
	Dam and Embankment			
10	Top of dam, elevation in feet msl	2280.5	1875	1660
11	Length of dam in feet	21,026 (excluding spillway)	11,300 (including spillway)	9,300 (excluding spillway)
12	Damming height in feet (5)	220	180	200
13	Maximum height in feet (5)	250.5	210	245
14	Max. base width, total & w/o berms in feet	3500, 2700	3400, 2050	3500, 1500
15	Abutment formations (under dam & embankment)	Bearpaw shale and glacial fill	Fort Union clay shale	Pierre shale
16	Type of fill	Hydraulic & rolled earth fill	Rolled earth filled	Rolled earth fill & shale berms
17	Fill quantity, cubic yards	125,628,000	66,500,000	55,000,000 & 37,000,000
18	Volume of concrete, cubic yards	1,200,000	1,500,000	1,045,000
19	Date of closure	24 June 1937	15 April 1953	3 August 1958
	Spillway Data			
20	Location	Right bank - remote	Left bank - adjacent	Right bank - remote
21	Crest elevation in feet msl	2225	1825	1596.5
22	Width (including piers) in feet	820 gated	1336 gated	456 gated
23	No., size and type of gates	16 - 40' x 25' vertical lift gates	28 - 40' x 29' Tainter	8 - 50' x 23.5' Tainter
24	Design discharge capacity, cfs	275,000 at elev 2253.3	827,000 at elev 1858.5	304,000 at elev 1644.4
25	Discharge capacity at maximum operating pool in cfs	230,000	660,000	80,000
	Reservoir Data (6)			
26	Max. operating pool elev. & area	2250 msl 246,000 acres	1854 msl 380,000 acres	1620 msl 374,000 acres
27	Max. normal op. pool elev. & area	2246 msl 240,000 acres	1850 msl 364,000 acres	1617 msl 360,000 acres
28	Base flood control elev & area	2234 msl 212,000 acres	1837.5 msl 307,000 acres	1607.5 msl 312,000 acres
29	Min. operating pool elev. & area	2160 msl 90,000 acres	1775 msl 128,000 acres	1540 msl 117,000 acres
	Storage allocation & capacity			
30	Exclusive flood control	2250-2246 975,000 a.f.	1854-1850 1,489,000 a.f.	1620-1617 1,102,000 a.f.
31	Flood control & multiple use	2246-2234 2,717,000 a.f.	1850-1837.5 4,222,000 a.f.	1617-1607.5 3,201,000 a.f.
32	Carryover multiple use	2234-2160 10,785,000 a.f.	1837.5-1775 13,130,000 a.f.	1607.5-1540 13,461,000 a.f.
33	Permanent	2160-2030 4,211,000 a.f.	1775-1673 4,980,000 a.f.	1540-1415 5,373,000 a.f.
34	Gross	2250-2030 18,688,000 a.f.	1854-1673 23,821,000 a.f.	1620-1415 23,137,000 a.f.
35	Reservoir filling initiated	November 1937	December 1953	August 1958
36	Initially reached min. operating pool	27 May 1942	7 August 1955	3 April 1962
37	Estimated annual sediment inflow	18,100 a.f. 1030 yrs.	25,900 a.f. 920 yrs.	19,800 a.f. 1170 yrs.
	Outlet Works Data			
38	Location	Right bank	Right Bank	Right Bank
39	Number and size of conduits	2 - 24' 8" diameter (nos. 3 & 4)	1 - 26' dia. and 2 - 22' dia.	6 - 19.75' dia. upstream, 18.25' dia. downstream
40	Length of conduits in feet (8)	No. 3 - 6,615, No. 4 - 7,240	1529	3496 to 3659
41	No., size, and type of service gates	1 - 28' dia. cylindrical gate 6 ports, 7.6' x 8.5' high (net opening) in each control shaft	1 - 18' x 24.5' Tainter gate per conduit for fine regulation	1 - 13' x 22' per conduit, vertical lift, 4 cable suspension and 2 hydraulic suspension (fine regulation)
42	Entrance invert elevation (msl)	2095	1672	1425
43	Avg. discharge capacity per conduit & total	Elev. 2250 22,500 cfs - 45,000 cfs	Elev. 1854 30,400 cfs - 98,000 cfs	Elev. 1620 18,500 cfs - 111,000 cfs
44	Present tailwater elevation (ft msl)	2032-2036 5,000 - 35,000 cfs	1670-1680 15,000- 60,000 cfs	1423-1428 20,000-55,000 cfs
	Power Facilities and Data			
45	Avg. gross head available in feet (15)	194	161	174
46	Number and size of conduits	No. 1-24'8" dia., No. 2-22'4" dia.	5 - 29' dia., 25' penstocks	7 - 24' dia., imbedded penstocks
47	Length of conduits in feet (8)	No. 1 - 5,653, No. 2 - 6,355	1829	From 3,280 to 4,005
48	Surge tanks	PH#1: 3-40' dia., PH#2: 2-65' dia.	65' dia. - 2 per penstock	70' dia., 2 per penstock
49	No., type and speed of turbines	5 Francis, PH#1-2: 128.5 rpm, 1-164 rpm , PH#2-2: 128.6 rpm	5 Francis, 90 rpm	7 Francis, 100 rpm
50	Discharge cap. at rated head in cfs	PH#1, units 1&3 170', 2-140' 8,800 cfs, PH#2-4&5 170'-7,200 cfs	150' 38,000 cfs	185' 54,000 cfs
51	Generator nameplate rating in kW	1&3: 43,500; 2: 18,250; 4&5: 40,000	3 - 109,250, 2 - 95,000	112,290
52	Plant capacity in kW	185,250	517,750	786,030
53	Dependable capacity in kW (9)	181,000	388,000	534,000
54	Avg. annual energy, million kWh (13)	1,170	2,472	2,898
55	Initial generation, first and last unit	July 1943 - June 1961	January 1956 - October 1960	April 1962 - June 1963
56	Estimated cost September 1996 completed project (14)	$158,428,000	$299,938,000	$346,521,000

Summary of Engineering Data -- Missouri River Main Stem Reservoirs

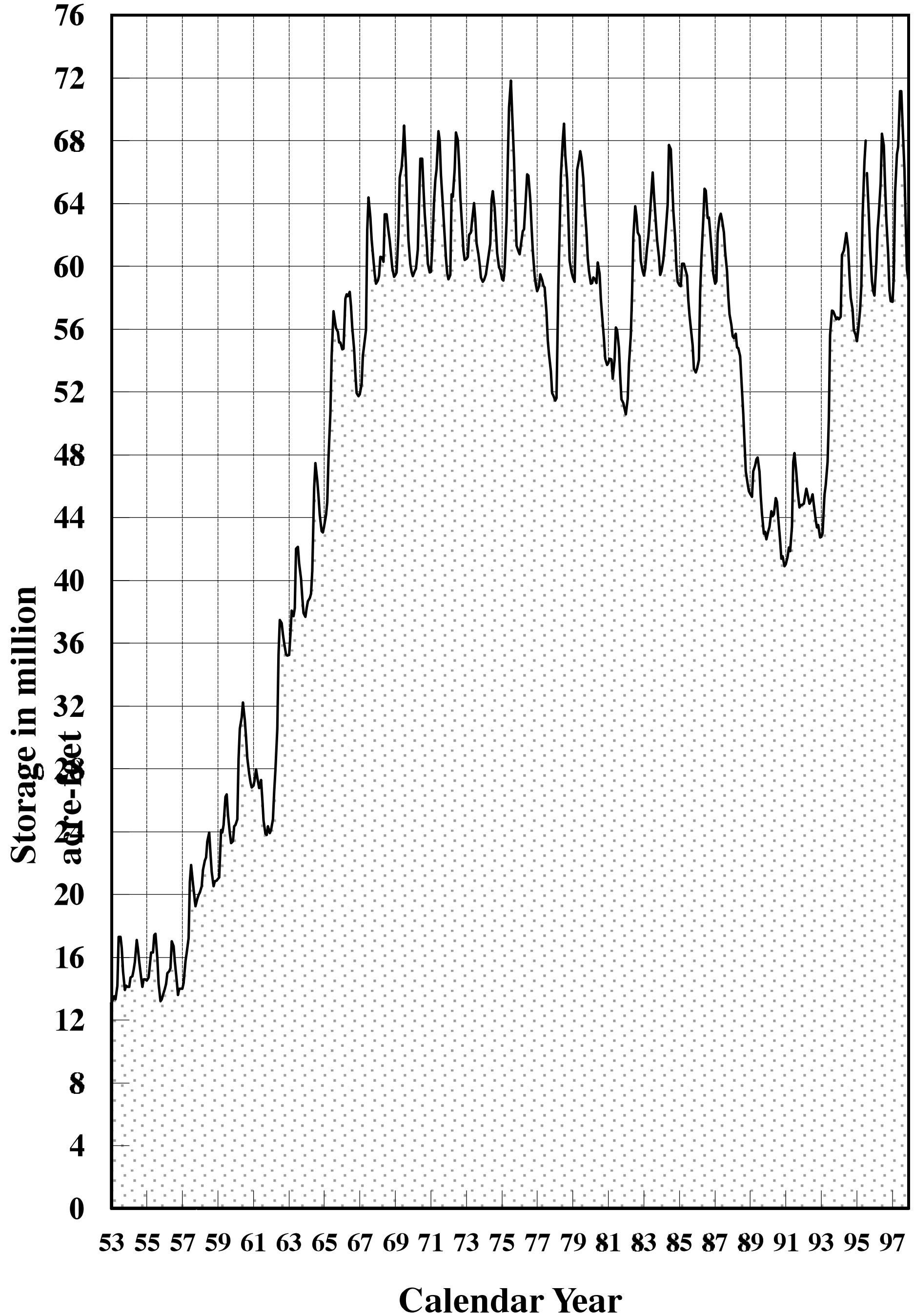
	Big Bend Dam - Lake Sharpe	Fort Randall Dam - Lake Francis Case	Gavins Point Dam - Lewis & Clark Lake	Total	Item No.
	21 miles upstream Chamberlain, SD	Near Lake Andes, SD	Near Yankton, SD		1
	Mile 987.4	Mile 880.0	Mile 811.1		2
	249,330 (1) 5,840	263,480 (1) 14,150	279,480 (1) 16,000		3
	80, ending near Pierre, SD	107, ending at Big Bend Dam	25, ending near Niobrara, NE	755 miles	4
	200 (elevation 1420)	540 (elevation 1350)	90 (elevation 1204.5)	5,940 miles	5
	28,900	30,000 1,100	32,000 2,000		6
	440,000 (April 1952)	447,000 (April 1952)	480,000 (April 1952)		7
	1959	1946	1952		8
	1964	1953	1955		9
	1440	1395	1234		10
	10,570 (including spillway)	10,700 (including spillway)	8,700 (including spillway)	71,596	11
	78	140	45	863 feet	12
	95	165	74		13
	1200, 700	4300, 1250	850, 450		14
	Pierre shale & Niobrara chalk	Niobrara chalk	Niobrara chalk & Carlile shale		15
	Rolled earth, shale, chalk fill	Rolled earth fill & chalk berms	Rolled earth & chalk fill		16
	17,000,000	28,000,000 & 22,000,000	7,000,000	358,128,000 cu. yds	17
	540,000	961,000	308,000	5,554,000 cu. yds.	18
	24 July 1963	20 July 1952	31 July 1955		19
	Left bank - adjacent	Left bank - adjacent	Right bank - adjacent		20
	1385	1346	1180		21
	376 gated	1000 gated	664 gated		22
	8 - 40' x 38' Tainter	21 - 40' x 29' Tainter	14 - 40' x 30' Tainter		23
	390,000 at elev 1433.6	620,000 at elev 1379.3	584,000 at elev 1221.4		24
	270,000	508,000	345,000		25
	1423 msl 61,000 acres	1375 msl 102,000 acres	1210 msl 31,000 acres	1,194,000 acres	26
	1422 msl 60,000 acres	1365 msl 95,000 acres	1208 msl 28,000 acres	1,147,000 acres	27
	1420 msl 57,000 acres	1350 msl 77,000 acres	1204.5 msl 24,000 acres	989,000 acres	28
	1415 msl 51,000 acres	1320 msl 38,000 acres	1204.5 msl 24,000 acres	450,000 acres	29
	1423-1422 60,000 a.f.	1375-1365 985,000 a.f.	1210-1208 59,000 a.f.	4,670,000 a.f.	30
	1422-1420 117,000 a.f.	1365-1350 1,309,000 a.f.	1208-1204.5 90,000 a.f.	11,656,000 a.f.	31
		1350-1320 1,607,000 a.f.		38,983,000 a.f.	32
	1420-1345 1,682,000 a.f.	1320-1240 1,517,000 a.f.	1204.5-1160 321,000 a.f.	18,084,000 a.f.	33
	1423-1345 1,859,000 a.f.	1375-1240 5,418,000 a.f.	1210-1160 470,000 a.f.	73,393,000 a.f.	34
	November 1963	January 1953	August 1955		35
	25 March 1964	24 November 1953	22 December 1955		36
	4,300 a.f. 430 yrs.	18,300 a.f. 250 yrs.	2,600 a.f. 180 yrs.	92,500 a.f.	37
		Left Bank			38
	None (7)	4 - 22' diameter	None (7)		39
		1013			40
		2 - 11' x 23' per conduit, vertical lift, cable suspension			41
	1385 (12)	1229	1180 (12)		42
		Elev 1375 32,000 cfs - 128,000 cfs			43
	1351-1355(11) 25,000-100,000 cfs	1228-1239 5,000-60,000 cfs	1155-1163 15,000-60,000 cfs		44
	70	117	48	764 feet	45
	None: direct intake	8 - 28' dia., 22' penstocks	None: direct intake		46
		1,074		55,083	47
	None	59' dia, 2 per alternate penstock	None		48
	8 Fixed blade, 81.8 rpm	8 Francis, 85.7 rpm	3 Kaplan, 75 rpm	36 units	49
	67' 103,000 cfs	112' 44,500 cfs	48' 36,000 cfs		50
	3 - 67,276, 5 - 58,500	40,000	44,100		51
	494,320	320,000	132,300	2,435,650 kw	52
	497,000	293,000	74,000	1,967,000 kw	53
	1,052	1,846	749	10,187 million kWh	54
	October 1964 - July 1966	March 1954 - January 1956	September 1956 - January 1957	July 1943 - July 1966	55
	$107,498,000	$199,066,000	$49,617,000	$1,161,068,000	56

Remarks

(1) Includes 4,280 square miles of non-contributing areas.
(2) Includes 1,350 square miles of non-contributing areas.
(3) With pool at base of flood control.
(4) Storage first available for regulation of flows.
(5) Damming height is height from low water to maximum operating pool. Maximum height is from average streambed to top of dam.
(6) Based on latest available storage data.
(7) River regulation is attained by flows over low-crested spillway and through turbines.
(8) Length from upstream face of outlet or to spiral case.
(9) Based on 8th year (1961) of drought drawdown (From study 8-83-1985).
(10) Storage volumes are exclusive of Snake Creek arm.
(11) Affected by level of Lake Francis case. Applicable to pool at elevation 1350.
(12) Spillway crest.
(13) 1967-1997 Average
(14) Source: Annual Report on Civil Works Activities of the Corps of Engineers. Extract Report Fiscal Year 1996.
(15) Based on Study 8-83-1985

Corps of Engineers, U.S. Army
Compiled by
Missouri River Division
May 1998

System Storage



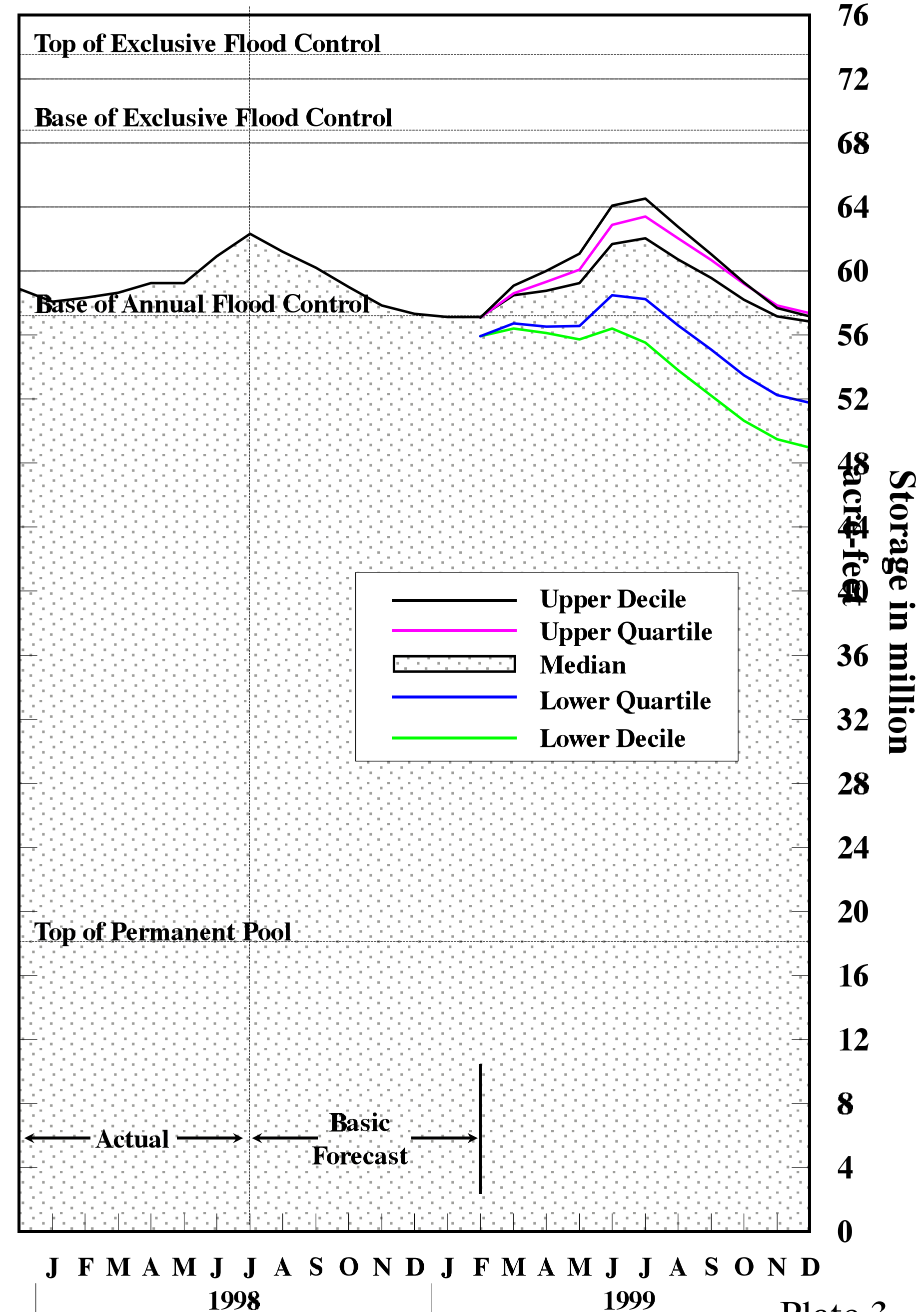


Plate 3

Gavins Point Releases

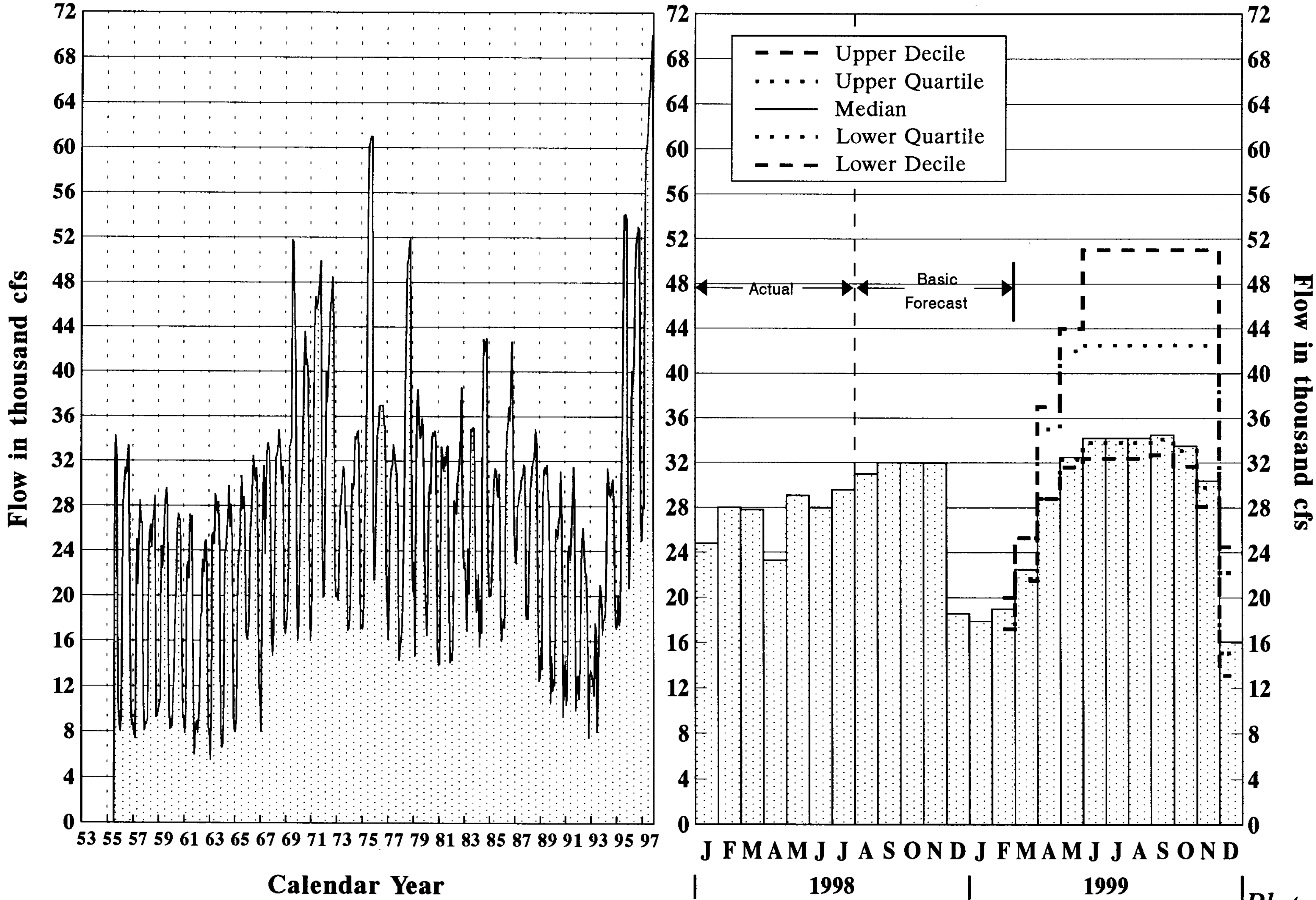


Plate 4

Fort Peck
Elevations and Releases

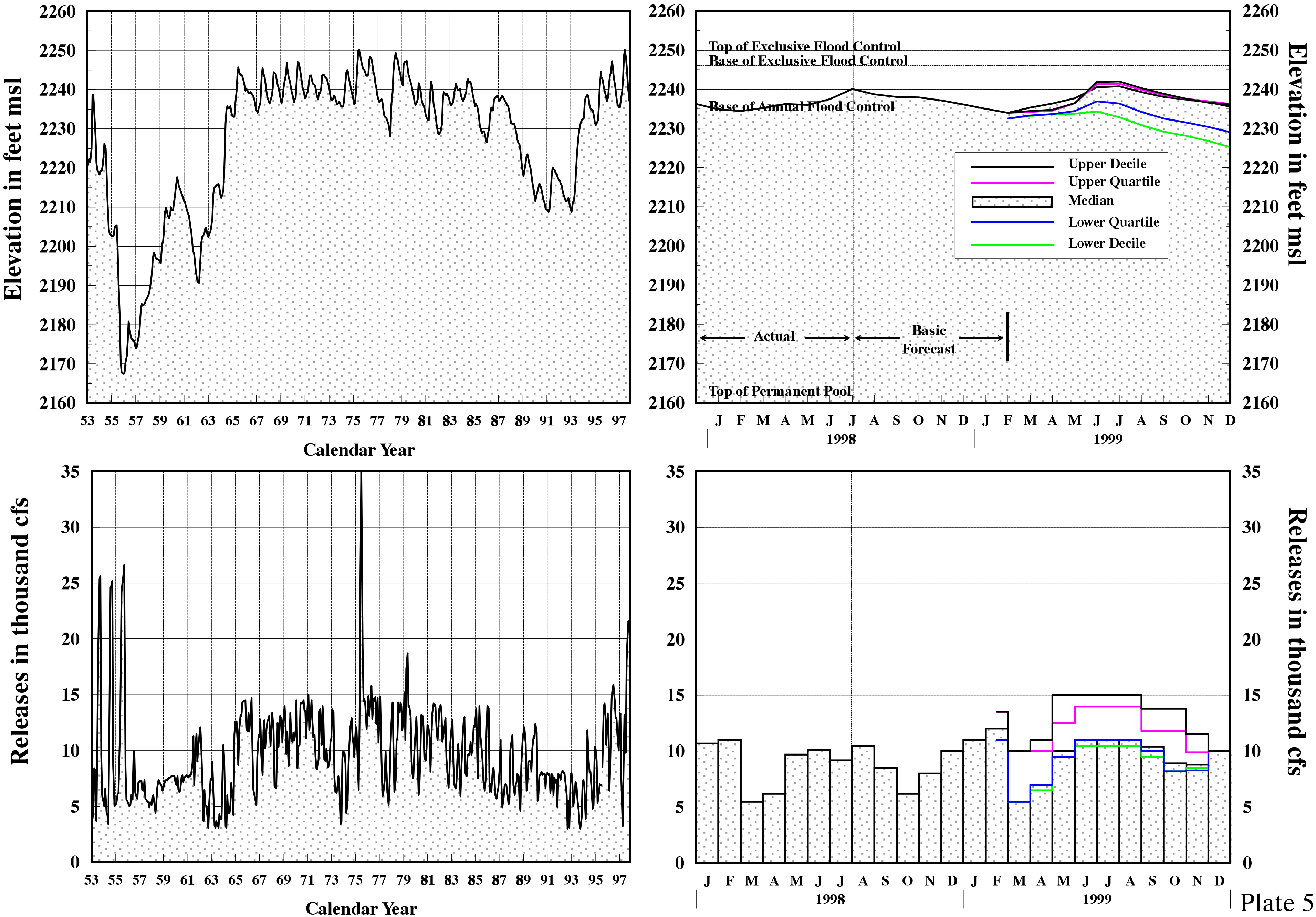


Plate 5

Garrison
Elevations and Releases

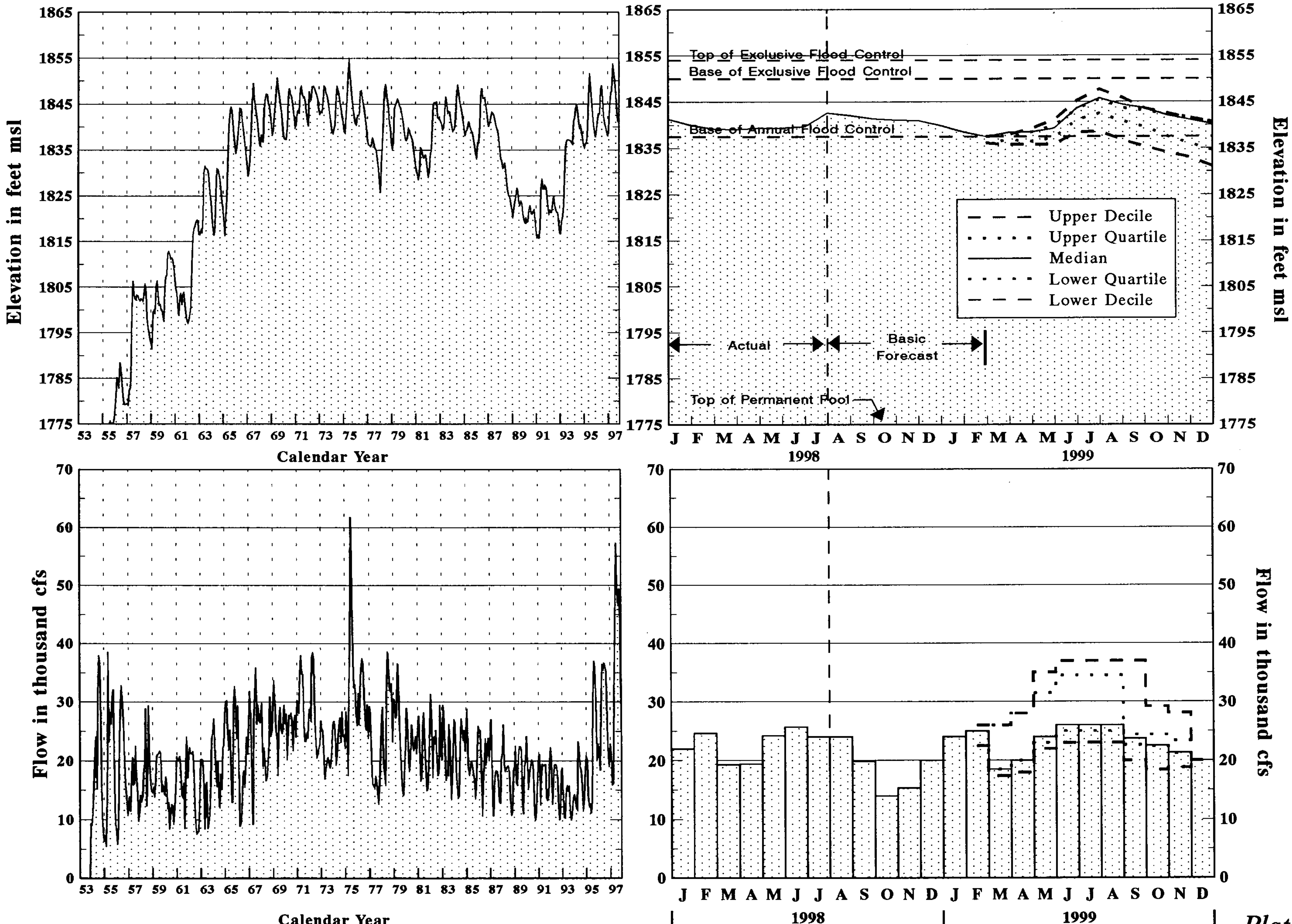


Plate 6

Oahe
Elevations and Releases

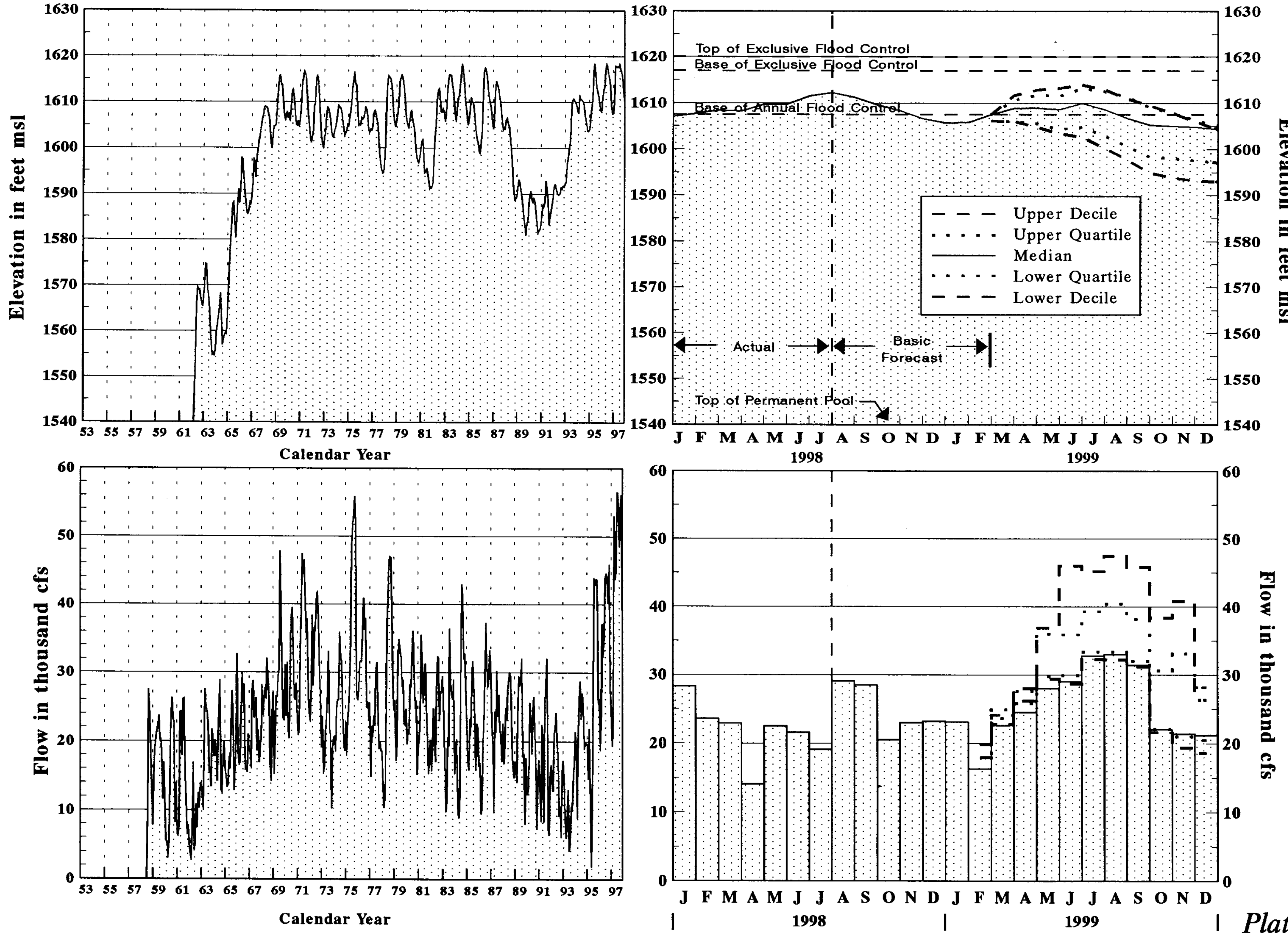


Plate 7

Fort Randall
Elevations and Releases

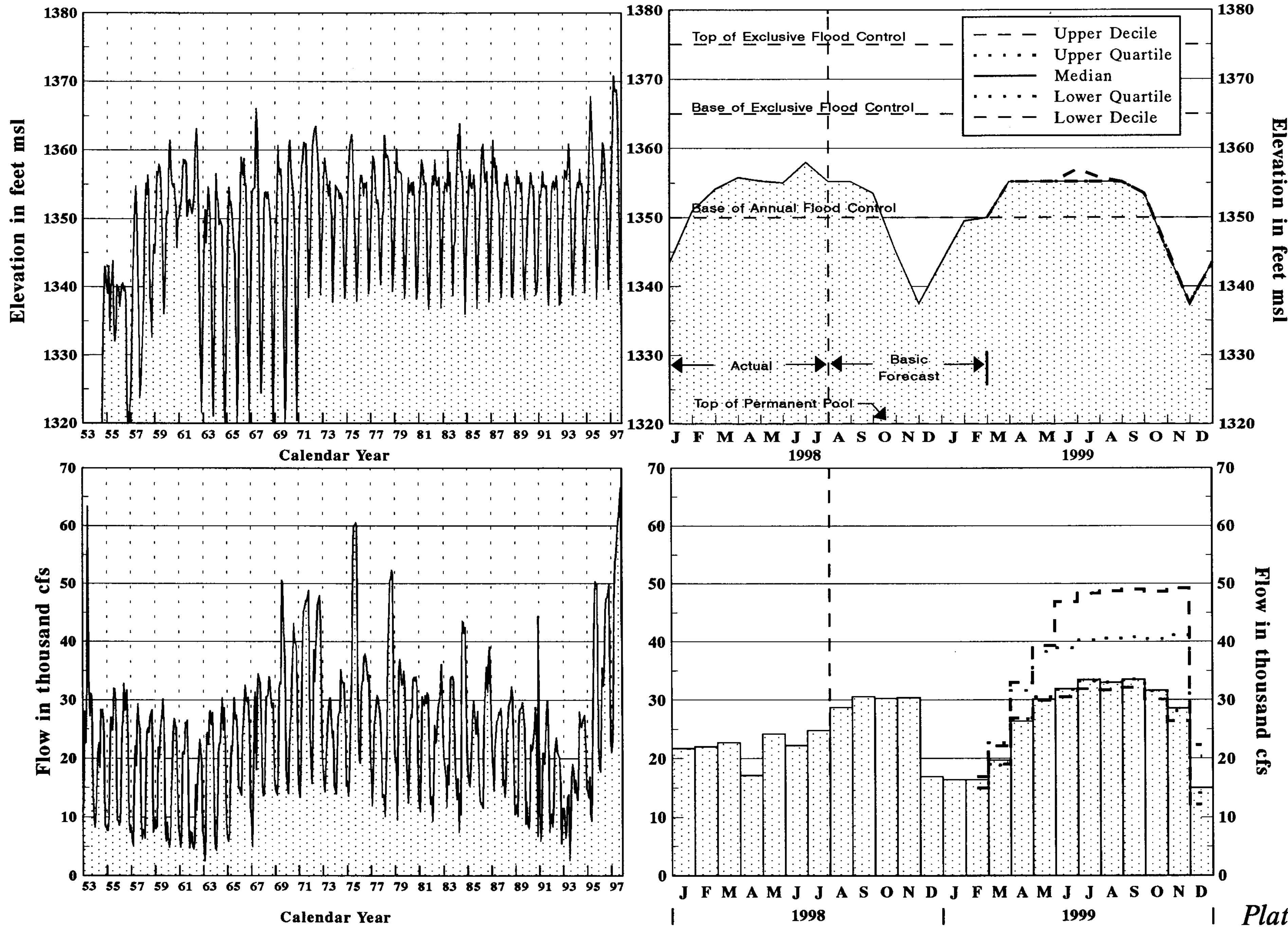
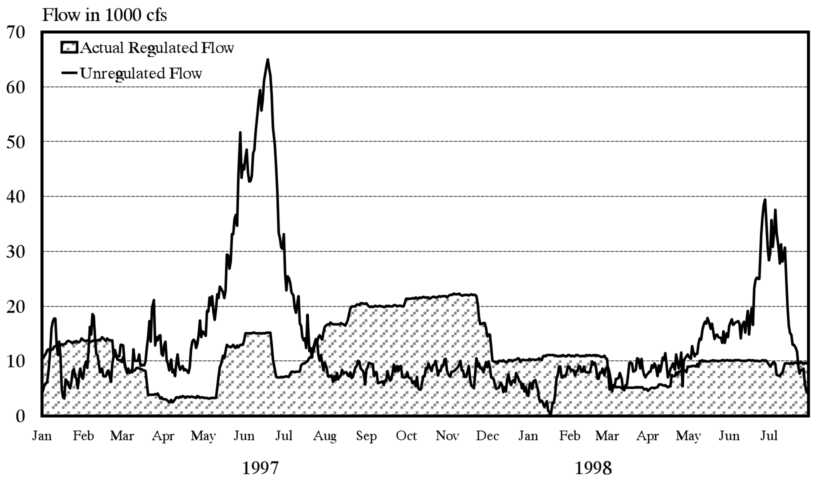


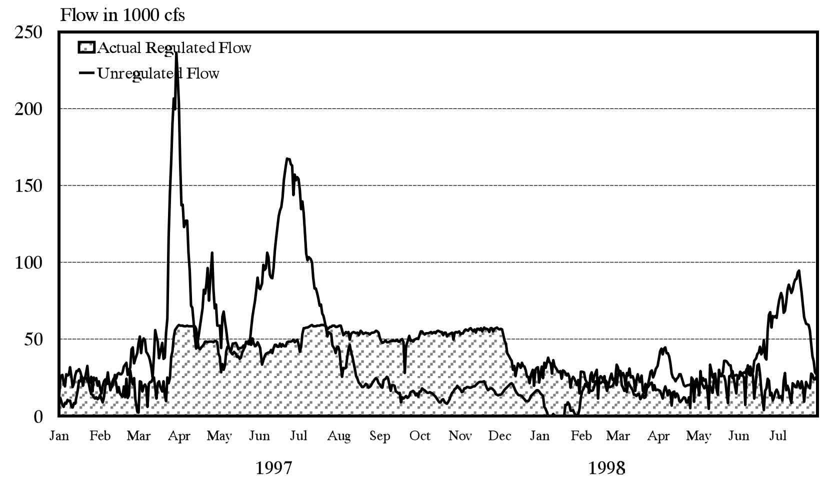
Plate 8

Reservoir Release and Unregulated Flow

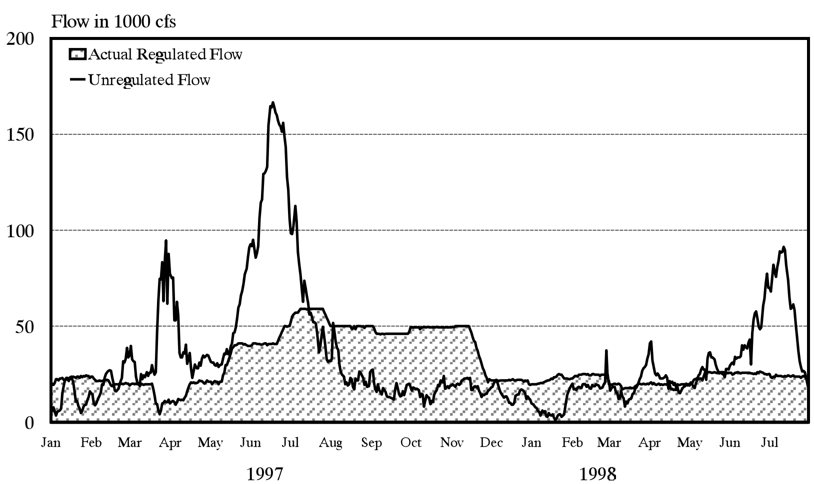
Fort Peck



Oahe



Garrison



Gavins Point

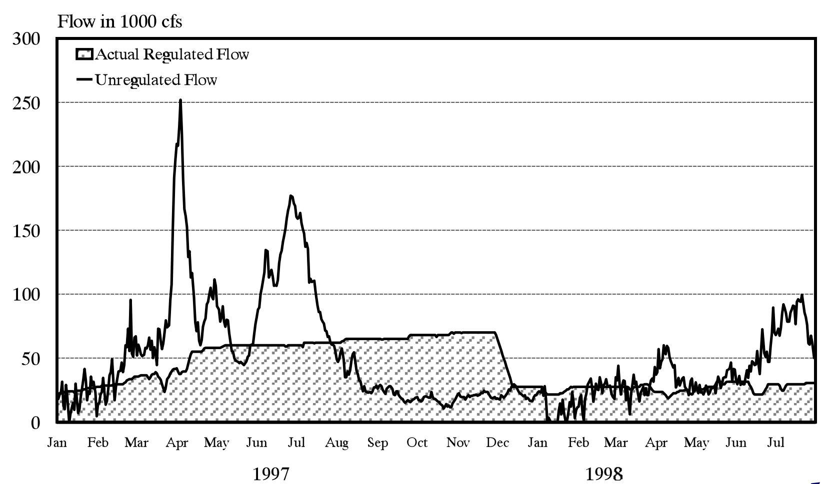


Plate 9

System Gross Capability and Average Monthly Generation

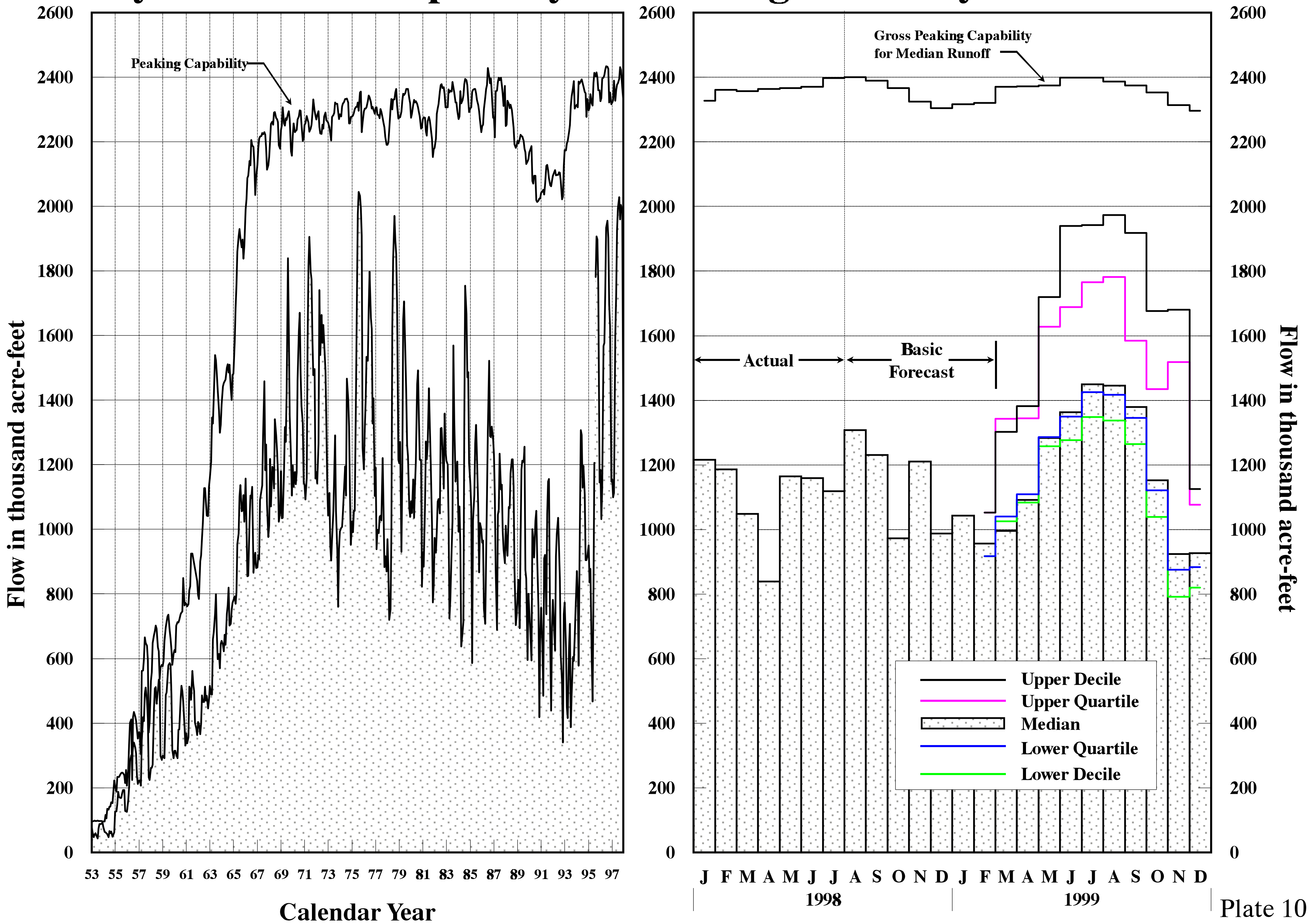


Plate 10

Tentative Five Year Extensions of 1998-1999 AOP

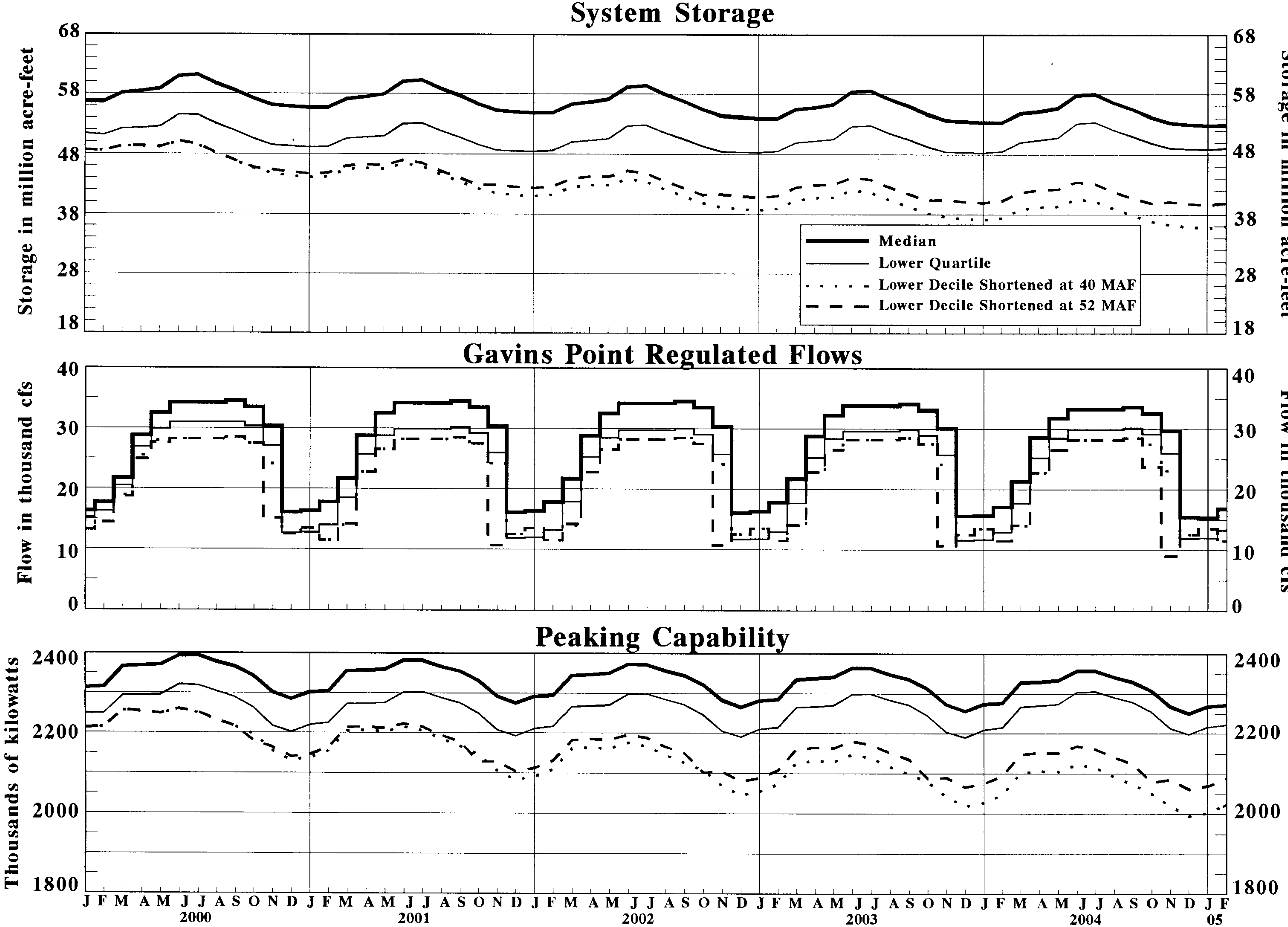


Plate 11

Tentative Five Year Extensions of 1998-1999 AOP

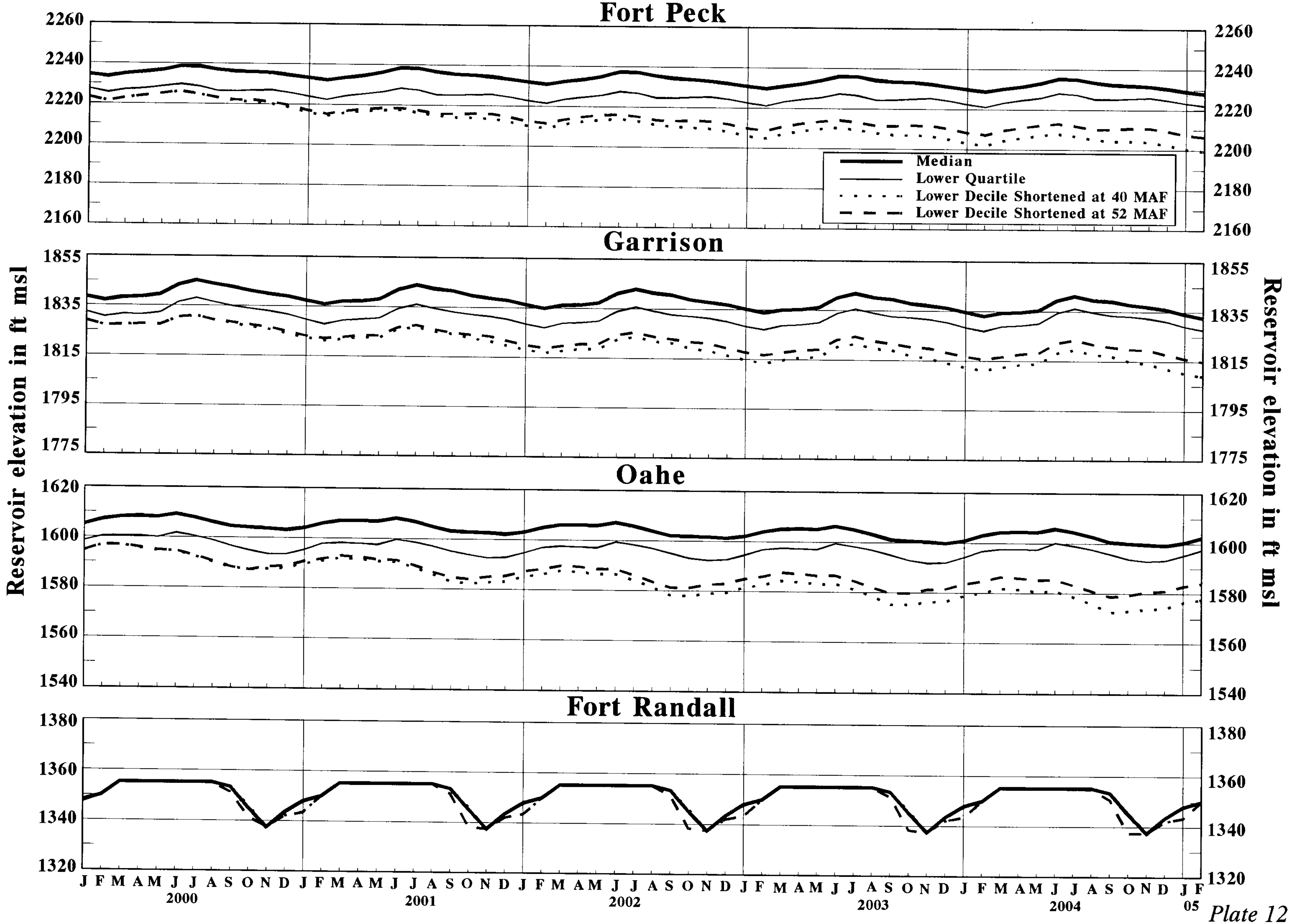


Plate 12

MRBA

Missouri River Basin Association

September 14, 1998

Mr. Larry Cieslik, Chief
Reservoir Control Center
U.S. Army Corps of Engineers, MRR Office
12565 West Center Rd.
Omaha, NE 68144

Dear Mr. Cieslik:

Thank you for the opportunity to comment on the upcoming plan for the Missouri River's Annual Operating Plan (AOP).

As you know, we recently developed a set of planning recommendations designed to improve the overall economic and environmental conditions of the Missouri River basin. Your agency was very helpful to this effort. We are now turning our attention to the Master Manual Review process. We hope to work with people throughout the basin to develop a consensus position on a new operating plan for the river.

Our focus on the Master Manual Review has prevented us from devoting our attention to the 1999 Annual Operating plan. Therefore, we have no recommendation for you to consider prior to your publication of next year's draft AOP. We look forward to seeing your draft, and we may have comments for you after we review it.

Thank you for your consideration.

Sincerely,

Bud Clinch

Bud Clinch, President
Missouri River Basin Association

P.O. Box 301 Lewistown, Montana 59457-0301 406-538-4469 Fax 406-538-4369

Exhibit 1

Missouri River Natural Resources Committee

"CARING FOR THE MISSOURI RIVER'S RESOURCES"

September 4, 1998

Colonel Michael Mueleners
Northwestern Division, Corps of Engineers
12565 W. Center Road
Omaha, NE 68144-3869

Dear Colonel Mueleners:

I am pleased to submit the following recommendations of the Missouri River Natural Resources Committee (MRNRC) for operation of the Missouri River system during 1998/1999. These recommendations were developed by our Fish Technical Section and Tern & Plover Subcommittee and adopted by our official MRNRC state delegates. I also want to thank your Reservoir Control Center staff for their close coordination and efforts this year to maintain minimum flows below Fort Randall Dam and Gavins Point Dam during the fish spawning season.

AQUATIC HABITAT AND FISHERY RECOMMENDATIONS

Inter-reservoir and Open River Reaches

- The Corps should implement spawning releases with relatively high spring flows peaking in early June and steady to slowly declining levels for the remainder of the year. These releases would provide spawning triggers and habitats for native riverine species. These releases should be attempted at Fort Peck, Fort Randall, and Gavins Point Dams.

- The Corps should maintain minimum instantaneous flow releases from each dam (even during downstream flood events) to maintain a wetted perimeter, necessary to sustain fish populations. Gavins Point should have a minimum discharge of 9 thousand cubic-feet-per-second (kcfs) which would provide for downstream water quality and National Scenic Rivers support; Fort Randall should have a minimum release of 9 kcfs. Fort Peck Dam should have an absolute minimum instantaneous discharge of 4.5 kcfs from April 1 through September 30 to ensure basic recruitment of rainbow trout. The recommended absolute minimum instantaneous discharge from Fort Peck Dam from October 1-March 31 is 3.0 kcfs. All other dams should have a hourly minimum of 7.5 kcfs. Minimum flows need to be maintained out of Big Bend Dam on the weekends to facilitate recreation. During the spawning season (May 15-June15), a minimum instantaneous discharge of 15 kcfs should be maintained from Fort Randall Dam. These minimums will be examined by the MRNRC on a case by case basis and refined as new data become available.

- The Corps should release warm water (surface or near surface) from either Fort Randall or Fort Peck Dams each year during the fish spawning season, under near normal water conditions.

- The Corps should release up to 30,000 cfs from Fort Peck Dam beginning in early June at least once every

Exhibit 2

four years when conditions allow. This discharge would produce a pulse of water that sturgeon, paddlefish, sauger, and other native species key on for pre-spawn staging. In addition, this flow may improve nesting habitat for terns and plovers by pushing up unvegetated sandbars to elevations that would not then become inundated during the nesting period.

- The Corps should release at least 25 % of the total discharge from Fort Peck Dam through the spillway from mid-June to mid-July to provide a more normal temperature profile. Suitable water temperature is critical to the development and survival of native riverine fish eggs, fry, and juveniles.

- Spiking of water releases from the dams for terns and plovers should be eliminated. We appreciate the efforts of the Corps in recent years to reduce spiking releases. We also ask that spiking or flood sag measures not be referenced as Corps management actions for interior least terns and piping plovers. These measures are primarily taken to either conserve water for navigation (spiking) or to lower downstream stages during high flow events.

Main Stem Reservoirs

- The Corps should implement offset storage in Fort Peck Lake and Lakes Sakakawea and Oahe if March 1 runoff projections are upper quartile or greater. Lake Oahe is the priority for the coming water year if offset storage is implemented. Offset storage would expose shorelines and stimulate the growth of shoreline vegetation and increase riverine habitat in the headwaters area of the affected reservoir. Subsequent submergence of this shoreline vegetation would increase natural reproduction of fish in the reservoir and provide cover for fry. In addition, offset storage would aid in the implementation of the Fort Peck discharge and temperature requests.

- **Fort Peck Lake**

  A maximum reservoir elevation of 2240.5 ft. msl was reached on July 25, 1998. A rise in pool of at least three feet above that level is recommended by May 1, 1999, to ensure shoreline vegetation is inundated. Flooded vegetation will provide spawning and rearing habitat for forage fish species such as yellow perch and game fish species like northern pike. A rising, or at least a static pool, is recommended through June to accommodate late spring and early summer spawners and provide rearing cover for young-of-the-year forage and game fish species.

- **Lake Sakakawea**

  A. An absolute open-water minimum lake elevation of 1822 ft. msl for drought periods and 1832 ft. msl for all other years is recommended. Below these specified elevations, the following negative circumstances affect the fishery resource or its use: a substantial loss of walleye spawning substrate (gravel/cobble) and coldwater habitat (for chinook salmon and rainbow smelt); critically needed water becomes less available to the Garrison Dam National Fish Hatchery for production; and boat access/recreation use becomes limited.

  B. Other than years in which severe drought conditions prevail, a maximum lake elevation window of 1838 to 1846 ft. msl is requested in order to maintain flexibility in annual recommendations and to reduce impacts from wave erosion.

  C. The spring water level rise must inundate good spawning substrate (i.e. cobble and/or terrestrial vegetation) by April 15 and continue to rise during spawning-incubation (April-May). A target increase of two-three feet between April 15 and May 15 should be established during a filling cycle. Even during a drawdown cycle or during drought conditions stabilizing the lake elevation should be attempted during this critical time period.

  D. Utilization of inundated terrestrial vegetation should be optimized during a filling cycle. When possible, an effort to flood a minimum of three vertical feet of two-year-old terrestrial vegetation should be attempted between April (ice-out) and mid-June. Also following a short-term drawdown, the inundation of four feet (minimum) of one-year-old vegetation (primarily matted smartweed) should be attempted between April and July. Flooding of vegetation from August through February serves no fishery purpose and is not recommended. Short-term peaking of the reservoir is discouraged.

- **Lake Oahe**

A. An absolute open-water minimum lake elevation of 1590 ft. msl for drought periods and 1600 ft. msl for all other years is recommended. Elevations below these minimal levels eliminate a tremendous amount of fish habitat. The upper stretch of Lake Oahe (North Dakota) is characterized by a shallow floodplain and during low water years much of this reach recedes into the original channel.

B. Other than during years of severe drought, a maximum lake elevation window of 1606 to 1616 ft. msl should be established to provide a degree of latitude for making annual recommendations and to a lesser extent reduce the impacts of bank erosion.

C. During a filling cycle, the spring water level rise must inundate favorable spawning substrate (i.e. cobble and/or terrestrial vegetation) by April 15 and continue to rise into June. If a rising pool is not possible during a drawdown cycle or drought conditions, then at least a stable pool must be achieved during this critical time period.

D. Whenever terrestrial vegetation is flooded, it is strongly recommended a target of inundating a minimum of three vertical feet of two-year-old terrestrial vegetation between April (ice-out) and mid-June be established. Flooding of vegetation from August through February serves no fishery purpose and is not recommended. Also following a short-term drawdown, the inundation of four feet (minimum) of one-year-old vegetation (primarily matted smartweed) should be attempted between April and July. Short-term peaking of the reservoir is discouraged.

- **Lake Francis Case**

A. Reach a water level elevation of 1355 ft. msl by mid-April that remains stable or increases to no more than elevation 1360 ft. msl through June. Any declines in lake elevation from mid-April through June need to be avoided. Elevations greater than 1360 ft. msl restrict recreational boating access and cause shoreline erosion problems.

B. The scheduled fall drawdown needs to continue the normal pattern of not beginning before October 1, again to facilitate recreational boating access.

- **Lewis & Clark Lake**

A. The water elevation should be held at 1206-1207 msl with limited fluctuations during May and July for fish spawning and nursery areas. Water levels during the rest of the year should be held stable as much as possible for recreational purposes and to avoid shoreline damage.

OPERATIONS FOR INTERIOR LEAST TERNS AND PIPING PLOVERS

- The Corps should schedule reservoir releases periodically to recreate interior least tern and piping plover sandbar habitat below Gavins Point Dam, Garrison Dam, Fort Randall Dam, and Fort Peck Dam when water supply conditions are favorable. Such releases should coincide with spring releases for fish spawning as much as possible and be followed by stable to declining flows during the nesting season.

  Preliminary indications from the 1998 nesting season are that interior least tern and piping plover fledge ratios may meet 1990 Biological Opinion targets for the first time. This is a result of the higher than normal reservoir releases of the past several years that pushed up and scoured sandbars resulting in a dramatic increase in high-elevation, unvegetated bars. The availability of desired quantity and quality sandbar nesting habitat throughout tern and plover nesting reaches dispersed the birds, thereby reducing predation, recreational, and weather-related impacts, and greatly reduced the risk of nest loss through operational and natural flooding events. The higher-elevation habitat should also increase Corps flexibility in managing for other authorized purposes.

- The Corps should identify what characteristics of the previous years' high flows, e.g., magnitude, timing, duration, created the extensive sandbar habitat of the past several years. Furthermore, causative factors and relationships (flow magnitude, timing, duration, sediment supply) affecting sandbar erosion, vegetative encroachment, and elevation under normal and below normal water supply conditions should also be determined. Experience from previous years indicates that sandbar habitat will decline under the Current Water Control Plan with normal or below normal runoff. Provision of this information will be essential to future management recommendations.

- The Corps should schedule daily operations that maximize tern and plover production during next year's nesting season. We recommend that operations maximize the availability of sandbar habitat, especially in the reaches below Garrison and Gavins Point Dams. We have advocated for some time now that the availability and condition of sandbar habitat during the nesting season is the key to tern and plover productivity and ultimately, their survival and recovery on the Missouri River. Populations of both terns and plovers have declined and system-wide productivity has been critically low to non-existent. Between 1988 and 1997 fledge ratio goals for terns were only met once (1989) and from 1994-1997 numbers of least terns declined by 37 percent. The fledge ratio has never been met for piping plovers (1988-1997) and from 1994-1997 plover numbers declined by 67 percent. It is paramount that productivity be maximized during this period of better habitat conditions made possible by the higher than normal reservoir releases in 1998.

  The 1998 nesting season has verified that Missouri River flows can be managed to effectively restore sandbar nesting habitat and increase the productivity of terns and plovers. As recommended above, the Corps should identify those operations (flow magnitude, timing, duration, and frequency) that create favorable sandbar habitat conditions for terns and plovers. Those operations should be incorporated into the Annual Operating Plan and scheduled when necessary to recover interior least tern and piping plover populations on the Missouri River.

- The Corps should complete the Missouri River Least Tern and Piping Plover Management Plan within the coming year. We support the Corp's commitment to develop this plan and our Tern and Plover Subcommittee has offered their assistance in its development. We believe such a plan is critical to recovering tern and plover populations on the Missouri River and should be a high priority within the Corps. We have yet to be contacted for any involvement in plan development, but remain available to assist with the plan and expedite its completion.

- The Corps should develop annual sandbar habitat/flow relationships within tern and plover nesting reaches. The importance of annually monitoring sandbar habitat/flow relationships cannot be understated. The availability of such data on an annual basis will be invaluable in the future if we are to recover tern and plover populations with changing biological and hydrological conditions. We support the Corp's work on identifying sandbar habitat and sandbar habitat trends through Geographic Information System (GIS) and Global Positioning System (GPS) techniques. We recognize that development of the GIS database is expensive and time-intensive and in the interim we recommend that aerial photos be taken at several flows within each nesting reach this fall or next spring that would allow habitat/flow relationships to be developed. If GIS data for the Gavins Point and Garrison Dam reaches is sufficiently developed, please provide to us and the U.S. Fish & Wildlife Service so that we can formulate the best annual operating recommendations possible.

- In 1996 and 1997 we requested a written response from the Corps outlining which of our AOP recommendations were implemented, which were not, and why. These requests were made so that we could obtain constructive feedback and adjust our recommendations if necessary for future AOPs. It is not always clear to us which of our recommendations are implemented on an annual basis. Formulation of our AOP recommendations would be greatly assisted by a letter from the Corps sometime from mid-July to mid-August which identifies which recommendations were implemented and evaluates how implementation affected operations. Provision of the letter at that time would allow us to use that information to formulate our recommendations in time for inclusion in next year's draft AOP.

I trust these recommendations will be helpful to your staff in developing the Annual Operating Plan for next year. If you have any questions concerning these recommendations, please contact Jim Riis, incoming MRNRC Chair at 605-773-6770 or our Coordinator, Mike LeValley, at the address or telephone number listed above.

Sincerely,

Michael J LeValley for

Gordon Farabee
MRNRC Chair
Missouri Department of Conservation

cc: MRNRC Delegates
MRNRC Ex-Officio Members and
Cooperating Agencies
MRBA Executive Director

News Release

US Army Corps
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Date: Dec. 30, 1998

FOR IMMEDIATE RELEASE

OMAHA -- The U.S. Army Corps of Engineers announced today its Annual Operating Plan for the Missouri River main stem dams and reservoirs for next year.

"The plan continues to provide good service to all users, both river and lake," said Col. Michael Meuleners, Missouri River Region Deputy Division Engineer. "We are on schedule to evacuate the excess water from the reservoirs. We should start the 1999 runoff season with sufficient capacity to capture next year's runoff and help prevent flooding of farmland along the river and still have plenty of water in storage to meet the needs of water-users throughout the basin," he said.

Releases to support navigation in 1999 will be in accordance with the operational objectives described in the current Master Water Control Manual. No major changes were made to the draft plan as a result of comments received during the review period. Two public meetings were conducted Oct. 26-27 in Sioux City, Iowa, and Nebraska City, Neb.

"Releases this winter should be high enough to provide adequate service to downstream municipal intakes," said Colonel Meuleners. "Higher than normal flows will continue all winter as we evacuate water in preparation for next year's runoff."

A number of clarifications and word changes were made to the draft to improve readability. Army Corps officials will distribute the final report next month.

Exhibit 3

Public meetings will be conducted in April 1999 to update the spring runoff outlook and review the operational plans for the remainder of the year. Specific dates and locations will be announced prior to the meetings.

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Daily reservoir and river information is available from the Reservoir Control Center by calling the recorded voice/fax message at (402) 697-2678. It is also available on the water management section of the Northwestern Division homepage at www.nwd.usace.army.mil.

VALUES IN 1000 AF EXCEPT AS INDICATED

	31JUL98 INI-SUM	1998 31AUG	30SEP	31OCT	15NOV	22NOV	30NOV	31DEC	1999 31JAN	28FEB
--FORT PECK--										
NAT INFLOW	2480	350	340	395	195	91	104	330	315	360
DEPLETION	-582	-52	-117	-56	-17	-8	-9	-103	-124	-97
EVAPORATION	443	91	113	99	45	21	24	51		
MOD INFLOW	2619	311	344	352	167	78	89	382	439	457
RELEASE	3966	646	506	379	208	111	159	615	676	666
STOR CHANGE	-1348	-335	-162	-27	-41	-33	-70	-233	-237	-209
STORAGE	16353	16018	15856	15829	15788	15754	15685	15452	15215	15005
ELEV FTMSL	2240.2	2238.7	2238.0	2237.9	2237.7	2237.5	2237.2	2236.1	2235.0	2234.0
DISCH KCFS	9.2	10.5	8.5	6.2	7.0	8.0	10.0	10.0	11.0	12.0
POWER										
AVE POWER MW		145	117	85	96	110	137	137	150	163
PEAK POW MW		212	211	211	211	211	211	210	209	208
ENERGY GWH	658.1	107.9	84.3	63.2	34.7	18.5	26.4	101.9	111.7	109.6
--GARRISON--										
NAT INFLOW	2895	615	480	525	205	96	109	250	265	350
DEPLETION	-385	9	-90	61	-60	-28	-32	-67	-107	-72
CHAN STOR	-27	-13	19	23	-8	-10	-20	0	-10	-10
EVAPORATION	500	103	128	111	50	23	27	58		
REG INFLOW	6718	1136	967	755	414	201	253	874	1039	1079
RELEASE	8522	1476	1184	859	416	208	286	1230	1476	1388
STOR CHANGE	-1804	-339	-217	-104	-1	-7	-32	-355	-437	-310
STORAGE	19921	19582	19364	19260	19259	19252	19220	18864	18427	18117
ELEV FTMSL	1843.1	1842.1	1841.4	1841.1	1841.1	1841.1	1841.0	1839.9	1838.5	1837.5
DISCH KCFS	24.0	24.0	19.9	14.0	14.0	15.0	18.0	20.0	24.0	25.0
POWER										
AVE POWER MW		303	251	177	177	189	227	250	298	307
PEAK POW MW		490	487	486	486	486	486	481	476	473
ENERGY GWH	1291.2	225.7	181.0	131.3	63.5	31.8	43.5	186.3	221.3	206.6
--OAHE--										
NAT INFLOW	385	60	115	70	33	15	17	-5	10	70
DEPLETION	149	71	19	-4	3	1	1	13	17	28
CHAN STOR	-6		16	23		-4	-12	-8	-16	-4
EVAPORATION	493	104	128	109	49	23	26	55		
REG INFLOW	8259	1361	1168	846	397	196	264	1149	1453	1426
RELEASE	9862	1787	1694	1262	615	283	468	1427	1418	908
STOR CHANGE	-1603	-426	-526	-416	-218	-88	-204	-278	34	519
STORAGE	20443	20017	19490	19074	18857	18769	18565	18288	18322	18840
ELEV FTMSL	1612.4	1611.2	1609.6	1608.3	1607.6	1607.3	1606.6	1605.7	1605.8	1607.5
DISCH KCFS	19.1	29.1	28.5	20.5	20.7	20.4	29.5	23.2	23.1	16.3
POWER										
AVE POWER MW		382	371	267	267	263	378	297	294	210
PEAK POW MW		725	717	710	706	705	701	696	697	706
ENERGY GWH	1543.4	284.2	267.4	198.3	96.0	44.1	72.6	220.7	218.9	141.1
--BIG BEND--										
EVAPORATION	97	20	25	22	10	5	5	11		
REG INFLOW	9765	1768	1669	1241	605	279	463	1415	1418	908
RELEASE	9765	1768	1669	1241	605	279	463	1415	1418	908
STORAGE	1683	1683	1683	1683	1683	1683	1683	1683	1683	1683
ELEV FTMSL	1420.0	1420.0	1420.0	1420.0	1420.0	1420.0	1420.0	1420.0	1420.0	1420.0
DISCH KCFS	19.6	28.8	28.0	20.2	20.3	20.1	29.2	23.0	23.1	16.3
POWER										
AVE POWER MW		135	133	99	102	101	146	113	111	78
PEAK POW MW		509	517	538	538	538	538	538	530	529
ENERGY GWH	570.6	100.1	95.7	73.6	36.7	16.9	27.9	84.4	82.4	52.7
--FORT RANDALL--										
NAT INFLOW	175	45	45	10	5	2	3	5	20	40
DEPLETION	34	15	7	1	1	0	1	3	3	3
EVAPORATION	110	25	31	25	10	4	4	10		
REG INFLOW	9796	1773	1676	1225	599	276	460	1407	1435	945
RELEASE	10216	1768	1820	1862	903	421	482	1041	1008	911
STOR CHANGE	-420	5	-144	-637	-304	-145	-22	366	427	34
STORAGE	3544	3549	3405	2768	2464	2319	2297	2663	3090	3124
ELEV FTMSL	1355.1	1355.2	1353.5	1345.1	1340.4	1337.9	1337.5	1343.5	1349.5	1350.0
DISCH KCFS	24.8	28.7	30.6	30.3	30.4	30.4	30.4	16.9	16.4	16.4
POWER										
AVE POWER MW		239	253	240	227	220	217	125	128	132
PEAK POW MW		350	343	307	287	276	274	302	328	330
ENERGY GWH	976.2	178.2	182.0	178.5	81.8	36.9	41.6	93.2	95.3	88.5
--GAVINS POINT--										
NAT INFLOW	810	170	105	115	58	27	31	90	95	120
DEPLETION	28	10	-5	2	5	2	3	10	1	
CHAN STOR	16	-8	-3	1	0	0	0	25	1	
EVAPORATION	35	7	9	8	4	2	2	4		
REG INFLOW	10978	1913	1917	1968	952	444	508	1142	1103	1031
RELEASE	10984	1906	1904	1968	952	444	508	1142	1103	1057
STOR CHANGE	-6	7	13							-26
STORAGE	364	371	384	384	384	384	384	384	384	358
ELEV FTMSL	1206.2	1206.5	1207.0	1207.0	1207.0	1207.0	1207.0	1207.0	1207.0	1206.0
DISCH KCFS	29.6	31.0	32.0	32.0	32.0	32.0	32.0	18.6	17.9	19.0
POWER										
AVE POWER MW		102	105	106	106	106	106	65	63	66
PEAK POW MW		114	114	114	114	114	114	76	76	75
ENERGY GWH	445.7	76.2	75.9	78.8	38.1	17.8	20.3	48.1	46.5	44.0
--GAVINS POINT - SIOUX CITY--										
NAT INFLOW	475	120	85	65	30	14	16	40	25	80
DEPLETION	101	31	20	8	5	2	2	10	11	12
REGULATED FLOW AT SIOUX CITY										
KAF	11358	1995	1969	2025	978	456	521	1172	1117	1125
KCFS		32.4	33.1	32.9	32.9	32.9	32.9	19.1	18.2	20.3
--TOTAL--										
NAT INFLOW	7220	1360	1170	1180	525	245	280	710	730	1020
DEPLETION	-655	84	-166	12	-63	-29	-34	-134	-199	-126
CHAN STOR	-18	-20	32	46	-8	-14	-32	17	-25	-14
EVAPORATION	1679	349	435	374	167	77	88	189		
STORAGE	62308	61219	60183	58998	58434	58161	57834	57334	57120	57127
SYSTEM POWER										
AVE POWER MW		1307	1231	973	975	989	1210	987	1043	956
PEAK POW MW		2400	2390	2367	2342	2329	2324	2304	2317	2321
ENERGY GWH	5485.2	972.4	886.3	723.8	350.8	166.1	232.3	734.6	776.3	642.6
DAILY GWH		31.4	29.5	23.3	23.4	23.7	29.0	23.7	25.0	23.0
	INI-SUM	31AUG	30SEP	31OCT	15NOV	22NOV	30NOV	31DEC	31JAN	28FEB

VALUES IN 1000 AF EXCEPT AS INDICATED

31JUL98	INI-SUM	1998 31AUG	30SEP	31OCT	15NOV	22NOV	30NOV	31DEC	1999 31JAN	28FEB
--FORT PECK--										
NAT INFLOW	2976	420	408	474	234	109	125	396	378	432
DEPLETION	-524	-48	-126	-65	-1	0	0	-85	-121	-78
EVAPORATION	299	69	86	74	16	7	8	38		
MOD INFLOW	3201	399	448	465	219	102	117	443	499	510
RELEASE	4564	646	599	619	300	139	159	615	738	750
STOR CHANGE	-1362	-246	-151	-155	-81	-37	-42	-172	-239	-240
STORAGE	16353	16107	15956	15801	15720	15684	15642	15469	15231	14991
ELEV FTMSL	2240.2	2239.1	2238.4	2237.7	2237.4	2237.2	2237.0	2236.2	2235.1	2234.0
DISCH KCFS	9.2	10.5	10.1	10.1	10.1	10.0	10.0	10.0	12.0	13.5
POWER										
AVE POWER MW		145	139	139	138	137	137	137	164	182
PEAK POW MW		212	212	211	211	211	211	210	209	208
ENERGY GWH	756.1	107.9	99.9	103.1	49.8	23.1	26.3	101.9	121.8	122.3
--GARRISON--										
NAT INFLOW	3474	738	576	630	246	115	131	300	318	420
DEPLETION	-356	15	-75	56	-59	-28	-31	-74	-100	-60
CHAN STOR	-42	-13	4	0	0	1	0	0	-20	-15
EVAPORATION	337	78	97	84	18	8	9	43		
REG INFLOW	8014	1278	1157	1109	587	274	312	946	1136	1215
RELEASE	9828	1476	1428	1435	644	301	333	1230	1537	1444
STOR CHANGE	-1813	-197	-271	-326	-57	-27	-21	-284	-401	-229
STORAGE	19921	19724	19453	19127	19070	19043	19022	18738	18337	18108
ELEV FTMSL	1843.1	1842.5	1841.7	1840.7	1840.5	1840.5	1840.4	1839.5	1838.2	1837.5
DISCH KCFS	24.0	24.0	24.0	23.3	21.6	21.6	21.0	20.0	25.0	26.0
POWER										
AVE POWER MW		304	303	293	271	271	263	250	309	319
PEAK POW MW		491	488	484	484	484	483	480	475	473
ENERGY GWH	1485.7	225.8	218.2	218.0	97.6	45.5	50.4	185.7	229.9	214.5
--OAHE--										
NAT INFLOW	462	72	138	84	39	18	21	-6	12	84
DEPLETION	149	71	19	-4	3	1	1	13	17	28
CHAN STOR	-9			3	7		3	4	-20	-4
EVAPORATION	334	78	97	83	18	8	9	42		
REG INFLOW	9798	1398	1450	1443	670	309	346	1173	1512	1496
RELEASE	11400	1730	2140	1712	825	385	581	1580	1349	1098
STOR CHANGE	-1602	-332	-689	-269	-155	-76	-235	-407	163	398
STORAGE	20443	20111	19422	19153	18997	18922	18687	18279	18442	18841
ELEV FTMSL	1612.4	1611.5	1609.4	1608.5	1608.0	1607.8	1607.0	1605.7	1606.2	1607.5
DISCH KCFS	19.1	28.1	36.0	27.8	27.7	27.8	36.6	25.7	21.9	19.8
POWER										
AVE POWER MW		370	468	361	358	358	469	329	280	254
PEAK POW MW		727	716	711	709	707	703	696	699	706
ENERGY GWH	1783.6	275.4	337.2	268.4	128.8	60.1	90.1	244.5	208.5	170.6
--BIG BEND--										
EVAPORATION	65	15	19	16	3	2	2	9		
REG INFLOW	11335	1716	2121	1696	821	384	579	1572	1349	1098
RELEASE	11335	1716	2121	1696	821	384	579	1572	1349	1098
STORAGE	1683	1683	1683	1683	1683	1683	1683	1683	1683	1683
ELEV FTMSL	1420.0	1420.0	1420.0	1420.0	1420.0	1420.0	1420.0	1420.0	1420.0	1420.0
DISCH KCFS	19.6	27.9	35.6	27.6	27.6	27.6	36.5	25.6	21.9	19.8
POWER										
AVE POWER MW		131	169	135	138	138	181	126	107	95
PEAK POW MW		509	517	538	538	538	538	538	538	529
ENERGY GWH	663.2	97.2	121.5	100.3	49.6	23.2	34.8	93.6	79.3	63.7
--FORT RANDALL--										
NAT INFLOW	210	54	54	12	6	3	3	6	24	48
DEPLETION	34	15	7	1	1	0	1	3	3	3
EVAPORATION	75	19	24	18	3	1	2	8		
REG INFLOW	11435	1736	2144	1689	823	385	579	1567	1370	1143
RELEASE	11855	1731	2288	2328	1127	526	601	1201	1113	939
STOR CHANGE	-420	5	-144	-640	-305	-141	-22	366	257	204
STORAGE	3544	3549	3405	2765	2460	2319	2297	2663	2920	3124
ELEV FTMSL	1355.1	1355.2	1353.5	1345.0	1340.3	1337.9	1337.5	1343.5	1347.2	1350.0
DISCH KCFS	24.8	28.1	38.5	37.9	37.9	37.9	37.9	19.5	18.1	16.9
POWER										
AVE POWER MW		235	314	296	275	264	259	144	140	134
PEAK POW MW		350	344	307	286	276	274	302	318	330
ENERGY GWH	1116.4	174.5	226.4	220.6	99.2	44.3	49.8	107.4	104.0	90.3
--GAVINS POINT--										
NAT INFLOW	972	204	126	138	69	32	37	108	114	144
DEPLETION	28	10	-5	2	5	2	3	10	1	
CHAN STOR	14	-6	-20	1	0	0	0	34	3	2
EVAPORATION	24	5	7	6	1	1	1	3		
REG INFLOW	12790	1913	2393	2460	1190	555	635	1331	1229	1085
RELEASE	12796	1906	2380	2460	1190	555	635	1331	1229	1111
STOR CHANGE	-6	7	13							-26
STORAGE	364	371	384	384	384	384	384	384	384	358
ELEV FTMSL	1206.2	1206.5	1207.0	1207.0	1207.0	1207.0	1207.0	1207.0	1207.0	1206.0
DISCH KCFS	29.6	31.0	40.0	40.0	40.0	40.0	40.0	21.6	20.0	20.0
POWER										
AVE POWER MW		102	113	114	114	114	114	73	69	68
PEAK POW MW		114	114	114	114	114	114	76	76	75
ENERGY GWH	475.3	76.2	81.7	84.7	41.0	19.1	21.9	54.0	51.1	45.8
--GAVINS POINT - SIOUX CITY--										
NAT INFLOW	570	144	102	78	36	17	19	48	30	96
DEPLETION	101	31	20	8	5	2	2	10	11	12
REGULATED FLOW AT SIOUX CITY										
KAF	13265	2019	2462	2530	1222	570	652	1369	1248	1195
KCFS		32.8	41.4	41.1	41.1	41.1	41.1	22.3	20.3	21.5
--TOTAL--										
NAT INFLOW	8664	1632	1404	1416	630	294	336	852	876	1224
DEPLETION	-568	94	-160	-2	-47	-22	-25	-123	-189	-95
CHAN STOR	-37	-19	-15	4	7	1	2	38	-37	-17
EVAPORATION	1134	264	328	282	59	27	31	142		
STORAGE	62308	61544	60302	58913	58315	58034	57714	57217	56997	57104
SYSTEM POWER										
AVE POWER MW		1286	1507	1337	1294	1281	1423	1058	1068	1052
PEAK POW MW		2403	2390	2366	2341	2329	2323	2302	2316	2321
ENERGY GWH	6280.3	957.1	1084.8	995.1	465.9	215.3	273.3	787.1	794.7	707.1
DAILY GWH		30.9	36.2	32.1	31.1	30.8	34.2	25.4	25.6	25.3
	INI-SUM	31AUG	30SEP	31OCT	15NOV	22NOV	30NOV	31DEC	31JAN	28FEB

VALUES IN 1000 AF EXCEPT AS INDICATED

	31JUL98 INI-SUM	1998 31AUG	30SEP	31OCT	15NOV	22NOV	30NOV	31DEC	1999 31JAN	28FEB
--FORT PECK--										
NAT INFLOW	1984	280	272	316	156	73	83	264	252	288
DEPLETION	-486	-53	-90	-23	-33	-15	-17	-111	-106	-38
EVAPORATION	551	114	141	123	55	26	29	63		
MOD INFLOW	1919	219	221	216	133	62	71	312	358	326
RELEASE	3598	646	355	321	164	83	127	615	676	611
STOR CHANGE	-1679	-426	-134	-105	-30	-21	-56	-303	-318	-285
STORAGE	16353	15927	15792	15688	15657	15636	15580	15277	14959	14674
ELEV FTMSL	2240.2	2238.3	2237.7	2237.2	2237.1	2237.0	2236.7	2235.3	2233.8	2232.5
DISCH KCFS	9.2	10.5	6.0	5.2	5.5	6.0	8.0	10.0	11.0	11.0
POWER										
AVE POWER MW		145	82	72	76	82	110	137	150	149
PEAK POW MW		211	211	211	211	211	210	209	208	207
ENERGY GWH	595.9	107.8	59.2	53.5	27.2	13.9	21.1	101.7	111.3	100.1
--GARRISON--										
NAT INFLOW	2316	492	384	420	164	77	87	200	212	280
DEPLETION	-479	12	-113	27	-78	-36	-41	-99	-88	-63
CHAN STOR	-18	-13	44	7	-3	-5	-20	-20	-10	0
EVAPORATION	622	129	160	138	62	29	33	71		
REG INFLOW	5753	984	736	583	340	162	203	824	966	954
RELEASE	7985	1476	1071	770	373	208	286	1230	1322	1250
STOR CHANGE	-2231	-492	-335	-187	-32	-46	-83	-406	-356	-296
STORAGE	19921	19429	19095	18908	18876	18830	18747	18341	17985	17690
ELEV FTMSL	1843.1	1841.6	1840.6	1840.0	1839.9	1839.8	1839.5	1838.2	1837.1	1836.1
DISCH KCFS	24.0	24.0	18.0	12.5	12.5	15.0	18.0	20.0	21.5	22.5
POWER										
AVE POWER MW		303	227	158	157	188	225	248	264	275
PEAK POW MW		488	484	482	482	481	480	475	471	467
ENERGY GWH	1203.2	225.7	163.3	117.2	56.6	31.6	43.1	184.5	196.7	184.5
--OAHE--										
NAT INFLOW	308	48	92	56	26	12	14	-4	8	56
DEPLETION	149	71	19	-4	3	1	1	13	17	28
CHAN STOR	4		23	21		-10	-12	-8	-6	-4
EVAPORATION	611	130	160	135	60	28	31	68		
REG INFLOW	7536	1323	1007	716	336	182	255	1137	1307	1274
RELEASE	9579	1844	1740	1301	633	292	282	1313	1181	993
STOR CHANGE	-2043	-522	-732	-585	-296	-110	-28	-176	126	280
STORAGE	20443	19921	19189	18604	18308	18198	18170	17994	18120	18400
ELEV FTMSL	1612.4	1610.9	1608.6	1606.8	1605.8	1605.4	1605.3	1604.7	1605.2	1606.1
DISCH KCFS	19.1	30.0	29.2	21.2	21.3	21.0	17.8	21.4	19.2	17.9
POWER										
AVE POWER MW		394	380	273	272	268	227	271	244	228
PEAK POW MW		724	712	702	697	695	694	691	694	699
ENERGY GWH	1493.5	293.0	273.8	203.0	98.0	45.0	43.5	202.0	181.7	153.4
--BIG BEND--										
EVAPORATION	121	24	31	27	12	6	7	14		
REG INFLOW	9458	1820	1709	1274	621	286	276	1299	1181	993
RELEASE	9458	1820	1709	1274	621	286	276	1299	1181	993
STORAGE	1683	1683	1683	1683	1683	1683	1683	1683	1683	1683
ELEV FTMSL	1420.0	1420.0	1420.0	1420.0	1420.0	1420.0	1420.0	1420.0	1420.0	1420.0
DISCH KCFS	19.6	29.6	28.7	20.7	20.9	20.6	17.4	21.1	19.2	17.9
POWER										
AVE POWER MW		139	136	102	105	103	87	104	93	86
PEAK POW MW		509	517	538	538	538	538	538	538	529
ENERGY GWH	553.1	103.1	98.0	75.6	37.6	17.4	16.8	77.5	69.5	57.6
--FORT RANDALL--										
NAT INFLOW	140	36	36	8	4	2	2	4	16	32
DEPLETION	34	15	7	1	1	0	1	3	3	3
EVAPORATION	137	32	39	31	12	5	5	13		
REG INFLOW	9427	1809	1698	1250	612	282	272	1287	1194	1022
RELEASE	9847	1804	1842	1887	916	427	294	921	922	833
STOR CHANGE	-420	5	-144	-637	-304	-145	-22	366	272	189
STORAGE	3544	3549	3405	2768	2464	2319	2297	2663	2935	3124
ELEV FTMSL	1355.1	1355.2	1353.5	1345.1	1340.4	1337.9	1337.5	1343.5	1347.5	1350.0
DISCH KCFS	24.8	29.3	31.0	30.7	30.8	30.8	18.5	15.0	15.0	15.0
POWER										
AVE POWER MW		244	256	243	230	223	133	111	116	120
PEAK POW MW		350	343	307	287	276	274	302	319	330
ENERGY GWH	942.5	181.8	184.3	180.9	82.9	37.4	25.6	82.7	86.5	80.4
--GAVINS POINT--										
NAT INFLOW	648	136	84	92	46	21	25	72	76	96
DEPLETION	28	10	-5	2	5	2	3	10	1	
CHAN STOR	18	-9	-3	1	0	0	23	7	0	
EVAPORATION	44	9	11	10	5	2	2	5		
REG INFLOW	10442	1913	1917	1968	952	444	336	984	997	929
RELEASE	10448	1906	1904	1968	952	444	336	984	997	955
STOR CHANGE	-6	7	13							-26
STORAGE	364	371	384	384	384	384	384	384	384	358
ELEV FTMSL	1206.2	1206.5	1207.0	1207.0	1207.0	1207.0	1207.0	1207.0	1207.0	1206.0
DISCH KCFS	29.6	31.0	32.0	32.0	32.0	32.0	21.2	16.0	16.2	17.2
POWER										
AVE POWER MW		102	105	106	106	106	73	56	57	59
PEAK POW MW		114	114	114	114	114	114	76	76	75
ENERGY GWH	424.6	76.2	75.9	78.8	38.1	17.8	14.1	41.6	42.2	39.9
--GAVINS POINT - SIOUX CITY--										
NAT INFLOW	380	96	68	52	24	11	13	32	20	64
DEPLETION	101	31	20	8	5	2	2	10	11	12
REGULATED FLOW AT SIOUX CITY										
KAF	10727	1971	1952	2012	972	453	347	1006	1006	1007
KCFS		32.1	32.8	32.7	32.7	32.7	21.9	16.4	16.4	18.1
--TOTAL--										
NAT INFLOW	5776	1088	936	944	420	196	224	568	584	816
DEPLETION	-653	86	-162	11	-97	-45	-52	-174	-162	-58
CHAN STOR	4	-21	64	29	-3	-15	-9	-21	-16	-4
EVAPORATION	2086	437	542	464	206	95	108	234		
STORAGE	62308	60880	59548	58035	57371	57049	56862	56342	56066	55928
SYSTEM POWER										
AVE POWER MW		1327	1187	953	946	970	855	927	925	917
PEAK POW MW		2396	2382	2354	2328	2314	2311	2292	2306	2307
ENERGY GWH	5212.7	987.6	854.4	709.0	340.4	163.0	164.3	690.0	688.0	616.0
DAILY GWH		31.9	28.5	22.9	22.7	23.3	20.5	22.3	22.2	22.0
	INI-SUM	31AUG	30SEP	31OCT	15NOV	22NOV	30NOV	31DEC	31JAN	28FEB

VALUES IN 1000 AF EXCEPT AS INDICATED

	28FEB99 INI-SUM	1999 15MAR	22MAR	31MAR	30APR	31MAY	30JUN	31JUL	31AUG	30SEP	31OCT	15NOV	22NOV	2000 30NOV	31DEC	31JAN	29FEB
--FORT PECK--																	
NAT INFLOW	9600	319	149	192	797	1604	2491	1219	456	379	531	210	98	112	346	297	400
DEPLETION	-135	-22	-10	-13	47	320	394	245	-145	-198	-111	-47	-22	-25	-179	-206	-163
EVAPORATION	323							22	70	87	75	16	7	8	38		
MOD INFLOW	9412	341	159	205	750	1284	2097	952	531	490	567	241	113	129	487	503	563
RELEASE	9415	298	139	179	655	922	893	922	922	821	848	360	168	159	615	738	777
STOR CHANGE	-3	44	20	26	95	362	1204	29	-391	-331	-281	-119	-56	-30	-128	-235	-214
STORAGE	14991	15034	15055	15081	15176	15538	16742	16772	16381	16050	15769	15650	15595	15565	15437	15202	14988
ELEV FTMSL	2234.0	2234.2	2234.3	2234.4	2234.8	2236.5	2241.9	2242.0	2240.3	2238.8	2237.6	2237.0	2236.8	2236.6	2236.1	2235.0	2234.0
DISCH KCFS	13.5	10.0	10.0	10.0	11.0	15.0	15.0	15.0	15.0	13.8	13.8	12.1	12.1	10.0	10.0	12.0	13.5
POWER																	
AVE POWER MW		136	136	136	150	200	203	205	205	189	188	166	166	137	137	164	182
PEAK POW MW		208	209	209	209	210	214	214	213	212	211	211	210	210	210	209	208
ENERGY GWH	1548.2	48.9	22.8	29.4	107.8	148.7	146.0	152.7	152.2	135.8	139.7	59.8	27.9	26.3	101.8	121.8	126.6
--GARRISON--																	
NAT INFLOW	14199	515	240	309	1376	1934	3530	2647	841	574	652	260	121	139	278	348	434
DEPLETION	723	-9	-4	-6	-67	87	821	400	44	-113	6	-79	-37	-42	-109	-100	-70
CHAN STOR	0	35			-10	-39				12		16		21	0	-20	-15
EVAPORATION	374							26	82	101	86	18	8	10	44		
REG INFLOW	22516	857	384	493	2088	2730	3602	3144	1638	1419	1408	697	318	350	958	1166	1266
RELEASE	22519	774	361	464	1666	2152	2202	2275	2275	2202	1798	870	406	397	1230	1722	1726
STOR CHANGE	-3	83	23	29	422	578	1400	869	-637	-783	-390	-173	-88	-47	-272	-555	-460
STORAGE	18108	18191	18214	18243	18664	19242	20642	21511	20873	20090	19700	19527	19439	19392	19120	18565	18105
ELEV FTMSL	1837.5	1837.8	1837.8	1837.9	1839.3	1841.1	1845.2	1847.7	1845.9	1843.6	1842.5	1841.9	1841.7	1841.5	1840.7	1839.0	1837.5
DISCH KCFS	26.0	26.0	26.0	26.0	28.0	35.0	37.0	37.0	37.0	37.0	29.2	29.2	29.2	25.0	20.0	28.0	30.0
POWER																	
AVE POWER MW		319	319	319	345	428	456	465	466	460	370	368	367	314	252	348	368
PEAK POW MW		474	474	474	479	486	502	502	502	495	491	489	488	488	484	478	473
ENERGY GWH	3388.4	114.7	53.6	69.0	248.3	318.7	328.6	345.9	346.6	331.4	275.0	132.5	61.7	60.4	187.1	258.6	256.3
--OAHE--																	
NAT INFLOW	3850	559	261	335	474	347	881	297	123	163	102	109	51	58	22	10	59
DEPLETION	513	21	10	12	43	58	107	121	77	20	-6	2	1	1	10	14	23
CHAN STOR	-15				-8	-26	-7				30	0		17	20	-33	-8
EVAPORATION	357							25	78	96	82	17	8	9	41		
REG INFLOW	25483	1311	612	787	2090	2415	2968	2426	2243	2248	1854	960	448	462	1221	1685	1754
RELEASE	25486	590	343	468	1668	2268	2735	2782	2921	2728	2359	1139	530	761	1736	1369	1090
STOR CHANGE	-3	721	269	319	422	147	233	-356	-678	-480	-505	-178	-82	-299	-514	316	664
STORAGE	18841	19562	19831	20150	20571	20718	20951	20595	19917	19438	18933	18754	18672	18373	17859	18175	18838
ELEV FTMSL	1607.5	1609.8	1610.6	1611.6	1612.8	1613.2	1613.9	1612.9	1610.9	1609.4	1607.8	1607.2	1607.0	1606.0	1604.3	1605.3	1607.5
DISCH KCFS	19.8	19.8	24.7	26.2	28.0	36.9	46.0	45.2	47.5	45.8	38.4	38.3	38.2	47.9	28.2	22.3	18.9
POWER																	
AVE POWER MW		257	322	343	369	487	607	597	619	595	495	491	489	605	358	283	243
PEAK POW MW		718	722	727	734	736	740	734	724	716	708	705	703	698	689	695	706
ENERGY GWH	4006.9	92.6	54.2	74.2	265.8	362.0	436.7	443.9	460.6	428.1	368.0	176.6	82.1	116.2	266.6	210.3	169.0
--BIG BEND--																	
EVAPORATION	70							5	15	19	16	3	2	2	9		
REG INFLOW	25416	590	343	468	1668	2268	2735	2777	2906	2710	2343	1135	529	759	1727	1369	1090
RELEASE	25416	590	343	468	1668	2268	2735	2777	2906	2710	2343	1135	529	759	1727	1369	1090
STORAGE	1683	1683	1683	1683	1683	1683	1683	1683	1683	1683	1683	1683	1683	1683	1683	1683	1683
ELEV FTMSL	1420.0	1420.0	1420.0	1420.0	1420.0	1420.0	1420.0	1420.0	1420.0	1420.0	1420.0	1420.0	1420.0	1420.0	1420.0	1420.0	1420.0
DISCH KCFS	19.8	19.8	24.7	26.2	28.0	36.9	46.0	45.2	47.3	45.5	38.1	38.2	38.1	47.8	28.1	22.3	18.9
POWER																	
AVE POWER MW		94	116	123	131	173	211	210	221	215	185	189	189	236	138	108	91
PEAK POW MW		517	509	509	509	509	496	505	509	518	538	538	538	538	538	538	529
ENERGY GWH	1459.7	33.9	19.4	26.5	94.5	128.4	152.3	156.4	164.4	155.1	137.6	68.0	31.7	45.3	102.7	80.5	63.3
--FORT RANDALL--																	
NAT INFLOW	1501	190	89	114	298	159	224	111	72	92	60	5	2	3	23	10	49
DEPLETION	80	1	1	1	4	9	12	18	15	7	1	1	0	1	3	3	3
EVAPORATION	81							6	19	24	19	3	1	2	8		
REG INFLOW	26755	779	431	581	1962	2418	2947	2864	2944	2771	2383	1136	529	759	1739	1376	1136
RELEASE	26755	488	297	581	1962	2418	2792	2968	2995	2915	2986	1465	683	781	1373	1119	932
STOR CHANGE	0	291	134				155	-104	-51	-144	-603	-329	-154	-22	366	257	204
STORAGE	3124	3415	3549	3549	3549	3549	3704	3600	3549	3405	2802	2473	2319	2297	2663	2920	3124
ELEV FTMSL	1350.0	1353.6	1355.2	1355.2	1355.2	1355.2	1357.0	1355.8	1355.2	1353.5	1345.6	1340.5	1337.9	1337.5	1343.5	1347.2	1350.0
DISCH KCFS	16.9	16.4	21.4	32.5	33.0	39.3	46.9	48.3	48.7	49.0	48.6	49.2	49.2	49.2	22.3	18.2	16.2
POWER																	
AVE POWER MW		134	178	271	274	321	352	355	351	347	327	298	280	274	165	141	129
PEAK POW MW		344	350	350	350	350	358	353	350	343	309	286	275	273	302	318	330
ENERGY GWH	2368.7	48.2	29.9	58.5	197.4	238.7	253.6	264.1	261.4	249.6	243.6	107.3	47.1	52.6	122.5	104.6	89.7
--GAVINS POINT--																	
NAT INFLOW	2252	107	50	64	246	319	281	211	170	135	157	60	28	32	95	106	191
DEPLETION	114	0	0	0	5	19	24	39	10	-5	2	5	2	3	10	1	
CHAN STOR	0	1	-10	-21	-1	-12	-15	-3	-1	-1	1	-1	0	0	50	8	4
EVAPORATION	25							2	5	7	6	1	1	1	3		
REG INFLOW	28868	596	338	624	2202	2705	3035	3136	3149	3048	3136	1517	708	809	1506	1232	1127
RELEASE	28868	596	338	624	2202	2705	3035	3136	3136	3035	3136	1517	708	809	1506	1232	1153
STOR CHANGE									13	13							-26
STORAGE	358	358	358	358	358	358	358	358	371	384	384	384	384	384	384	384	358
ELEV FTMSL	1206.0	1206.0	1206.0	1206.0	1206.0	1206.0	1206.0	1206.0	1206.5	1207.0	1207.0	1207.0	1207.0	1207.0	1207.0	1207.0	1206.0
DISCH KCFS	20.0	20.0	24.3	35.0	37.0	44.0	51.0	51.0	51.0	51.0	51.0	51.0	51.0	51.0	24.5	20.0	20.0
POWER																	
AVE POWER MW		68	82	110	112	111	110	110	111	113	113	113	113	113	77	69	68
PEAK POW MW		113	113	113	112	111	110	110	112	113	113	113	113	113	76	76	75
ENERGY GWH	873.0	24.5	13.8	23.8	81.0	82.9	79.6	82.2	82.7	81.0	84.1	40.7	19.0	21.7	57.3	51.2	47.5
--GAVINS POINT - SIOUX CITY--																	
NAT INFLOW	3100	195	91	117	1006	553	318	246	184	127	66	26	12	14	30	12	105
DEPLETION	233	6	3	3	19	33	29	35	32	20	8	5	2	3	11	12	12
REGULATED FLOW AT SIOUX CITY																	
KAF	31735	785	426	737	3189	3225	3324	3347	3288	3142	3194	1538	718	820	1525	1232	1246
KCFS		26.4	30.7	41.3	53.6	52.5	55.9	54.4	53.5	52.8	51.9	51.7	51.7	51.7	24.8	20.0	21.7
--TOTAL--																	
NAT INFLOW	34502	1885	879	1131	4197	4916	7725	4731	1846	1470	1568	670	312	357	794	783	1238
DEPLETION	1528	-3	-2	-2	51	526	1387	858	33	-269	-100	-113	-53	-60	-254	-276	-195
CHAN STOR	-16	36	-10	-21	-18	-78	-22	-3	-1	11	31	15	0	37	70	-45	-19
EVAPORATION	1231							86	269	332	284	59	27	31	142		
STORAGE	57104	58243	58689	59063	60002	61088	64081	64519	62774	61050	59271	58471	58092	57694	57146	56928	57097
SYSTEM POWER																	
AVE POWER MW		1008	1153	1302	1382	1720	1940	1942	1973	1918	1677	1625	1604	1680	1126	1111	1081
PEAK POW MW		2374	2377	2382	2394	2403	2420	2419	2410	2397	2370	2341	2327	2320	2299	2314	2321
ENERGY GWH	13645.0	362.9	193.7	281.3	994.8	1279.4	1396.7	1445.2	1467.9	1380.9	1248.0	584.9	269.5	322.5	838.0	826.9	752.4
DAILY GWH		24.2	27.7	31.3	33.2	41.3	46.6	46.6	47.4	46.0	40.3	39.0	38.5	40.3	27.0	26.7	25.9
	INI-SUM	15MAR	22MAR	31MAR	30APR	31MAY	30JUN	31JUL	31AUG	30SEP	31OCT	15NOV	22NOV	30NOV	31DEC	31JAN	29FEB

VALUES IN 1000 AF EXCEPT AS INDICATED

	28FEB99	1999												2000			
	INI-SUM	15MAR	22MAR	31MAR	30APR	31MAY	30JUN	31JUL	31AUG	30SEP	31OCT	15NOV	22NOV	30NOV	31DEC	31JAN	29FEB
--FORT PECK--																	
NAT INFLOW	8901	296	138	178	739	1487	2309	1130	423	351	492	195	91	104	321	276	371
DEPLETION	-115	-22	-10	-13	47	320	394	235	-139	-157	-116	-50	-23	-26	-182	-208	-165
EVAPORATION	357							22	69	86	74	33	16	18	38		
MOD INFLOW	8659	318	148	191	692	1167	1915	873	493	422	534	211	99	113	465	484	536
RELEASE	8646	298	139	179	595	769	833	861	861	701	724	292	136	159	615	738	748
STOR CHANGE	13	20	9	12	97	398	1082	12	-368	-279	-191	-81	-38	-46	-150	-254	-212
STORAGE	14991	15011	15021	15033	15130	15528	16610	16622	16254	15975	15784	15704	15666	15620	15470	15216	15004
ELEV FTMSL	2234.0	2234.1	2234.1	2234.2	2234.6	2236.5	2241.3	2241.4	2239.8	2238.5	2237.6	2237.3	2237.1	2236.9	2236.2	2235.0	2234.0
DISCH KCFS	13.5	10.0	10.0	10.0	10.0	12.5	14.0	14.0	14.0	11.8	11.8	9.8	9.8	10.0	10.0	12.0	13.0
POWER																	
AVE POWER MW		136	136	136	136	170	191	192	192	162	162	135	135	137	137	164	176
PEAK POW MW		208	208	208	209	210	214	214	213	212	211	211	211	210	210	209	208
ENERGY GWH	1430.1	48.9	22.8	29.4	97.9	126.8	137.3	143.1	142.7	116.9	120.4	48.5	22.6	26.3	101.9	121.8	122.6
--GARRISON--																	
NAT INFLOW	12901	482	225	289	1250	1723	3207	2405	764	522	593	236	110	126	260	316	394
DEPLETION	726	-9	-4	-6	-67	87	821	400	44	-112	8	-78	-36	-42	-109	-100	-71
CHAN STOR	5	35				-25	-15			21		19		-2	0	-20	-10
EVAPORATION	409							25	79	99	86	38	18	20	44		
REG INFLOW	20416	823	368	473	1912	2380	3204	2841	1501	1257	1224	587	265	304	940	1134	1203
RELEASE	20406	774	361	464	1666	1937	2053	2121	2121	1455	1503	700	327	365	1230	1660	1668
STOR CHANGE	10	49	7	9	246	443	1151	719	-620	-197	-280	-114	-62	-61	-290	-526	-465
STORAGE	18108	18157	18164	18173	18419	18862	20013	20732	20113	19915	19636	19522	19460	19399	19109	18583	18118
ELEV FTMSL	1837.5	1837.7	1837.7	1837.7	1838.5	1839.9	1843.4	1845.5	1843.7	1843.1	1842.3	1841.9	1841.7	1841.6	1840.7	1839.0	1837.5
DISCH KCFS	26.0	26.0	26.0	26.0	28.0	31.5	34.5	34.5	34.5	24.4	24.4	23.5	23.5	23.0	20.0	27.0	29.0
POWER																	
AVE POWER MW		319	319	319	344	389	428	434	434	310	309	297	297	290	252	335	356
PEAK POW MW		473	473	473	476	482	495	502	495	493	490	489	488	488	484	478	473
ENERGY GWH	3077.4	114.7	53.6	68.9	247.5	289.2	307.8	322.8	323.1	222.9	230.0	107.0	49.9	55.6	187.1	249.5	248.0
--OAHE--																	
NAT INFLOW	3200	460	214	276	394	285	749	246	103	135	85	91	42	48	18	5	49
DEPLETION	513	21	10	12	43	58	107	121	77	20	-6	2	1	1	10	14	23
CHAN STOR	-13				-8	-13	-11			38	0	4		2	12	-29	-8
EVAPORATION	395							25	78	96	82	37	17	19	41		
REG INFLOW	22684	1213	566	727	2009	2151	2684	2221	2069	1512	1512	756	351	395	1209	1623	1686
RELEASE	22683	768	254	506	1643	2217	2134	2418	2482	2271	1880	910	422	637	1621	1373	1149
STOR CHANGE	1	445	312	221	367	-66	549	-197	-413	-760	-367	-154	-71	-242	-412	250	537
STORAGE	18841	19286	19597	19819	20185	20120	20669	20472	20059	19300	18933	18779	18708	18466	18055	18305	18842
ELEV FTMSL	1607.5	1608.9	1609.9	1610.6	1611.7	1611.5	1613.1	1612.5	1611.3	1609.0	1607.8	1607.3	1607.1	1606.3	1605.0	1605.8	1607.5
DISCH KCFS	19.8	25.8	18.3	28.4	27.6	36.0	35.9	39.3	40.4	38.2	30.6	30.6	30.4	40.1	26.4	22.3	20.0
POWER																	
AVE POWER MW		333	238	370	362	472	472	518	529	496	395	393	390	512	336	284	256
PEAK POW MW		714	719	722	728	727	735	732	726	714	708	705	704	700	692	697	706
ENERGY GWH	3565.7	120.0	40.1	79.9	260.4	351.4	339.5	385.4	393.6	357.2	293.6	141.6	65.5	98.3	249.7	211.4	178.3
--BIG BEND--																	
EVAPORATION	78							5	15	19	16	7	3	4	9		
REG INFLOW	22605	768	254	506	1643	2217	2134	2413	2467	2253	1863	903	419	633	1612	1373	1149
RELEASE	22605	768	254	506	1643	2217	2134	2413	2467	2253	1863	903	419	633	1612	1373	1149
STORAGE	1683	1683	1683	1683	1683	1683	1683	1683	1683	1683	1683	1683	1683	1683	1683	1683	1683
ELEV FTMSL	1420.0	1420.0	1420.0	1420.0	1420.0	1420.0	1420.0	1420.0	1420.0	1420.0	1420.0	1420.0	1420.0	1420.0	1420.0	1420.0	1420.0
DISCH KCFS	19.8	25.8	18.3	28.4	27.6	36.0	35.9	39.3	40.1	37.9	30.3	30.4	30.2	39.9	26.2	22.3	20.0
POWER																	
AVE POWER MW		121	86	133	129	169	168	184	188	179	148	151	150	198	129	109	96
PEAK POW MW		511	509	509	509	509	509	509	509	517	538	538	538	538	538	538	529
ENERGY GWH	1302.2	43.6	14.4	28.7	93.0	125.5	120.8	136.6	139.7	129.1	109.8	54.4	25.3	37.9	96.0	80.8	66.7
--FORT RANDALL--																	
NAT INFLOW	1200	142	66	85	239	150	195	89	65	64	38	3	1	1	18	5	39
DEPLETION	80	1	1	1	4	9	12	18	15	7	1	1	0	1	3	3	3
EVAPORATION	88							6	19	24	19	7	3	3	8		
REG INFLOW	23636	908	320	590	1878	2358	2317	2478	2498	2286	1882	897	416	630	1619	1375	1185
RELEASE	23636	500	303	590	1878	2358	2317	2478	2498	2430	2489	1223	570	652	1253	1138	961
STOR CHANGE	0	408	17			0	0	0	0	-144	-607	-325	-154	-22	366	237	224
STORAGE	3124	3532	3549	3549	3549	3549	3549	3549	3549	3405	2798	2473	2319	2297	2663	2900	3124
ELEV FTMSL	1350.0	1355.0	1355.2	1355.2	1355.2	1355.2	1355.2	1355.2	1355.2	1353.5	1345.5	1340.5	1337.9	1337.5	1343.5	1347.0	1350.0
DISCH KCFS	16.9	16.8	21.8	33.1	31.6	38.3	38.9	40.3	40.6	40.8	40.5	41.1	41.1	41.1	20.4	18.5	16.7
POWER																	
AVE POWER MW		138	182	275	263	316	319	325	326	325	308	288	274	269	150	143	133
PEAK POW MW		350	350	350	350	350	350	350	350	344	310	287	276	274	302	317	330
ENERGY GWH	2253.2	49.7	30.6	59.4	189.0	235.4	229.8	241.9	242.9	233.7	229.0	103.6	46.1	51.6	111.9	106.2	92.3
--GAVINS POINT--																	
NAT INFLOW	1899	93	44	56	207	257	237	178	144	114	132	51	24	27	86	89	161
DEPLETION	114	0	0	0	5	19	24	39	10	-5	2	5	2	3	10	1	
CHAN STOR	-1	0	-10	-22	3	-13	-1	-3	-1	0	1	-1	0	0	39	4	3
EVAPORATION	28							2	5	7	6	3	1	1	3		
REG INFLOW	25393	594	337	625	2082	2583	2529	2613	2626	2542	2613	1264	590	674	1365	1229	1125
RELEASE	25393	594	337	625	2082	2583	2529	2613	2613	2529	2613	1264	590	674	1365	1229	1151
STOR CHANGE									13	13							-26
STORAGE	358	358	358	358	358	358	358	358	371	384	384	384	384	384	384	384	358
ELEV FTMSL	1206.0	1206.0	1206.0	1206.0	1206.0	1206.0	1206.0	1206.0	1206.5	1207.0	1207.0	1207.0	1207.0	1207.0	1207.0	1207.0	1206.0
DISCH KCFS	20.0	20.0	24.3	35.0	35.0	42.0	42.5	42.5	42.5	42.5	42.5	42.5	42.5	42.5	22.2	20.0	20.0
POWER																	
AVE POWER MW		68	82	110	110	112	112	112	112	113	114	114	114	114	74	69	68
PEAK POW MW		113	113	113	113	112	112	112	113	114	114	114	114	114	76	76	75
ENERGY GWH	873.1	24.4	13.8	23.8	79.4	83.1	80.4	83.1	83.6	81.6	84.5	40.9	19.1	21.8	55.0	51.1	47.4
--GAVINS POINT - SIOUX CITY--																	
NAT INFLOW	2500	181	85	109	811	406	252	199	148	97	53	21	10	11	24	10	84
DEPLETION	233	6	3	3	19	33	29	35	32	20	8	5	2	3	11	12	12
REGULATED FLOW AT SIOUX CITY																	
KAF	27660	770	419	731	2874	2956	2752	2777	2729	2606	2658	1280	597	683	1378	1227	1223
KCFS		25.9	30.2	40.9	48.3	48.1	46.2	45.2	44.4	43.8	43.2	43.0	43.0	43.0	22.4	20.0	21.3
--TOTAL--																	
NAT INFLOW	30601	1654	772	992	3640	4308	6949	4247	1647	1283	1393	595	278	317	727	701	1098
DEPLETION	1551	-3	-2	-2	51	526	1387	848	39	-227	-103	-115	-54	-61	-257	-278	-198
CHAN STOR	-10	35	-10	-22	-5	-51	-27	-3	-1	59	1	21	0	-1	51	-45	-15
EVAPORATION	1355							84	266	330	283	126	58	66	143		
STORAGE	57104	58027	58372	58614	59324	60099	62882	63417	62029	60662	59218	58544	58220	57849	57363	57071	57129
SYSTEM POWER																	
AVE POWER MW		1115	1043	1343	1344	1628	1688	1765	1782	1585	1435	1378	1360	1519	1077	1103	1085
PEAK POW MW		2368	2373	2376	2385	2390	2415	2419	2407	2393	2370	2344	2330	2324	2302	2315	2321
ENERGY GWH	12501.8	401.3	175.2	290.0	967.4	1211.4	1215.7	1312.8	1325.5	1141.4	1067.4	496.0	228.4	291.6	801.6	820.8	755.3
DAILY GWH		26.8	25.0	32.2	32.2	39.1	40.5	42.3	42.8	38.0	34.4	33.1	32.6	36.5	25.9	26.5	26.0
	INI-SUM	15MAR	22MAR	31MAR	30APR	31MAY	30JUN	31JUL	31AUG	30SEP	31OCT	15NOV	22NOV	30NOV	31DEC	31JAN	29FEB

DATE OF STUDY 08/20/98 PRELIMINARY 1998-1999 AOP MEDIAN RUNOFF 99001 9901 4 PAGE 1

TIME OF STUDY 06:59:49 STUDY NO 6

VALUES IN 1000 AF EXCEPT AS INDICATED

	28FEB99 INI-SUM	15MAR	1999 22MAR	31MAR	30APR	31MAY	30JUN	31JUL	31AUG	30SEP	31OCT	15NOV	22NOV	2000 30NOV	31DEC	31JAN	29FEB
--FORT PECK--																	
NAT INFLOW	7400	264	123	158	628	1210	1851	829	324	319	398	188	88	100	310	261	349
DEPLETION	15	-38	-18	-23	11	292	560	93	-139	-134	-100	-37	-17	-19	-128	-164	-125
EVAPORATION	473							29	92	114	99	44	21	24	51		
MOD INFLOW	6912	302	141	181	617	918	1291	707	371	339	399	180	84	96	387	425	474
RELEASE	7043	179	69	89	417	615	655	676	676	617	547	238	125	159	615	676	690
STOR CHANGE	-131	124	71	92	200	303	636	30	-305	-278	-147	-58	-41	-63	-228	-251	-216
STORAGE	15005	15129	15200	15292	15492	15796	16432	16462	16157	15879	15731	15673	15632	15569	15342	15090	14874
ELEV FTMSL	2234.0	2234.6	2235.0	2235.4	2236.3	2237.7	2240.5	2240.7	2239.3	2238.1	2237.4	2237.1	2237.0	2236.7	2235.6	2234.4	2233.4
DISCH KCFS	12.0	6.0	5.0	5.0	7.0	10.0	11.0	11.0	11.0	10.4	8.9	8.0	9.0	10.0	10.0	11.0	12.0
POWER																	
AVE POWER MW		82	68	68	96	137	152	152	152	143	122	110	123	137	137	150	163
PEAK POW MW		209	209	209	210	211	213	213	212	211	211	211	210	210	209	209	208
ENERGY GWH	1169.6	29.4	11.5	14.8	69.0	102.0	109.2	113.4	113.2	102.9	91.0	39.6	20.7	26.3	101.8	111.5	113.3
--GARRISON--																	
NAT INFLOW	11001	469	219	282	853	1423	2958	2066	581	497	454	192	89	102	253	237	326
DEPLETION	735	-14	-6	-8	36	263	661	359	18	-128	16	-72	-33	-38	-127	-113	-79
CHAN STOR	0	59	10		-20	-30	-10			6	14	9	-10	-10	0	-10	-10
EVAPORATION	544							33	106	132	114	51	24	27	58		
REG INFLOW	16765	721	305	379	1214	1745	2942	2350	1133	1116	885	459	214	262	937	1017	1085
RELEASE	16925	595	236	303	1190	1476	1547	1599	1599	1412	1384	670	278	317	1230	1537	1553
STOR CHANGE	-160	126	69	75	24	270	1395	751	-465	-295	-499	-211	-63	-55	-293	-521	-468
STORAGE	18117	18243	18312	18387	18411	18680	20075	20826	20361	20065	19567	19356	19293	19238	18945	18425	17957
ELEV FTMSL	1837.5	1837.9	1838.2	1838.4	1838.5	1839.3	1843.6	1845.8	1844.4	1843.6	1842.1	1841.4	1841.2	1841.1	1840.2	1838.5	1837.0
DISCH KCFS	25.0	20.0	17.0	17.0	20.0	24.0	26.0	26.0	26.0	23.7	22.5	22.5	20.0	20.0	20.0	25.0	27.0
POWER																	
AVE POWER MW		246	210	210	247	297	326	331	332	301	285	284	252	252	251	310	331
PEAK POW MW		474	475	476	476	479	495	502	500	495	489	487	486	486	482	476	471
ENERGY GWH	2565.9	88.6	35.3	45.5	178.1	220.9	235.0	246.4	247.0	217.1	211.8	102.1	42.3	48.3	186.5	230.6	230.4
--OAHE--																	
NAT INFLOW	2300	317	148	190	364	236	689	162	33	118	14	5	2	3	-20		40
DEPLETION	513	21	10	12	43	58	107	121	77	20	-6	2	1	1	10	14	23
CHAN STOR	-8	20	12		-12	-16	-8			9	5		10	0	0	-21	-8
EVAPORATION	497							31	97	119	103	46	22	25	53		
REG INFLOW	18207	911	386	481	1499	1638	2121	1608	1458	1399	1306	627	268	295	1146	1503	1562
RELEASE	18371	658	328	402	1459	1719	1723	2019	2032	1871	1353	671	309	290	1302	1236	997
STOR CHANGE	-163	253	58	78	40	-81	398	-411	-574	-472	-47	-44	-41	5	-156	266	565
STORAGE	18840	19093	19151	19229	19269	19188	19586	19175	18601	18129	18082	18038	17997	18001	17846	18112	18677
ELEV FTMSL	1607.5	1608.3	1608.5	1608.8	1608.9	1608.6	1609.9	1608.6	1606.7	1605.2	1605.0	1604.9	1604.8	1604.8	1604.3	1605.1	1607.0
DISCH KCFS	16.3	22.1	23.6	22.5	24.5	28.0	29.0	32.8	33.0	31.4	22.0	22.6	22.3	18.3	21.2	20.1	17.3
POWER																	
AVE POWER MW		286	305	292	318	362	376	426	425	401	280	287	283	232	268	255	222
PEAK POW MW		710	711	713	713	712	718	712	702	694	693	692	691	692	689	694	703
ENERGY GWH	2854.0	102.8	51.3	63.1	228.8	269.3	270.5	316.6	315.9	288.4	208.1	103.1	47.5	44.5	199.7	189.9	154.4
--BIG BEND--																	
EVAPORATION	103							6	20	25	22	10	5	5	11		
REG INFLOW	18267	658	328	402	1459	1719	1723	2013	2012	1846	1331	661	305	285	1291	1236	997
RELEASE	18267	658	328	402	1459	1719	1723	2013	2012	1846	1331	661	305	285	1291	1236	997
STORAGE	1683	1683	1683	1683	1683	1683	1683	1683	1683	1683	1683	1683	1683	1683	1683	1683	1683
ELEV FTMSL	1420.0	1420.0	1420.0	1420.0	1420.0	1420.0	1420.0	1420.0	1420.0	1420.0	1420.0	1420.0	1420.0	1420.0	1420.0	1420.0	1420.0
DISCH KCFS	16.3	22.1	23.6	22.5	24.5	28.0	29.0	32.7	32.7	31.0	21.6	22.2	21.9	17.9	21.0	20.1	17.3
POWER																	
AVE POWER MW		105	111	106	115	131	136	153	153	147	106	111	110	90	104	98	83
PEAK POW MW		517	509	509	509	509	509	509	509	517	538	538	538	538	538	537	529
ENERGY GWH	1052.9	37.7	18.6	22.8	82.7	97.4	97.6	114.0	113.9	105.9	78.9	40.1	18.5	17.3	77.0	72.6	57.9
--FORT RANDALL--																	
NAT INFLOW	900	122	57	73	115	140	185	74	57	42	2	2	1	1	10		19
DEPLETION	80	1	1	1	4	9	12	18	15	7	1	1	0	1	3	3	3
EVAPORATION	118							8	25	31	25	10	4	4	10		
REG INFLOW	18970	779	384	475	1570	1850	1896	2061	2029	1850	1307	652	301	281	1288	1233	1013
RELEASE	18970	488	250	475	1570	1850	1896	2061	2029	1994	1944	956	446	303	922	922	863
STOR CHANGE	0	291	134					0	0	-144	-637	-304	-145	-22	366	311	150
STORAGE	3124	3415	3549	3549	3549	3549	3549	3549	3549	3405	2768	2464	2319	2297	2663	2974	3124
ELEV FTMSL	1350.0	1353.6	1355.2	1355.2	1355.2	1355.2	1355.2	1355.2	1355.2	1353.5	1345.1	1340.4	1337.9	1337.5	1343.5	1348.0	1350.0
DISCH KCFS	16.4	16.4	18.0	26.6	26.4	30.1	31.9	33.5	33.0	33.5	31.6	32.1	32.1	19.1	15.0	15.0	15.0
POWER																	
AVE POWER MW		134	150	222	220	251	265	279	274	277	250	240	232	137	111	117	120
PEAK POW MW		344	350	350	350	350	350	350	350	343	308	287	276	274	302	321	330
ENERGY GWH	1858.9	48.2	25.2	48.0	158.6	186.4	190.9	207.3	204.1	199.1	186.3	86.5	39.0	26.4	82.7	86.7	83.4
--GAVINS POINT--																	
NAT INFLOW	1450	92	43	55	148	174	166	86	103	77	122	50	23	27	77	79	127
DEPLETION	114	0	0	0	5	19	24	39	10	-5	2	5	2	3	10	1	
CHAN STOR	2		-3	-16	0	-7	-3	-3	1	-1	4	-1	0	24	8	0	
EVAPORATION	37							2	7	9	8	4	2	2	4		
REG INFLOW	20271	581	291	514	1714	1998	2035	2103	2116	2066	2060	997	465	349	992	1000	990
RELEASE	20271	581	291	514	1714	1998	2035	2103	2103	2053	2060	997	465	349	992	1000	1016
STOR CHANGE									13	13							-26
STORAGE	358	358	358	358	358	358	358	358	371	384	384	384	384	384	384	384	358
ELEV FTMSL	1206.0	1206.0	1206.0	1206.0	1206.0	1206.0	1206.0	1206.0	1206.5	1207.0	1207.0	1207.0	1207.0	1207.0	1207.0	1207.0	1206.0
DISCH KCFS	19.0	19.5	20.9	28.8	28.8	32.5	34.2	34.2	34.2	34.5	33.5	33.5	33.5	22.0	16.1	16.3	17.7
POWER																	
AVE POWER MW		66	71	96	96	105	109	109	109	111	109	109	109	76	56	57	61
PEAK POW MW		113	113	113	113	113	113	113	113	114	114	114	114	114	76	76	75
ENERGY GWH	804.6	23.9	11.9	20.8	69.4	78.2	78.3	80.9	81.2	79.8	81.2	39.3	18.3	14.6	42.0	42.3	42.4
--GAVINS POINT - SIOUX CITY--																	
NAT INFLOW	1550	169	79	102	199	310	224	129	96	60	42	16	7	9	21	5	82
DEPLETION	233	6	3	3	19	33	29	35	32	20	8	5	2	3	11	12	12
REGULATED FLOW AT SIOUX CITY																	
KAF	21588	744	367	612	1894	2275	2230	2197	2167	2093	2094	1008	470	355	1002	993	1086
KCFS		25.0	26.4	34.3	31.8	37.0	37.5	35.7	35.2	35.2	34.1	33.9	33.9	22.4	16.3	16.2	18.9
--TOTAL--																	
NAT INFLOW	24601	1435	669	860	2307	3493	6073	3346	1194	1113	1032	452	211	241	651	582	943
DEPLETION	1690	-24	-11	-14	118	674	1393	665	13	-220	-79	-96	-45	-51	-221	-247	-166
CHAN STOR	-6	79	19	-16	-31	-52	-21	-3	1	14	23	8	1	15	8	-30	-18
EVAPORATION	1772							110	347	431	370	164	76	87	188		
STORAGE	57127	57921	58253	58498	58763	59254	61683	62053	60722	59545	58215	57598	57307	57173	56863	56668	56673
SYSTEM POWER																	
AVE POWER MW		919	916	995	1092	1283	1363	1450	1445	1379	1152	1141	1109	924	927	986	980
PEAK POW MW		2367	2368	2370	2372	2374	2399	2399	2387	2375	2353	2329	2316	2314	2296	2313	2316
ENERGY GWH	10305.8	330.8	153.9	214.9	786.6	954.2	981.5	1078.6	1075.3	993.1	857.3	410.7	186.4	177.5	689.7	733.6	681.9
DAILY GWH		22.1	22.0	23.9	26.2	30.8	32.7	34.8	34.7	33.1	27.7	27.4	26.6	22.2	22.2	23.7	23.5
	INI-SUM	15MAR	22MAR	31MAR	30APR	31MAY	30JUN	31JUL	31AUG	30SEP	31OCT	15NOV	22NOV	30NOV	31DEC	31JAN	29FEB

VALUES IN 1000 AF EXCEPT AS INDICATED

	28FEB99		1999											2000			
	INI-SUM	15MAR	22MAR	31MAR	30APR	31MAY	30JUN	31JUL	31AUG	30SEP	31OCT	15NOV	22NOV	30NOV	31DEC	31JAN	29FEB
--FORT PECK--																	
NAT INFLOW	6000	242	113	145	525	925	1454	633	263	252	324	167	78	89	295	212	283
DEPLETION	-72	-5	-2	-3	45	167	254	60	-73	-117	-78	-21	-10	-11	-107	-109	-61
EVAPORATION	555							35	108	134	116	52	24	27	58		
MOD INFLOW	5517	247	115	148	480	758	1200	538	228	235	286	136	64	73	344	321	344
RELEASE	6918	179	69	89	417	584	655	676	676	597	501	223	111	159	615	676	690
STOR CHANGE	-1400	69	46	59	63	174	545	-138	-449	-362	-215	-87	-47	-86	-271	-355	-346
STORAGE	14674	14743	14789	14848	14911	15085	15630	15492	15043	14681	14466	14380	14332	14246	13975	13620	13273
ELEV FTMSL	2232.5	2232.8	2233.0	2233.3	2233.6	2234.4	2236.9	2236.3	2234.2	2232.5	2231.5	2231.0	2230.8	2230.4	2229.0	2227.2	2225.4
DISCH KCFS	11.0	6.0	5.0	5.0	7.0	9.5	11.0	11.0	11.0	10.0	8.2	7.5	8.0	10.0	10.0	11.0	12.0
POWER																	
AVE POWER MW		81	68	68	95	129	150	151	150	136	110	101	108	134	134	147	159
PEAK POW MW		207	208	208	208	209	210	210	208	207	206	206	206	206	205	203	202
ENERGY GWH	1131.3	29.3	11.4	14.7	68.5	96.1	108.1	112.0	111.6	97.9	82.0	36.4	18.1	25.8	99.7	109.1	110.6
--GARRISON--																	
NAT INFLOW	9400	443	207	266	712	1197	2521	1765	496	417	400	164	76	87	222	165	262
DEPLETION	785	-12	-6	-7	-2	102	485	391	47	-84	54	-51	-24	-27	-44	-26	-11
CHAN STOR	-11	50	10		-20	-25	-15			9	18	6	-5	-20	0	-10	-10
EVAPORATION	644							40	128	158	134	59	27	31	67		
REG INFLOW	14878	684	292	362	1111	1654	2676	2010	998	950	731	385	179	222	814	857	953
RELEASE	16545	595	236	303	1190	1414	1488	1537	1537	1346	1375	665	278	317	1230	1537	1496
STOR CHANGE	-1667	89	56	59	-79	240	1188	473	-539	-397	-644	-280	-99	-95	-416	-680	-542
STORAGE	17690	17779	17834	17893	17814	18054	19242	19715	19175	18779	18135	17855	17756	17660	17245	16565	16022
ELEV FTMSL	1836.1	1836.4	1836.6	1836.8	1836.5	1837.3	1841.1	1842.5	1840.9	1839.6	1837.6	1836.7	1836.3	1836.0	1834.6	1832.3	1830.4
DISCH KCFS	22.5	20.0	17.0	17.0	20.0	23.0	25.0	25.0	25.0	22.6	22.4	22.4	20.0	20.0	20.0	25.0	26.0
POWER																	
AVE POWER MW		244	208	208	245	281	310	315	315	282	276	274	244	244	243	299	306
PEAK POW MW		469	469	470	469	472	486	491	485	480	473	469	468	467	462	453	446
ENERGY GWH	2455.3	87.8	35.0	45.0	176.1	209.2	223.0	234.1	234.0	203.4	205.7	98.6	41.0	46.8	180.4	222.1	213.0
--OAHE--																	
NAT INFLOW	1449	154	72	92	229	130	577	102	24	65	9				-35	-6	36
DEPLETION	513	21	10	12	43	58	107	121	77	20	-6	2	1	1	10	14	23
CHAN STOR	-15	10	12		-12	-12	-8			10	1	0	10	0	0	-22	-4
EVAPORATION	569							36	112	137	117	53	25	28	61		
REG INFLOW	16897	738	310	383	1364	1474	1949	1482	1372	1265	1274	611	263	288	1124	1495	1504
RELEASE	18603	650	347	454	1535	1832	1777	2051	2052	1901	1360	669	308	274	1258	1147	988
STOR CHANGE	-1706	88	-37	-71	-171	-358	173	-569	-679	-637	-86	-58	-45	15	-134	348	516
STORAGE	18400	18489	18451	18381	18210	17852	18024	17455	16776	16139	16053	15995	15949	15964	15830	16178	16694
ELEV FTMSL	1606.1	1606.4	1606.3	1606.0	1605.5	1604.3	1604.8	1602.9	1600.6	1598.3	1598.0	1597.7	1597.6	1597.6	1597.1	1598.4	1600.3
DISCH KCFS	17.9	21.8	25.0	25.4	25.8	29.8	29.9	33.4	33.4	32.0	22.1	22.5	22.2	17.2	20.5	18.7	17.2
POWER																	
AVE POWER MW		279	320	325	329	377	378	420	415	393	270	275	271	211	249	228	212
PEAK POW MW		700	699	698	695	689	692	682	669	658	656	655	654	655	652	659	668
ENERGY GWH	2806.4	100.6	53.8	70.2	236.7	280.8	271.9	312.4	308.8	282.6	201.2	98.9	45.5	40.4	185.5	169.6	147.5
--BIG BEND--																	
EVAPORATION	129							8	24	31	27	12	6	7	14		
REG INFLOW	18474	650	347	454	1535	1832	1777	2044	2027	1870	1333	657	303	267	1244	1147	988
RELEASE	18474	650	347	454	1535	1832	1777	2044	2027	1870	1333	657	303	267	1244	1147	988
STORAGE	1683	1683	1683	1683	1683	1683	1683	1683	1683	1683	1683	1683	1683	1683	1683	1683	1683
ELEV FTMSL	1420.0	1420.0	1420.0	1420.0	1420.0	1420.0	1420.0	1420.0	1420.0	1420.0	1420.0	1420.0	1420.0	1420.0	1420.0	1420.0	1420.0
DISCH KCFS	17.9	21.8	25.0	25.4	25.8	29.8	29.9	33.2	33.0	31.4	21.7	22.1	21.8	16.8	20.2	18.7	17.2
POWER																	
AVE POWER MW		103	117	119	121	139	140	156	154	149	106	111	109	85	100	91	82
PEAK POW MW		518	511	509	509	509	509	509	509	517	538	538	538	538	538	538	529
ENERGY GWH	1064.4	37.2	19.7	25.7	86.9	103.8	100.6	115.7	114.8	107.2	79.0	39.8	18.4	16.3	74.3	67.5	57.4
--FORT RANDALL--																	
NAT INFLOW	500	68	32	41	64	51	130	26	49	23	1				5	-5	15
DEPLETION	80	1	1	1	4	9	12	18	15	7	1	1	0	1	3	3	3
EVAPORATION	147							10	32	39	31	12	5	5	13		
REG INFLOW	18747	717	379	494	1595	1874	1895	2042	2029	1847	1302	644	297	262	1233	1139	1000
RELEASE	18748	446	241	477	1595	1874	1895	2042	2029	1991	1939	948	442	284	867	867	811
STOR CHANGE	-1	270	138	17		0	0		0	-144	-637	-304	-145	-23	366	272	189
STORAGE	3124	3394	3532	3549	3549	3549	3549	3549	3549	3405	2768	2464	2319	2296	2662	2934	3123
ELEV FTMSL	1350.0	1353.4	1355.0	1355.2	1355.2	1355.2	1355.2	1355.2	1355.2	1353.5	1345.1	1340.4	1337.9	1337.5	1343.5	1347.4	1350.0
DISCH KCFS	15.0	15.0	17.3	26.7	26.8	30.5	31.8	33.2	33.0	33.5	31.5	31.9	31.8	17.9	14.1	14.1	14.1
POWER																	
AVE POWER MW		123	144	223	224	254	265	276	274	276	250	238	230	129	105	109	112
PEAK POW MW		343	350	350	350	350	350	350	350	343	308	287	276	274	301	319	330
ENERGY GWH	1838.0	44.1	24.3	48.1	161.0	188.8	190.7	205.4	204.2	198.9	185.8	85.7	38.7	24.8	77.9	81.4	78.3
--GAVINS POINT--																	
NAT INFLOW	1251	91	43	55	124	138	143	81	80	58	105	47	22	25	70	68	101
DEPLETION	114	0	0	0	5	19	24	39	10	-5	2	5	2	3	10	1	
CHAN STOR	1		-4	-18	0	-7	-3	-3	0	-1	4	-1	0	26	7		
EVAPORATION	47							3	9	11	10	5	2	2	5		
REG INFLOW	19839	538	279	514	1714	1986	2011	2078	2091	2042	2035	985	460	330	929	934	912
RELEASE	19839	538	279	514	1714	1986	2011	2078	2078	2029	2035	985	460	330	929	934	938
STOR CHANGE									13	13							-26
STORAGE	358	358	358	358	358	358	358	358	371	384	384	384	384	384	384	384	358
ELEV FTMSL	1206.0	1206.0	1206.0	1206.0	1206.0	1206.0	1206.0	1206.0	1206.5	1207.0	1207.0	1207.0	1207.0	1207.0	1207.0	1207.0	1206.0
DISCH KCFS	17.2	18.1	20.1	28.8	28.8	32.3	33.8	33.8	33.8	34.1	33.1	33.1	33.1	20.8	15.1	15.2	16.3
POWER																	
AVE POWER MW		62	68	96	96	105	108	108	108	110	108	108	108	72	53	53	56
PEAK POW MW		113	113	113	113	113	113	113	113	114	114	114	114	114	76	76	75
ENERGY GWH	789.3	22.3	11.5	20.8	69.4	77.8	77.7	80.2	80.6	79.2	80.6	39.0	18.2	13.9	39.4	39.6	39.3
--GAVINS POINT - SIOUX CITY--																	
NAT INFLOW	900	115	54	69	90	174	125	75	56	35	24	13	6	7	13	-3	48
DEPLETION	233	6	3	3	19	33	29	35	32	20	8	5	2	3	11	12	12
REGULATED FLOW AT SIOUX CITY																	
KAF	20506	648	330	580	1785	2127	2107	2118	2102	2044	2051	992	463	334	931	919	974
KCFS		21.8	23.8	32.5	30.0	34.6	35.4	34.5	34.2	34.4	33.4	33.4	33.4	21.1	15.1	14.9	16.9
--TOTAL--																	
NAT INFLOW	19500	1114	520	668	1744	2615	4950	2682	968	850	863	390	182	208	570	431	745
DEPLETION	1653	10	5	6	114	388	911	664	108	-159	-19	-60	-28	-32	-117	-105	-34
CHAN STOR	-24	60	18	-18	-32	-44	-26	-3	0	19	23	6	5	7	7	-32	-15
EVAPORATION	2090							132	413	510	435	192	89	101	218		
STORAGE	55928	56445	56647	56711	56525	56580	58486	58252	56597	55070	53489	52760	52423	52234	51779	51364	51155
SYSTEM POWER																	
AVE POWER MW		893	926	1040	1109	1286	1350	1425	1417	1346	1121	1107	1071	875	883	926	928
PEAK POW MW		2350	2349	2348	2344	2342	2361	2355	2336	2320	2295	2270	2257	2254	2234	2248	2249
ENERGY GWH	10084.6	321.3	155.6	224.6	798.6	956.5	972.0	1059.9	1053.9	969.2	834.2	398.4	179.9	168.0	657.2	689.3	646.0
DAILY GWH		21.4	22.2	25.0	26.6	30.9	32.4	34.2	34.0	32.3	26.9	26.6	25.7	21.0	21.2	22.2	22.3
	INI-SUM	15MAR	22MAR	31MAR	30APR	31MAY	30JUN	31JUL	31AUG	30SEP	31OCT	15NOV	22NOV	30NOV	31DEC	31JAN	29FEB

DATE OF STUDY 08/20/98 PRELIMINARY 1998-1999 AOP LOWER DECILE RUNOFF 99001 9901 9901 PAGE 1

TIME OF STUDY 06:56:42 STUDY NO 8

VALUES IN 1000 AF EXCEPT AS INDICATED

	28FEB99 INI-SUM	1999 15MAR	22MAR	31MAR	30APR	31MAY	30JUN	31JUL	31AUG	30SEP	31OCT	15NOV	22NOV	2000 30NOV	31DEC	31JAN	29FEB
--FORT PECK--																	
NAT INFLOW	5100	234	109	140	515	783	996	439	253	242	320	159	74	85	271	205	275
DEPLETION	-54	-5	-2	-3	45	167	254	63	-70	-120	-81	-20	-9	-11	-103	-103	-55
EVAPORATION	529							34	104	128	110	49	23	26	56		
MOD INFLOW	4625	240	112	144	470	616	742	342	219	234	291	130	61	69	318	308	330
RELEASE	6787	179	69	89	387	584	625	646	646	566	507	238	111	159	615	676	690
STOR CHANGE	-2161	61	42	54	83	32	117	-303	-427	-332	-216	-108	-51	-89	-296	-368	-360
STORAGE	14674	14735	14777	14832	14915	14947	15064	14761	14334	14001	13786	13677	13627	13538	13241	12873	12512
ELEV FTMSL	2232.5	2232.8	2233.0	2233.2	2233.6	2233.8	2234.3	2232.9	2230.8	2229.1	2228.1	2227.5	2227.2	2226.8	2225.2	2223.2	2221.2
DISCH KCFS	11.0	6.0	5.0	5.0	6.5	9.5	10.5	10.5	10.5	9.5	8.2	8.0	8.0	10.0	10.0	11.0	12.0
POWER																	
AVE POWER MW		81	68	68	88	129	143	142	142	128	110	107	107	133	132	144	156
PEAK POW MW		207	208	208	208	208	209	207	206	205	204	203	203	203	201	199	197
ENERGY GWH	1099.4	29.3	11.4	14.7	63.6	96.0	102.7	106.0	105.4	91.9	82.0	38.4	17.9	25.5	98.5	107.5	108.7
--GARRISON--																	
NAT INFLOW	7299	270	126	162	700	903	2020	1277	361	277	390	161	75	86	108	160	223
DEPLETION	796	-12	-6	-7	-2	102	485	391	47	-84	54	-51	-24	-27	-38	-22	-10
CHAN STOR	-11	50	10		-15	-30	-10			10	13	2		-20	0	-10	-10
EVAPORATION	609							38	120	147	126	57	26	30	64		
REG INFLOW	12670	511	211	258	1074	1355	2150	1493	840	790	729	396	184	222	697	848	913
RELEASE	15274	595	208	268	1071	1353	1369	1414	1414	1191	1131	536	264	317	1230	1476	1438
STOR CHANGE	-2603	-84	3	-9	3	2	781	79	-574	-401	-401	-140	-80	-96	-533	-628	-525
STORAGE	17690	17605	17608	17599	17601	17604	18385	18464	17890	17489	17088	16948	16868	16772	16239	15611	15086
ELEV FTMSL	1836.1	1835.8	1835.8	1835.8	1835.8	1835.8	1838.4	1838.6	1836.8	1835.4	1834.1	1833.6	1833.3	1833.0	1831.1	1828.9	1827.0
DISCH KCFS	22.5	20.0	15.0	15.0	18.0	22.0	23.0	23.0	23.0	20.0	18.4	18.0	19.0	20.0	20.0	24.0	25.0
POWER																	
AVE POWER MW		244	183	183	219	267	282	284	283	244	222	217	228	239	237	280	288
PEAK POW MW		466	466	466	466	466	476	477	470	465	460	458	457	456	449	441	434
ENERGY GWH	2227.9	87.7	30.8	39.6	157.9	198.9	202.7	211.3	210.3	175.6	165.5	77.9	38.3	45.9	176.7	208.6	200.4
--OAHE--																	
NAT INFLOW	1049	197	92	118	183	100	215	82	21	64	5	-5	-2	-3	-48	-12	41
DEPLETION	513	21	10	12	43	58	107	121	77	20	-6	2	1	1	10	14	23
CHAN STOR	-12	10	20	0	-12	-16	-4			13	7	2	-5	-5	0	-18	-5
EVAPORATION	541							35	108	131	111	50	23	26	57		
REG INFLOW	15256	782	311	374	1199	1378	1472	1340	1251	1117	1038	481	233	283	1114	1431	1452
RELEASE	17922	645	373	465	1560	1811	1707	1983	1982	1854	1327	632	291	233	1146	1031	882
STOR CHANGE	-2666	137	-62	-91	-361	-432	-235	-643	-732	-737	-290	-151	-58	50	-32	400	570
STORAGE	18400	18537	18475	18384	18024	17591	17357	16713	15981	15245	14955	14804	14746	14796	14765	15165	15734
ELEV FTMSL	1606.1	1606.5	1606.3	1606.0	1604.8	1603.4	1602.6	1600.3	1597.7	1594.9	1593.8	1593.2	1593.0	1593.2	1593.0	1594.6	1596.8
DISCH KCFS	17.9	21.7	26.8	26.0	26.2	29.4	28.7	32.3	32.2	31.2	21.6	21.2	21.0	14.7	18.6	16.8	15.3
POWER																	
AVE POWER MW		277	343	333	333	372	360	401	395	376	259	253	249	175	222	201	185
PEAK POW MW		701	700	698	692	684	680	668	655	641	636	633	632	633	632	640	651
ENERGY GWH	2670.8	99.8	57.7	71.8	240.1	276.5	259.1	298.1	294.0	271.0	192.5	91.2	41.9	33.6	165.2	149.3	129.1
--BIG BEND--																	
EVAPORATION	129							8	24	31	27	12	6	7	14		
REG INFLOW	17793	645	373	465	1560	1811	1707	1975	1958	1823	1300	620	285	226	1132	1031	882
RELEASE	17793	645	373	465	1560	1811	1707	1975	1958	1823	1300	620	285	226	1132	1031	882
STORAGE	1683	1683	1683	1683	1683	1683	1683	1683	1683	1683	1683	1683	1683	1683	1683	1683	1683
ELEV FTMSL	1420.0	1420.0	1420.0	1420.0	1420.0	1420.0	1420.0	1420.0	1420.0	1420.0	1420.0	1420.0	1420.0	1420.0	1420.0	1420.0	1420.0
DISCH KCFS	17.9	21.7	26.8	26.0	26.2	29.4	28.7	32.1	31.8	30.6	21.1	20.8	20.5	14.3	18.4	16.8	15.3
POWER																	
AVE POWER MW		102	126	122	123	138	134	150	149	145	104	104	103	72	91	82	74
PEAK POW MW		518	511	509	509	509	509	509	509	517	538	538	538	538	538	538	529
ENERGY GWH	1024.7	36.9	21.1	26.3	88.3	102.6	96.7	111.9	110.9	104.5	77.1	37.6	17.3	13.8	67.7	60.7	51.2
--FORT RANDALL--																	
NAT INFLOW	300	55	26	33	43	35	120	13	36	-10	-52	-3	-1	-1		-6	12
DEPLETION	80	1	1	1	4	9	12	18	15	7	1	1	0	1	3	3	3
EVAPORATION	147							10	32	39	31	12	5	5	13		
REG INFLOW	17866	698	398	497	1599	1837	1815	1961	1947	1767	1216	604	279	219	1116	1022	891
RELEASE	17866	446	242	480	1599	1837	1815	1961	1947	1911	1853	908	424	241	750	750	702
STOR CHANGE	0	252	156	17				0	0	-144	-637	-304	-145	-22	366	272	189
STORAGE	3124	3376	3532	3549	3549	3549	3549	3549	3549	3405	2768	2464	2319	2297	2663	2935	3124
ELEV FTMSL	1350.0	1353.1	1355.0	1355.2	1355.2	1355.2	1355.2	1355.2	1355.2	1353.5	1345.1	1340.4	1337.9	1337.5	1343.5	1347.5	1350.0
DISCH KCFS	15.0	15.0	17.4	26.9	26.9	29.9	30.5	31.9	31.7	32.1	30.1	30.5	30.5	15.2	12.2	12.2	12.2
POWER																	
AVE POWER MW		122	145	224	224	249	254	265	263	265	239	228	221	110	91	95	98
PEAK POW MW		342	350	350	350	350	350	350	350	343	307	287	276	274	301	319	330
ENERGY GWH	1754.6	44.1	24.3	48.4	161.4	185.1	182.8	197.3	196.0	191.0	177.7	82.2	37.1	21.1	67.5	70.5	67.9
--GAVINS POINT--																	
NAT INFLOW	1200	87	41	52	120	131	138	76	76	55	104	45	21	24	67	65	98
DEPLETION	114	0	0	0	5	19	24	39	10	-5	2	5	2	3	10	1	
CHAN STOR	5		-5	-18	0	-6	-1	-3	0	-1	4	-1	0	29	6		
EVAPORATION	47							3	9	11	10	5	2	2	5		
REG INFLOW	18910	534	278	514	1714	1943	1928	1992	2005	1959	1949	943	440	289	808	814	800
RELEASE	18910	534	278	514	1714	1943	1928	1992	1992	1946	1949	943	440	289	808	814	826
STOR CHANGE									13	13							-26
STORAGE	358	358	358	358	358	358	358	358	371	384	384	384	384	384	384	384	358
ELEV FTMSL	1206.0	1206.0	1206.0	1206.0	1206.0	1206.0	1206.0	1206.0	1206.5	1207.0	1207.0	1207.0	1207.0	1207.0	1207.0	1207.0	1206.0
DISCH KCFS	17.2	17.9	20.0	28.8	28.8	31.6	32.4	32.4	32.4	32.7	31.7	31.7	31.7	18.2	13.1	13.2	14.4
POWER																	
AVE POWER MW		61	68	96	96	103	105	105	105	107	105	105	105	63	46	47	50
PEAK POW MW		113	113	113	113	113	113	113	113	114	114	114	114	114	76	76	75
ENERGY GWH	758.9	22.1	11.4	20.8	69.4	76.7	75.5	78.0	78.4	77.0	78.3	37.9	17.7	12.2	34.3	34.6	34.7
--GAVINS POINT - SIOUX CITY--																	
NAT INFLOW	550	36	17	22	77	144	106	47	22	15	14	10	4	5	10	-5	26
DEPLETION	233	6	3	3	19	33	29	35	32	20	8	5	2	3	11	12	12
REGULATED FLOW AT SIOUX CITY																	
KAF	19227	564	292	533	1772	2054	2005	2004	1982	1941	1955	948	442	291	807	797	840
KCFS		19.0	21.0	29.8	29.8	33.4	33.7	32.6	32.2	32.6	31.8	31.9	31.9	18.4	13.1	13.0	14.6
--TOTAL--																	
NAT INFLOW	15498	880	411	528	1638	2096	3595	1934	769	643	781	367	171	195	408	407	675
DEPLETION	1682	10	5	6	114	388	911	667	111	-162	-22	-59	-27	-31	-107	-95	-27
CHAN STOR	-18	60	25	-18	-27	-52	-15	-3	0	22	24	4	-5	4	6	-29	-15
EVAPORATION	2001							128	396	488	415	184	85	97	210		
STORAGE	55928	56294	56433	56405	56130	55732	56395	55528	53808	52207	50663	49960	49627	49470	48975	48651	48498
SYSTEM POWER																	
AVE POWER MW		889	933	1026	1084	1258	1277	1348	1337	1265	1039	1015	1013	792	820	849	850
PEAK POW MW		2348	2347	2345	2339	2331	2337	2325	2304	2286	2259	2233	2220	2218	2198	2213	2215
ENERGY GWH	9536.4	319.9	156.8	221.6	780.7	935.6	919.5	1002.7	994.9	911.0	773.1	365.2	170.2	152.1	609.9	631.3	591.9
DAILY GWH		21.3	22.4	24.6	26.0	30.2	30.7	32.3	32.1	30.4	24.9	24.3	24.3	19.0	19.7	20.4	20.4
	INI-SUM	15MAR	22MAR	31MAR	30APR	31MAY	30JUN	31JUL	31AUG	30SEP	31OCT	15NOV	22NOV	30NOV	31DEC	31JAN	29FEB