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This Draft Annual Operating Plan (AOP) presents pertinent information regarding water management in the Missouri River Mainstem Reservoir System (System) through December 2010. The information provided in this Draft AOP is based upon water management guidelines designed to meet the reservoir regulation objectives as described in the Missouri River Master Water Control Manual (Master Manual).

The guidelines set forth in the Master Manual are applied to computer simulations of System regulation assuming five statistically derived inflow scenarios based on an analysis of water supply records from 1898 to 2006. This approach provides a good range of water management simulations for dry, average, and wet conditions. The AOP information 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 its Congressionally-authorized project purposes. System water management is provided by my staff at the Missouri River Basin Water Management Division, Northwestern Division, US Army Corps of Engineers, located in Omaha, NE.

In addition to the AOP, two separate documents are also available entitled: "System Description and Operation" and "Summary of Actual 2008 Regulation." To receive copies of those documents, you may contact the Missouri River Basin Water Management Division at 1616 Capitol Avenue, Suite 365, Omaha, NE 68102-4909, phone (402) 996-3841. Both reports will also be available at the "Reports and Publications" link on our web site at: [www.nwd-mr.usace.army.mil/rcc/](http://www.nwd-mr.usace.army.mil/rcc/).

Six public meetings to discuss this Draft AOP are scheduled as follows: October 5 in Nebraska City, NE; October 6 in Kansas City and Jefferson City, MO; October 7 in Fort Peck, MT and Bismarck, ND; and October 8 in Pierre, SD. We ask that any comments be provided by November 20, 2009. The Final AOP is scheduled for publication in December 2009.

We thank you for your interest in the regulation of the System and look forward to your participation in this process.

// signed //

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# MISSOURI RIVER MAINSTEM RESERVOIR SYSTEM

## Draft Annual Operating Plan 2009 - 2010

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## ABBREVIATIONS

AOP	-	annual operating plan
ac.ft.	-	acre-feet
ACHP	-	Advisory Council on Historic Preservation
AF	-	acre-feet
B	-	Billion
BiOp	-	Biological Opinion
BOR	-	Bureau of Reclamation
cfs	-	cubic feet per second
COE	-	Corps of Engineers
CY	-	calendar year (January 1 to December 31)
elev	-	elevation
ESA	-	Endangered Species Act
ft	-	feet
FTT	-	Flow-to-Target
FY	-	fiscal year (October 1 to September 30)
GIS	-	Geographic Information System
GWh	-	gigawatt hour
ISP	-	initial starting point
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
MRNRC	-	Missouri River Natural Resources Committee
msl	-	mean sea level
MW	-	megawatt
MWh	-	megawatt hour
NEPA	-	National Environmental Policy Act
plover	-	piping plover
pp	-	powerplant
PA	-	Programmatic Agreement
P-S MBP	-	Pick-Sloan Missouri Basin Program
RCC	-	Reservoir Control Center
RM	-	river mile
RPA	-	Reasonable and Prudent Alternative
SHPO	-	State Historic Preservation Officers
SR	-	Steady Release
tern	-	interior least tern

- T&E - Threatened and Endangered
- THPO - Tribal Historic Preservation Officers
- tw - tailwater
- USFWS - United States Fish and Wildlife Service
- USGS - United States Geological Survey
- WY - water year
- 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.

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# MISSOURI RIVER MAINSTEM RESERVOIR SYSTEM

## Draft Annual Operating Plan 2009 - 2010

### I. FOREWORD

This Draft Annual Operating Plan (AOP) presents pertinent information and plans for regulating the Missouri River Mainstem Reservoir System (System) through December 2010 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 coming year to serve the Congressionally authorized project purposes; to fulfill the Corps' responsibilities to Native American Tribes; and to comply with environmental laws, including the Endangered Species Act (ESA). Regulation is directed by the Missouri River Basin Water Management Division, Northwestern Division, U. S. Army Corps of Engineers (Corps) located in Omaha, Nebraska. A map of the Missouri River basin is shown on *Plate 1* and the summary of engineering data for the six individual Mainstem projects and System is shown on *Plate 2*.

This plan may require adjustments such as when substantial departures from expected runoff occur; to meet emergencies including short-term intrasystem adjustments to protect human health and safety during periods of extended drought to maintain minimum river or reservoir levels to keep intakes operational, and adjustments in reservoir releases or reservoir levels to prevent loss of historic and cultural properties; or to meet the provisions of applicable laws, including the ESA. These adjustments would be made to the extent possible after evaluating impacts to all System uses, would generally be short term in nature and would continue only until the issue is resolved.

This document provides the plan for future regulation of the System. Other documents that may be of interest include the "System Description and Regulation" report dated November 2007 or the "Summary of Actual Calendar Year 2008 Regulation," dated April 2009. Both reports are currently available at the "Reports and Publications" link on our web site at: [www.nwd-mr.usace.army.mil/rcc](http://www.nwd-mr.usace.army.mil/rcc), or you may contact the Missouri River Basin Water Management Division at 1616 Capitol Avenue, Suite 365, Omaha, Nebraska 68102-4909, phone (402) 996-3841 for copies. The "Summary of Actual Calendar Year 2009 Regulation" will be available at the same site in April of 2010.

## II. PURPOSE AND SCOPE

Beginning in 1953, projected System reservoir regulation 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 regulation. The Coordinating Committee on Missouri River Mainstem 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 the Draft AOP, which typically is published in mid-September each year. The spring meetings are conducted to update the public on the current hydrologic conditions and projected System regulation for the remainder of the year as it relates to implementing the Final AOP.

Under the terms of Stipulation 18 of the March 2004 "Programmatic Agreement for the Operation and Management of the Missouri River Main Stem System for Compliance with the National Historic Preservation Act, as amended" (PA) the Corps has agreed to consult/meet with the affected Tribes and Tribal Historic Preservation Officers (THPO's), State Historic Preservation Officers (SHPO's), the Advisory Council on Historic Preservation (ACHP) and other parties on the Draft AOP. The purpose of this consultation/meeting is to determine whether operational changes are likely to cause changes to the nature, location or severity of adverse effects to historic properties or to the types of historic properties affected and whether amendments to the Corps Cultural Resources Management Plans and Five-Year Plan are warranted in order to better address such effects to historic properties. During 2006 the Corps worked with the affected Tribes to establish processes for consultation on AOP's under 36 CFR Part 800, the PA, and Executive Order 13175. The process consists of a series of informational meetings with the Tribes and/or government-to-government consultation with Tribes, as requested. A letter, dated August 4, 2009, was sent to the Tribes offering consultation on the 2009-2010 AOP. Meeting times and locations of the six fall public meetings were also provided. Separate meetings will be scheduled for all Tribes requesting government-to-government consultation. All tribes, whether signatory to the PA or not, may request government-to-government consultation on this and all future AOP's. In addition, the Tribes have reserved water rights to the Missouri River and its major tributaries. In no way does this AOP attempt to define, regulate or quantify water rights or any other rights that the Tribes are entitled to by law/treaty.

The 2009 spring public meetings were held at the following locations and dates: April 6 at Fort Peck, Montana; April 7 at Bismarck, North Dakota and Fort Pierre, South Dakota; April 8 at Jefferson City, Missouri and Kansas City, Missouri; April 9 at

Nebraska City, Nebraska. The attendees were given an update regarding the outlook for 2009 runoff and projected System regulation for the remainder of 2009. Six fall public meetings on the Draft 2009-2010 AOP are planned: October 5 in Nebraska City, Nebraska; October 6 in Kansas City and Jefferson City, Missouri; October 7 in Fort Peck, Montana and Bismarck, North Dakota; and October 8 in Pierre, South Dakota.

In the spring of 2010, public meetings will be held to discuss the basin's hydrologic conditions and the effects those conditions are expected to have on the implementation of the Final 2009-2010 AOP.

### **III. MAINSTEM MASTER MANUAL AND ESA CONSULTATIONS**

The Missouri River Mainstem Reservoir System Master Water Control Manual (Master Manual) presents the water control plan and operational objectives for the integrated regulation of the System. First published in 1960 and subsequently revised during the 1970's, the Master Manual was revised in March 2004 to include more stringent drought conservation measures. The 2003 Amendment to the 2000 Biological Opinion (2003 Amended BiOp) presented the USFWS' opinion that the regulation of the System would jeopardize the continued existence of the endangered pallid sturgeon. The USFWS provided a Reasonable and Prudent Alternative (RPA) to avoid jeopardy to the pallid sturgeon that included a provision for the Corps to develop a plan to implement a bimodal 'spring pulse' from Gavins Point Dam. Working with the USFWS, Tribes, states and basin stakeholders, the Corps developed technical criteria for the bimodal spring pulse releases. In March 2006 the Master Manual was revised to include technical criteria for a spring pulse.

### **IV. FUTURE RUNOFF: AUGUST 2009 - DECEMBER 2010**

Runoff into the six System reservoirs is typically low and relatively stable during the August-to-February period. The August 1 calendar year runoff forecast is used as input to the Basic reservoir regulation simulation in the AOP studies for the period August 2009 to February 2010. The August 1 runoff forecast for 2009 was 32.7 million acre-feet (MAF). Two other runoff scenarios based on the August 1 runoff forecast were developed for the same period. These are the Upper Basic and Lower basic simulations, which are based on 120 percent and 80 percent of the August 1 runoff forecast, respectively.

Simulations for the March 1, 2010 to February 28, 2011 time period use five statistically derived inflow scenarios based on an analysis of historic water supply. The report that presents the details of the calculations used to develop these inflow scenarios was updated in July 2008 to include 9 additional years of inflow data that now

extends from 1898 to 2006. Using statistically derived inflow scenarios provides a good range of simulation for dry, average, and wet conditions, and eliminates the need to forecast future precipitation, which is very difficult.

The five statistically derived inflows are identified as the Upper Decile, Upper Quartile, Median, Lower Quartile and Lower Decile runoff conditions. Upper Decile runoff (34.3 MAF) has a 1 in 10 chance of being exceeded, Upper Quartile (30.3 MAF) has a 1 in 4 chance of being exceeded, and Median (24.4 MAF) has a 1 in 2 chance of being exceeded. Lower Quartile runoff (19.3 MAF) has a 1 in 4 chance of the occurrence of less runoff, and Lower Decile (16.2 MAF) has a 1 in 10 chance of the occurrence of less runoff. There is still a 20 percent chance that a runoff condition may occur that has not been simulated; i.e., a 10 percent chance runoff could be lower than Lower Decile, and a 10 percent chance runoff could be greater than Upper Decile.

The Upper Decile and Upper Quartile simulations extend from the end of the Upper Basic simulation through February 2011. Likewise, the Median simulation extends from the end of the Basic simulation, and the Lower Quartile and Lower Decile simulations extend from the end of the Lower Basic simulation through February 2011.

The estimated natural flow at Sioux City, the corresponding post-1949 water use effects, and the net flow available above Sioux City are shown in *Table I*, where water supply conditions are quantified for the period August 2009 through February 2011. The natural water supply for calendar year (CY) 2008 totaled 26.8 MAF.

**TABLE I**  
**NATURAL AND NET RUNOFF AT SIOUX CITY**  
**(Volumes in 1,000 Acre-Feet)**

	<u>Natural</u> <u>1/</u>	<u>Post-1949 Depletions</u>	<u>Net</u> <u>2/</u>
August 2009 through February 2010 (Basic Runoff Scenario)			
Basic	7,100	600	7,700
120% Basic	8,500	500	9,000
80% Basic	5,700	800	6,500
Runoff Year March 2010 through February 2011 (Statistical Analysis of Past Records)			
Upper Decile	34,300	-2,200	32,100
Upper Quartile	30,300	-2,200	28,100
Median	24,400	-2,500	21,900
Lower Quartile	19,300	-2,500	16,800
Lower Decile	16,200	-2,500	13,700

1/ The word "Natural" is used to designate runoff 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 regulation prior to 1949.

2/ The word "Net" represents the total runoff after deduction of the post-1949 irrigation, upstream storage, and other use effects.

## V. ANNUAL OPERATING PLAN FOR 2009-2010

**A. General.** The anticipated regulation described in this AOP is designed to meet the regulation objectives presented in the current Master Manual. While some aspects of System and individual project regulation are clearly defined by technical criteria in the Master Manual, for example navigation service level and season length, others such as minimum releases for irrigation and water supply in the reaches between the reservoirs are based on regulation experience and will be adjusted as needed to respond to changing conditions. Consideration has been given to all of the authorized project purposes, to historic and cultural resources and to the needs of threatened and endangered (T&E) species. The “System Description and Regulation” report provides a concise summary of the primary aspects of System regulation and should be referred to for further information. For ease of use, a summary of the frequently used technical criteria included in the Master Manual is presented on *Plate 3*.

The plan relies on a wealth of regulation experience. Reservoir regulation experience available for preparation of the 2009-2010 AOP includes 13 years of regulation at Fort Peck (1940) by itself, plus 56 years of System experience as Fort Randall (1953), Garrison (1955), Gavins Point (1955), Oahe (1962), and Big Bend (1964) have been brought progressively into System regulation. This regulation experience includes lessons learned during two major droughts of six and eight years (1987-1992 and 2000-2007) that have occurred since the System filled in 1967 and the high runoff period from 1993 - 1999 during which five of the seven years experienced runoff greater than Upper Quartile including the record runoff of 49.0 MAF in 1997. In addition to the long period of actual System reservoir regulation experience, many background regulation studies for the completed System are available for reference.

**B. 2009-2010 AOP Simulations.** AOP simulations for the five runoff scenarios are shown in the final section of this AOP as studies 4 through 8. The return of System storage to near normal levels will provide a great opportunity for the System to provide improved service to all authorized purposes. In summary, the studies provide the following: full service flow support during the first part of the navigation season under the Upper Quartile and Upper Decile runoff scenarios, near full service flow support for Median runoff, and intermediate service for Lower Quartile and Lower Decile; full service flow support after the July 1 System storage check for Median runoff and above and intermediate service for Lower Quartile and Lower Decile; a full length navigation season for all runoff scenarios; low winter releases for Lower Quartile and Lower Decile runoff; higher than normal winter releases for Upper Decile and Upper Quartile runoff, and near normal winter releases for Median runoff; March and May spring pulses from Gavins Point dam; a steady release-flow to target regulation during the tern and plover nesting season for Median and below runoff and nearly steady releases for Upper Quartile and Upper Decile runoff though flood water evacuation is required; emphasis on Oahe and Fort Peck for a steady to rising reservoir level during the forage fish

spawn; and reservoir releases and pool levels sufficient to keep all intakes operational under all runoff scenarios. Water conservation measures will be implemented if runoff conditions indicate that it would be appropriate including cycling releases from Gavins Point during the early part of the nesting season, only supporting flow targets in reaches being used by commercial navigation, reducing flows to minimum levels to support various authorized purposes, and utilization of the Kansas River projects authorized for Missouri River navigation flow support. Additional details about the studies are provided in the following paragraphs. Results of the simulations are shown in *Plates 4 and 5* for the System storage and the Fort Peck, Garrison and Oahe pool elevations.

Under all runoff scenarios modeled for the AOP, the March 1 and May 1 System storage is above the Gavins Point spring pulse precludes of 40.0 MAF. The peak magnitude of the March pulse is 5,000 cfs over navigation flows. Based on the technical criteria, the peak magnitude of the May pulse would be 20,000 cfs under the Upper Decile and Upper Quartile runoff scenarios, 16,000 for Median runoff, 11,600 cfs for Lower Quartile runoff and 11,500 cfs for Lower Decile runoff. The actual peak magnitude of the May pulse will be determined based on the actual System storage and the May 1 runoff forecast. The Master Manual technical criteria includes safeguards to minimize the risk of flooding associated with the spring pulses. Both spring pulses may be reduced or eliminated due to the downstream flow limits, shown on Plate 3, which are well below the channel capacity of the Missouri River. These flow limits are identical to the most restrictive flood control constraints presented in the previous Master Manual and provide a very similar level of flood protection. An additional safeguard is the incorporation of observed and anticipated precipitation into the daily river forecast to provide greater assurance that flows will remain below the downstream flow limits during the duration of the spring pulses. For simulation purposes, the magnitude of the May pulse for Median and above runoff was limited to 10,000 cfs due to the downstream flow limits. Water for the spring pulses will be withdrawn from one or more of the upper three reservoirs and/or Fort Randall depending on releases required to maintain steady to rising pools during the forage fish spawn and other considerations including impacts to historical and cultural sites and the need to evacuate stored flood waters. Prior to implementing the May pulse, the Corps will coordinate with the affected Tribes and States. The Corps will also work closely with the USFWS to insure the planned implementation of the spring pulses meet the intent of the 2003 Amended BiOp.

The reach of the Missouri River downstream of the Platte River experiences a more normalized hydrograph than the reach between Gavins Point and the Platte. As a result, the USFWS has indicated that reducing the spring pulses when possible downstream of the Platte River through reductions in Corps tributary reservoir projects still meets the intent of the 2003 Amended BiOp. If the releases at these downstream Corps tributary reservoirs can be reduced without undue increased risk to other areas,

it may be possible to reduce the impacts on the lower Missouri River due to the spring pulses. This type of regulation was implemented in conjunction with the March 2008 and May 2009 spring pulses. However, this type of regulation is only feasible when releases are scheduled from certain downstream Corps' tributary reservoirs, most likely due to recently captured runoff. Because of its higher magnitude, it is unlikely that the May pulse can be completely eliminated.

The March 15 and July 1 System storage checks were used to determine the level of flow support for navigation and other downstream purposes as well as the navigation season length. Full service navigation flows or more are provided for Upper Quartile and Upper Decile runoff conditions throughout the navigation season. Median runoff starts the season near full service and increases to full service based on the July 1 System storage check. Service levels for Lower Quartile and Lower Decile begin the season at an intermediate service level, and drop slightly based on the July 1 System storage check. Application of the July 1 System storage check (*see Plate 3*) indicated a full length navigation season would be provided for all five runoff conditions. Upper Quartile and Upper Decile simulations reach the desired 56.8 MAF System storage level on March 1, 2011.

For modeling purposes in this AOP, the Steady Release – Flow to Target (SR-FTT) regulation scenario for Gavins Point dam is shown during the 2010 tern and plover nesting season for Median and lower runoff conditions. For these simulations, the monthly average May release used in the simulations was determined by adding the May spring pulse hydrograph to the long-term average release (*see Plate 3*) based on the service level, followed by cycling between the May and July table values for the remainder of the month to reflect an every third day peaking cycle from Gavins Point. The June release was modeled as a steady release due to the presence of chicks along the river at that time, and was set equal to long-term average release for July (*see Plate 3*) based on the service level for the first half of the navigation season. The long-term average releases (*see Plate 3*) were used for July and August to indicate flowing to target. The Lower Quartile and Lower Decile runoff conditions reflect a decrease in service level after July 1. The Upper Quartile and Upper Decile runoff simulations follow the Master Manual, with much above normal runoff requiring release increases early in the year to evacuate floodwater from the reservoirs. Although these modeled Gavins Point releases represent our best estimate of required releases during 2010, actual releases will be based on hydrologic conditions and the availability of habitat at that time. To the extent reasonably possible, measures to minimize incidental take of the protected species will be utilized. These may include not meeting flow targets in reaches without commercial navigation and utilizing the Kansas River tributary reservoirs for navigation flow support when appropriate. It may also be necessary to cycle releases for flood control regulation during the T&E species' nesting season.



The long-term average Gavins Point releases to meet target flows were used in the AOP studies for navigation support during the spring and fall months with the exception of Upper Quartile and Upper Decile. Under those two runoff scenarios, releases were based on flood water evacuation. Based on the September 1 storage checks, Gavins Point winter modeled releases ranged from 14,000 to 15,000 cfs during the 2009-2010 winter season for all runoff scenarios, and from 12,500 cfs to 20,000 cfs during the 2010-2011 winter season depending on the runoff scenario. Gavins Point releases will be increased to meet downstream water supply requirements in critical reaches, to the extent reasonably possible, if downstream incremental runoff is low.

The Gavins Point releases shown in this and previous AOPs are estimates based on historic averages and experience. Adjustments are made as necessary in real-time based on hydrologic conditions.

Intrasystem releases are adjusted to best serve the multiple purposes of the projects with special emphasis placed on regulation for non-listed fisheries starting in early April and for T&E bird species beginning in early May and continuing through August. As part of the overall plan to rotate emphasis among the upper three reservoirs during low runoff years, Fort Peck and Oahe are scheduled to be favored during the 2010 forage fish spawn while also attempting to maintain rising water levels in Garrison. The Median, Upper Quartile, and Upper Decile simulations show that it is possible to provide steady-to-rising pool levels in each of the three large upper reservoirs during the spring forage fish spawn period. Releases in the Lower Quartile and Lower Decile simulations are adjusted to maintain steady-to-rising pool levels at Fort Peck. The Lower Quartile and Lower Decile simulations show the Oahe pool rising during April, but dropping slightly during May and June.

Two additional modified reservoir regulation plans, the Fort Peck “mini-test” and unbalancing the upper three reservoirs, have been shown in previous AOPs, but have not been implemented due to low reservoir levels. The unbalancing of the three reservoirs to benefit reservoir fisheries and the endangered interior least tern and threatened piping plover will be transitioned to in 2010, and then implemented beginning in 2011. In 2011, Fort Peck will be high (see Plate 3), Garrison low, and Oahe allowed to float (normal operation) should Median or greater runoff occur. In terms of elevations for Upper Decile and Upper Quartile, Fort Peck would be 4.2 feet high, Garrison would be 3.0 feet low, and Oahe would be balanced on March 1, 2011. In terms of elevations for Median, Fort Peck would be 1.0 foot high and Garrison would be 1.0 foot low on March 1, 2011. This unbalancing is computed based on the percent of the carryover multiple-use pool. With regard to the Fort Peck mini-test, a priority for pallid sturgeon recovery has been placed on the Lower Yellowstone Project at Intake. The Fort Peck mini-test and full test flows will be deferred until the efficacy of the Lower Yellowstone Project has been assessed.

Actual System regulation from January 1 through July 31, 2009 and the simulated regulating plans for each project through CY 2010 using the five runoff scenarios described on Page 4 are presented on *Plates 6 through 11*, inclusive. Big Bend regulation is omitted 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 regulation since 1953.

*Plate 12* illustrates for Fort Peck, Garrison, Oahe, and Gavins Point the actual releases (Regulated Flow) as well as the Missouri River flows that would have resulted if the reservoirs were not in place (Unregulated Flow) during the period January 2008 through July 2009. *Plate 13* presents past and simulated gross average monthly power generation and gross peaking capability for the System.

**C. Regulation Plan for the Balance of the 2009 Navigation Season and Fall of 2009.** The regulation of the System for the period of August through November 2009 is presented in the following paragraphs.

Fort Peck Dam. Releases will average 6,500 cfs during August and the first half of September. When irrigation ceases in mid-September they will be reduced to 4,000 cfs. The releases will be held near that level through December. The Fort Peck pool will remain essentially steady through the period and end November near 2220 ft msl. It will slowly climb through the winter as releases are kept low due to the upper three reservoirs not being in balance. The record low pool elevation of 2196.2 feet msl was set in March 2007. The previous record low pool elevation was 2208.7 feet msl set in April 1991.

Garrison Dam. Releases will average 16,000 cfs from August through early September. They will then be reduced to 12,500 cfs when irrigation ceases and be held there during October and the first half of November as a water conservation measure then raised to 16,000 cfs in mid-November. The Garrison pool level will slowly fall to 1841 feet msl by the end of November and will continue to slowly decline through the winter as higher releases for hydropower are initiated. The record low pool elevation of 1805.8 feet msl was set in May 2005. The previous record low pool elevation was 1815.0 feet msl set in May 1991.

Oahe Dam. Releases will average 28,500 cfs in August and 29,300 cfs in September in support of full service navigation and will be reduced in late September to initiate the fall drawdown of the Fort Randall pool. Lower releases will continue in October, and November to complete the annual fall draw of Fort Randall. Releases will be increased in December for winter power production. The Oahe pool will end November at elevation 1604.1 feet msl. The record low Oahe pool elevation of 1570.2 feet msl was set

in August 2006. The previous record low pool elevation was 1580.7 feet msl set in November 1989.

Big Bend Dam. Releases will parallel those from Oahe. Big Bend will generally fluctuate between 1420.0 feet msl and 1421.0 feet msl for weekly cycling during high power load periods.

Fort Randall Dam. Releases will average 28,400 cfs in August and will be scheduled in September to back up the releases from Gavins Point Dam. The fall draw down of Fort Randall will be initiated in mid September with the majority of the draw down occurring in October and November. After the navigation season ends in late-November, releases will gradually be reduced to the level required to back up Gavins Point winter releases.

Gavins Point Dam. Releases will be scheduled to support downstream full service flows in reaches with scheduled commercial navigation throughout the 2009 navigation season. A full length navigation season will be provided in accordance with the technical criteria for the July 1 System storage check presented in the Master Manual. The last day of flow support for the commercial navigation season will range from November 21 at Sioux City to November 30 at the mouth near St. Louis. Releases will be reduced by 3,000 cfs per day in mid-November until they reach 14,500 cfs. The Gavins Point pool level will be raised 1.5 feet to elevation 1207.5 feet msl in September. The pool level will remain near that elevation during the fall and winter months.

**D. Regulation Plan for Winter 2009-2010.** The September 1 System storage check is used to determine the winter release rate from Gavins Point dam. A winter release of 12,000 cfs is scheduled if System storage is less than 55 MAF on September 1; 17,000 cfs is scheduled when System storage is above 58 MAF; and the release is prorated for System storages between 55 and 58 MAF. Under the basic runoff scenario, Gavins Point releases will be 14,500 cfs during the winter of 2009-2010, well above the levels seen in the previous drought years . If mild weather conditions prevail, System releases may be set lower than 14,500 cfs, but only if downstream water supply intakes can remain operable at those levels. The planned winter release rate may be less than is required for downstream water supply intakes without sufficient incremental tributary flows below the System, and therefore, releases may need to be set at levels higher than the winter release rate at times to ensure downstream water supply intakes are operable. However, we believe the minimum winter release of 12,000 cfs presented in the Master Manual represents a reasonable long-term goal for water intake operability and for owners to strive for as they make improvements to their facilities. It may be necessary at times to increase Gavins Point releases to provide adequate downstream flows due to the forecast of excessive river ice formation or if ice jams or blockages form which temporarily restrict flows. Based on past experiences, these events are expected to occur infrequently and be of short duration. Given these infrequent temporary

release increases above the winter release rate, the winter System release will likely average around 15,000 cfs. It is anticipated that this year's winter release will be adequate to serve all downstream water intakes except for very short periods during significant river ice formation or ice jamming.

Fort Peck Dam. Releases are expected to average 4,000 cfs to help balance System storage from December through February. Average winter release rates are about 11,000 cfs. The Basic simulation shows that the Fort Peck pool level will rise slightly to near 2223.2 feet msl during the winter period, ending February about 10.8 feet below the base of the annual flood control storage zone. Carryover multiple purpose storage in the three large upper reservoirs will be out of balance on March 1, 2010 due to minimum release requirements below the dam throughout the year. Fort Peck will end February 2010 about 6.1 feet low, Garrison about 2.0 feet high, and Oahe about 2.0 feet high. The pool level is expected to rise during March to near elevation 2224.5 feet msl.

Garrison Dam. Releases will be scheduled at 16,000 cfs in December increasing to 21,000 cfs for January and February to serve winter power loads and to help balance System storage. The December release rate should be sufficient to prevent ice induced flooding at the time of freeze-in, but temporary reductions in the releases may be scheduled to prevent exceedence of a 13-foot stage at the Bismarck gage. Flood stage is 16 feet. Average winter release rates for Garrison are 20,300 cfs in December, 22,800 cfs in January and 24,000 cfs in February. The Garrison pool level is expected to decline about 5.5 feet from near elevation 1841.0 feet msl at the end of November to near elevation 1835.5 feet msl by March 1, 2.0 feet below the base of the annual flood control storage zone. The Median simulation indicates the pool level will rise to elevation 1836.7 feet msl by March 31.

Oahe Dam. Releases for the winter season will provide backup for the Fort Randall and Gavins Point releases plus fill the recapture space available in the Fort Randall reservoir 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 about 16,800 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 Oahe pool level is expected to remain steady at 1604.1 from the end of November through the end of December before starting to rise to elevation 1605.4 feet msl by the beginning of March, 2.1 feet below the base of the annual flood control storage zone. The pool is expected to rise to elevation 1606.2 feet msl by the end of March.

Big Bend Dam. The Big Bend pool level will be maintained in the normal 1420.0 to 1421.0 feet msl range during the winter.

Fort Randall Dam. Releases will average about 12,500 cfs during the winter season. The Fort Randall pool level is expected to rise from its fall drawdown elevation of 1337.5 feet msl to near elevation 1350.0 feet msl, the seasonal base of flood control, by March 1. However, if the plains snowpack flood potential downstream of Oahe Dam remains quite low, the Fort Randall pool level will be raised to near 1353.0 feet msl by March 1. It is likely that a pool level as high as 1355.2 feet msl could be reached by the end of the winter period on March 31 if runoff conditions permit. The Fort Randall pool level above the White River delta near Chamberlain, South Dakota will likely remain at a higher elevation than the pool level below the delta from early October through December, due to the damming effect of this delta area.

Gavins Point Dam. Gavins Point winter releases are discussed in the first paragraph of this section. The Gavins Point pool level will be near elevation 1207.5 feet msl until late February when it will be lowered to elevation 1206.0 feet msl to create additional capacity to store spring runoff.

System storage for all runoff conditions will range between 52.0 and 55.0 million acre-feet by March 1, 2010, the beginning of next year's runoff season. System storage at the base of the annual flood control zone is 56.8 million acre-feet.

**E. Regulation During the 2010 Navigation Season.** All five runoff scenarios modeled for this year's AOP follow the technical criteria presented in the current Master Manual for downstream flow support. Beginning in mid-March, Gavins Point releases will be gradually increased to provide navigation flow support at the mouth of the Missouri near St. Louis by April 1, 2010, the normal navigation season opening date. The corresponding dates at upstream locations are Sioux City, March 23; Omaha, March 25; Nebraska City, March 26; and Kansas City, March 28. However, if during the 2010 navigation season there is no commercial navigation scheduled to use the upper reaches of the navigation channel, we will consider eliminating navigation flow support for targets in those reaches to conserve water in the System, provide additional flood control, and/or minimize incidental take of the protected species during the nesting season.

Navigation flow support for the 2010 season will be determined by actual System storage on March 15 and July 1. Runoff scenarios modeled indicate full service flow support at the start of the 2010 navigation season for Upper Decile and Upper Quartile runoffs and near full support for Median runoff (200 cfs below full service). Lower Quartile and Lower Decile runoffs would result in reductions below full service of 2,000 cfs and 2,100 cfs, respectively. Following the July 1 System storage check, full service would be provided for the Median runoff scenario and above. Service levels would be further reduced for Lower Quartile and Lower Decile runoffs to 2,600 cfs and 3,600 cfs below full service, respectively. If the July 1 System storage check indicates an increase in service level, any increase may be delayed until the end of the nesting season,

depending on the potential for incidental take of the protected species. The normal 8-month navigation season is provided for all runoff scenarios as shown in *Table II*.

**TABLE II  
NAVIGATION SERVICE SUPPORT  
FOR THE 2010 SEASON**

	Runoff Scenario (MAF)	System Storage		Flow Level Above or Below Full Service (cfs)		Season Shortening (Days)
		March 15 (MAF)	July 1 (MAF)			
				Spring	Summer/Fall	
U.D.*	34.3	56.1	63.3	0	0	0
U.Q.*	30.3	56.0	62.6	0	0	0
Med *	24.4	54.3	58.4	-200	0	0
L.Q.*	19.3	52.7	54.2	-2,000	-2,600	0
L.D.*	16.2	52.6	53.1	-2,100	-3,600	0

\*Includes both March and May Spring Pulses

As previously stated, the planned regulation for the 2010 nesting season below Gavins Point dam will be Steady Release – Flow to Target (SR-FTT) for median runoff or below. The initial steady release, which is estimated to be 25,000 to 32,000 cfs, will be based on hydrologic conditions and the availability of habitat at that time. Model runs included in this AOP have a Gavins Point release peaking cycle of 2 days down and 1 day up following the May pulse to keep birds from nesting at low elevations. Gavins Point releases will be adjusted to meet downstream targets as tributary flows recede, but ideally the initial steady release will be sufficient to meet downstream targets until the majority of the birds have nested. The purpose of this regulation is to continue to meet the project purposes while minimizing the loss of nesting T&E species and conserving water in the upper three reservoirs. Gavins Point releases for the Upper Quartile and Upper Decile runoff simulations are much above normal to evacuate floodwater from the reservoirs. Releases from Garrison and Fort Randall will follow repetitive daily patterns from early May, at the beginning of the T&E species’ nesting season, to the end of the nesting in late August. In addition to the intra-day pattern, Fort Randall releases may also be cycled with 2 days of low releases and 1 day of higher releases during the early part of the nesting season to maintain release flexibility in that reach while minimizing the potential for take.

As discussed previously, System storage will be above the storage precludes for both spring pulses under all runoff scenarios modeled.

Gavins Point releases may be quite variable during the 2009 navigation season but are expected to range from 12,000 to 35,000 cfs. Release reductions necessary to minimize downstream flooding are not reflected in the monthly averages shown in the

simulations but will be implemented as conditions warrant. Reductions in System releases to integrate the use of downstream Missouri River flow support from the Kansas Reservoir System have not been included since they are based on downstream hydrologic conditions. However, this storage will be utilized to the extent possible as a water conservation measure or to minimize incidental take of protected species during the nesting season if conditions indicate it is prudent to do so. Simulated storages and releases for the System and individual reservoirs within the System are shown on *Plates 6 through 11*. Ample storage space exists in the System to control flood inflows under all scenarios simulated for this AOP.

**F. Regulation Activities for T&E Species and Fish Propagation Enhancement.**

The ability to provide steady to rising pool levels in the upper three reservoirs in low runoff years is very dependent on the volume, timing, and distribution of runoff. The reservoir regulation simulations presented in this AOP for the Upper Decile, Upper Quartile, and Median runoff scenarios show that steady to rising pool levels would occur during the spring fish spawn period for the upper three System reservoirs. As part of the overall plan to rotate emphasis among the upper three reservoirs during low runoff years, Fort Peck and Oahe are scheduled to be favored during the 2010 forage fish spawn if runoff is below median. The studies show that inflows are sufficient to maintain steady to rising pools at Fort Peck from April through June for Lower Quartile and Lower Decile runoff scenarios, however, the Oahe pool level may fall during this period. Oahe will be supported by releases from Garrison during the forage fish spawn if local runoff is not sufficient to keep Oahe rising. These adjustments may be restricted when the terns and plovers begin nesting in May. If the drought re-emerges, emphasis during the fish spawn will be rotated among the upper three reservoirs and may also be adjusted to be opportunistic in regard to runoff potential. The upper three reservoirs will be managed to benefit forage fish to the extent reasonably possible, while continuing to serve the other Congressionally authorized project purposes.

As discussed in the previous section, the 2009-2010 AOP includes provisions for unbalancing the Fort Peck, Garrison, and Oahe reservoirs for the first time under the revised Master Manual to benefit the endangered species and reservoir fishery. On March 1, 2011 for the Upper Quartile and Upper Decile runoff scenarios the reservoirs will be unbalanced 4.2 feet in favor of Fort Peck and Garrison will be 3 feet lower than lower than balanced. Under Median runoff the reservoirs will be unbalanced 1 foot in favor of Fort Peck and Garrison will be 1 foot lower than balanced. The criteria for unbalancing are based on recommendations provided by the MORAST, MRNRC and the USFWS. System storage will be below the minimum levels under which unbalancing is recommended by either the MRNRC or the USFWS under the lowest two runoff scenarios.

Fort Peck Dam. The repetitive daily pattern of releases from Fort Peck Dam has not been implemented since the 2004 tern and plover nesting season. This adaptive

management decision was made based on data collected during previous nesting seasons. In recent years, birds in this reach have nested on available high habitat, and thus were not expected to be impacted by the potential range of releases from Fort Peck during the summer. Releases during the 2010 nesting season will not be restricted by the repetitive daily pattern unless habitat conditions or nesting patterns warrant a change. Overall habitat should be slightly less than in 2009 as flows during the nesting season will be slightly higher.

If flood flows enter the Missouri River below the project during the nesting season, hourly releases will generally 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. In rare instances releases below 3,000 cfs may be scheduled for flood damage reduction. April releases should be adequate for trout spawning below the project.

Maintaining a rising Fort Peck pool level will be dependent upon the daily inflow pattern to the reservoir, but appears possible under all the runoff scenarios. The Fort Peck "mini-test" will not be run pending an evaluation of the results of the Yellowstone River Intake Diversion fish passage structure.

Garrison Dam. Daily average releases from Garrison will be much less than full powerplant capacity during the tern and plover nesting season under all runoff scenarios. As in previous years, releases from Garrison will follow a repetitive daily pattern during the T&E nesting season to limit peak stages below the project for nesting birds. Releases during the 2010 nesting season will be higher than was experienced during the drought resulting in less available habitat.

The Garrison pool was much higher in the summer of 2009 than in the past several years. Early indications are that the cold-water habitat volume in the reservoir has improved significantly this year. In 2005 plywood was attached to the lower 50 feet of the trash racks on two of the penstocks to allow water to be drawn from a higher, and therefore warmer, region of the reservoir to conserve the volume of cold-water habitat in the reservoir. In 2007 plywood was installed on one additional trash rack. In 2005-2008, releases from Garrison during the summer months were made through the hydropower units with modified intakes, to the extent reasonably possible. In addition, the manner in which the other hydropower units were operated was adjusted to run them at or near full capacity when in use, which also had the effect of drawing water off the upper, warmer, portion of the reservoir. With the higher pool elevation improving cold-water habitat volume this summer, the modified unit operation was discontinued. Additional sampling of data in September and a comparison of previous cold-water habitat will occur this fall. If the significantly improved cold-water volumes verify, it's likely that the plywood will be removed from the trash racks later this fall.



If runoff is not sufficient to keep all the pool levels rising during the fish spawn in 2010, the Corps will, to the extent reasonably possible while serving other Congressionally authorized project purposes, set releases to result in a steady to rising pool at Fort Peck and Oahe from April 20 to May 20. Adjustments to Garrison's releases, however, may be restricted when the terns and plovers begin nesting in May. A rising pool at Garrison during the fish spawn in April and May will be dependent upon the daily inflow pattern to the reservoir but appears possible for Median runoff and above runoff simulations.

Oahe Dam. Releases in the spring and summer will back up those from Gavins Point Dam. The pool level should be steady to rising in the spring during the fish spawn under median and above runoff scenarios. Under lower runoff conditions, Garrison's releases will be adjusted to the extent reasonably possible to maintain a steady to rising pool at Oahe, but depending on the timing and distribution of runoff that goal may not be possible under all conditions.

Fort Randall Dam. To the extent reasonably possible, Fort Randall will be regulated to provide for a pool elevation near 1355 feet msl during the fish spawn period, provided water can be supplied from other reservoirs for downstream uses. The pool will not be drawn down below elevation 1337.5 feet msl in the fall to ensure adequate supply for water intakes. As a measure to minimize take while maintaining the flexibility to increase releases during the nesting season, hourly releases from Fort Randall during the 2009 nesting season will follow a repetitive daily pattern to limit peak stages below the project for nesting birds. Daily average flows may be increased every third day to preserve the capability of increasing releases later in the summer with little or no incidental take if drier downstream conditions occur. If higher daily releases are required later in the nesting season, the daily peaking pattern may be adjusted, reduced or eliminated resulting in a steady release to avoid increased stages at downstream nesting sites.

Gavins Point Dam. March and May spring pulses from Gavins Point Dam for the benefit of the endangered pallid sturgeon would be implemented under all runoff scenarios in 2010. The Master Manual technical criteria for the pulses are presented in Plate 3. Details of the spring pulses included in the AOP simulations are provided in Chapter V, Section B, entitled "**2009-2010 AOP Simulations**".

Based on 2003 through 2008 nesting season results with the SR-FTT regulation and planned habitat development activities, it is anticipated that sufficient habitat will be available above the planned release rates for Median or below runoff to provide for successful nesting. All reasonable measures to minimize the loss of nesting T&E bird species will be used. These measures include, but are not limited to, such things as a relatively high initial steady release during the peak of nest initiation, the use of the Kansas River basin reservoirs, moving nests to higher ground when possible, and monitoring nest fledge dates to determine if delaying an increase a few days might

allow threatened chicks to fledge. The location of navigation tows and river conditions at intakes would also be monitored to determine if an increase could be temporarily delayed without impact. Cycling releases every third day may be used to conserve water early in the nesting season if extremely dry conditions develop. In addition, cycling may be used during downstream flood control regulation. It is anticipated that for Upper Decile and Upper Quartile runoff scenarios a SR scenario will be implemented due to the need to evacuate flood water. A SR-FTT release scenario will be implemented for Median and below runoff scenarios. A full description of these two release scenarios can be found in the Missouri River Mainstem Master Water Control Manual.

The Gavins Point pool will be regulated near 1206.0 feet msl in the spring and early summer, with minor day-to-day variations due to inflows resulting from rainfall runoff. Several factors can limit the ability to protect nests from inundation in the upper end of the Gavins Point pool. First, because there are greater numbers of T&E bird species nesting below the Gavins Point project, regulation to minimize incidental take usually involves restricting Gavins Point releases, which means that the Gavins Point pool can fluctuate significantly due to increased runoff from rainfall events. Second, rainfall runoff between Fort Randall Dam and Gavins Point Dam can result in relatively rapid pool rises because the Gavins Point project has a smaller storage capacity than the other System reservoirs. And third, the regulation of Gavins Point for downstream flood control may necessitate immediate release reductions to reduce downstream damage. When combined, all these factors make it difficult and sometimes impossible to prevent inundation of nests in the upper end of the Gavins Point reservoir. Planned habitat creation projects in Lewis and Clark Lake will reduce the inundation risk to T&E bird species by providing higher habitat for nesting. The pool will be increased to elevation 1207.5 feet msl when it is determined that there are no terns or plovers nesting along the reservoir.

**G. Regulation Activities for Historic and Cultural Properties.** As acknowledged in the 2004 Programmatic Agreement for the Operation and Management of the Missouri River Main Stem System (PA), wave action and fluctuation in the level of the reservoirs results in erosion along the banks of the reservoirs. The Corps will work with the Tribes utilizing 36 CFR Part 800 and the PA to address the exposure of historic and cultural sites. The objective of a programmatic agreement is to deal "...with the potential adverse effects of complex projects or multiple undertakings..." The PA objective was to collaboratively develop a preservation program that would avoid, minimize and/or mitigate adverse effects along the System reservoirs. All tribes, whether signatory to the PA or not, may request government-to-government consultation on the regulation of the System and the resulting effect on historic and cultural properties and other resources. Pool levels at the upper three reservoirs improved significantly in 2009 and are currently 11 to 18 feet higher than one year ago, but continuing exposure of cultural sites along the shorelines

is still possible. Actions to avoid, minimize or mitigate adverse impacts and expected results of the actions are covered under Chapter VI of this AOP. *Plate 14* shows the locations of the Tribal Reservations.

Fort Peck Dam. Depending on runoff in the Missouri River basin, System regulation during 2010 could result in a Fort Peck pool elevation variation from a high of 2241 feet msl to a low of 2217 feet msl. This is based on the Upper and Lower Decile runoff scenarios (see *Plate 8* and the studies included at the end of this report). Based on a review of existing information, approximately 13 known sites could be affected during this period.

Garrison Dam. Based on the Upper and Lower Decile runoff scenarios (see *Plate 9* and the studies included at the end of this report), Garrison pool elevations could range between 1847 and 1823 feet msl during 2010. Based on a review of existing information, approximately 93 known sites could be affected during this period.

Oahe Dam. At the Oahe reservoir, the System regulation under the Upper and Lower Decile runoff scenarios could result in pool elevations between 1615 and 1590 feet msl (see *Plate 10* and the studies included at the end of this report). Based on a review of existing information, approximately 203 known sites could be affected during this period.

Big Bend Dam. System regulation will be adjusted to maintain the Big Bend pool level in the normal 1420 to 1421 feet msl range during 2010. Short-term increases above 1421 due to local rainfall may also occur. Based on a review of existing information, approximately 4 known sites could be affected during this period.

Fort Randall Dam. As part of the normal System regulation, the Fort Randall pool elevations will vary between 1350 and 1355 feet msl during the spring and summer of 2010. Short-term increases above 1355 feet msl due to local rainfall may occur. The annual fall drawdown of the reservoir to elevation 1337.5 feet msl will begin prior to the close of the navigation season and will be accomplished by early December. The reservoir will then refill during the winter to elevation 1350 feet msl. Based on a review of existing information, approximately 32 known sites could be affected during this period.

Gavins Point Dam. System regulation will be adjusted to maintain the Gavins Point pool level in the normal 1206 to 1207.5 feet msl range during 2010. Short-term increases above 1207.5 feet msl may occur due to local rainfall. Based on a review of existing information, no known sites could be affected during this period.

## VI. SUMMARY OF RESULTS EXPECTED IN 2010

With regulation of the System in accordance with the 2009-2010 Draft AOP outlined in the preceding pages, the following results can be expected. Table III summarizes the critical decision points throughout the year for all runoff conditions.

**Table III**  
**Summary of 2009-2010 AOP Studies**

Decision Points	2009-2010 Runoff Condition				
	Upper Decile	Upper Quartile	Median	Lower Quartile	Lower Decile
<b>March 1 System Storage</b> March Spring Pulse? Pulse Magnitude March 23-31 GP Release	55.0 MAF Yes 5 kcfs 28.9 kcfs	55.0 MAF Yes 5 kcfs 28.9 kcfs	53.4 MAF Yes 5 kcfs 28.7 kcfs	52.0 MAF Yes 5 kcfs 30.0 kcfs	52.0 MAF Yes 5 kcfs 29.9 kcfs
<b>March 15 System Storage</b> Spring Service Level	56.1 MAF full service	56.0 MAF full service	54.3 MAF 0.2 Kcfs blw full service	52.7 MAF 2.0 Kcfs blw full service	52.6 MAF 2.1 Kcfs blw full service
<b>May 1 System Storage</b> May Spring Pulse? Pulse Magnitude May Cycling May GP Release	58.5 MAF Yes 20.0 (10) kcfs 37.5/37.5 kcfs 37.5 kcfs	58.0 MAF Yes 20.0 (10) kcfs 28.0/31.0 kcfs 33.0 kcfs	55.2 MAF Yes 16.0 (10.0) kcfs 27.8/31.4 kcfs 30.5kcfs	52.7 MAF Yes 11.6 kcfs 29.3/32.3 kcfs 32.0 kcfs	52.4 MAF Yes 11.6 kcfs 29.2/32.2 kcfs 31.9 kcfs
<b>Fish Spawn Rise (Apr-Jun)</b> FTPK Pool Elev Change GARR Pool Elev Change OAHE Pool Elev Change	+12.6 feet +5.8 feet +5.7 feet	+10.6 feet +5.0 feet +6.0 feet	+6.5 feet +5.1 feet +2.5 feet	+5.7 feet +1.6 feet -0.9 feet	+3.0 feet +0.6 feet -1.5 feet
<b>July 1 System Storage</b> Sum-Fall Service Level (kcfs) Nav Season Shortening	63.3 MAF Full Service 0 Days	62.6 MAF Full Service 0 Days	58.4 MAF Full Service 0 Days	54.2 MAF 2.6 blw full service 0 Days	53.1 MAF 3.6 blw full Service 0 Days
<b>September 1 System Storage</b> Winter GP Release	62.1 MAF 20.0 kcfs	62.2 MAF 20.0 kcfs	56.8 MAF 15.2 kcfs	52.0 MAF 12.5 kcfs	50.3 MAF 12.5 kcfs
<b>February 28 System Storage</b> End-Year Pool Balance Percent Pool	56.8 MAF Unbalanced 100% FP+4.2/GA -3.0	56.8 MAF Unbalanced 100% FP+4.2/GA -3.0	53.5 MAF Unbalanced 91% FP+1.0/GA -1.0	48.0 MAF Balanced 76%	45.6 MAF Balanced 70%

**A. Flood Control.** All runoff scenarios studied will begin the March 1, 2009 runoff season below the desired 56.8 MAF base of the annual flood control and multiple

use zone. Therefore, the entire System flood control zone, plus an additional 1.8 to 4.8 MAF of the carryover multiple use zone, will be available to store surplus runoff. The System will be available to significantly reduce peak discharges and store a significant volume of water for all floods that may originate above the System.

Remaining storage in the carryover multiple use zone will be adequate to provide support for all of the other multiple purposes of the System, though at reduced service levels after July 1 if lower quartile or lower decile runoff occurs in 2010.

**B. Water Supply and Water Quality Control.** Problems at intakes located in the river reaches and Mainstem reservoirs are related primarily to intake elevations or river access rather than inadequate water supply. In emergency situations, short-term adjustments to protect human health and safety would be considered to keep intakes operational.

Low reservoir levels during the 2000-2007 drought contributed to both intake access and water quality problems for intakes on Garrison and Oahe reservoirs, including several Tribal intakes; however better runoff in 2008 and 2009 has eliminated concern over many of these intakes. Gains in the Oahe pool level required modification of the Standing Rock Sioux Tribe's temporary intake at Fort Yates to protect it from the rising water levels. The Bureau of Reclamation (BOR) installed the temporary intake after the primary intake failed in November 2003 leaving the community without water for several days. If the drought re-emerges, reservoir pool levels and releases may decline renewing the potential for intake access and water quality problems at both river and reservoir intakes. Under the Lower Decile runoff scenario, minimum reservoir levels in 2010 would be approximately 20 feet higher than the record lows set in the current drought. Although not below the critical shut-down elevations for any intake, return to lower levels would require extra monitoring to ensure the continued operation of the intakes.

Although below normal Gavins Point releases are being scheduled in the winter of 2009-2010 for all runoff scenarios and in the winter of 2010-2011 for all but the Upper Decile and Quartile 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. Lower releases may result in additional water treatment costs such as intake operators experienced during the past eight year drought. It is also possible with the lower releases during winter that river ice formation or ice jams may temporarily reduce river stages to levels below which some intakes can draw water. Therefore, during severe cold spells, experience has shown that for brief periods it may be necessary to increase Gavins Point releases to help alleviate downstream water supply problems.

During non-navigation periods in the spring and fall from 2004 through 2007, System releases were scheduled as low as 9,000 cfs provided that enough downstream tributary flow existed to allow for continued operation of downstream water intakes. If a non-navigation year would occur in the future, summer releases (May thru August) could average around 18,000 cfs from the System. However, it should be noted that System releases will be set at levels that meet the operational requirements of all water intakes to the extent reasonably possible. Problems have occurred at several downstream intakes in the past, however in all cases the problems have been associated with access to the river or reservoir rather than insufficient water supply. In addition, the low summer release rate would likely result in higher water temperatures in the river, which could impact a power plant's ability to meet their thermal discharge permits. Again, it should be noted that System releases will be set at levels that allow the downstream power plant to meet their thermal discharge permit requirements to the extent reasonably possible. This may mean that actual System releases in the hottest part of the summer period may be set well above the 18,000 cfs level. The Corps continues to encourage intake operators throughout the System and along the lower river reach to make necessary modifications to their intakes to allow efficient operation over the widest possible range of hydrologic conditions. While the current level of System storage should allow adequate access for all intakes for those intake operators whom had issues or difficulty with access during the past drought years, adjustments should continue to be made during this more normal release period to improve access and flexibility when drought returns to the basin.

**C. Irrigation.** Scheduled releases from the System reservoirs will be sufficient to meet the volumes of flow required for irrigation diversions from the Missouri River. Some access problems may be experienced, however, if Lower Quartile or Decile runoff conditions return. Below Fort Peck, localized dredging may once again be required in the vicinity of irrigation intakes in order to maintain access to the water if releases are low next summer as a significant storage imbalance exists that will require releases to be at minimums for irrigation. Tributary irrigation water usage is fully accounted for in the estimates of water supply.

**D. Navigation.** Service to navigation in 2010 will be at or near full service flow support from the beginning of the navigation season through the July 1 storage check for Median and above runoff scenarios. For lower runoff scenarios, navigation flow support will be at intermediate levels of 2,000 cfs below full service for Lower Quartile, and 2,100 cfs below full service for Lower Decile. Full service flow support will continue throughout the entire navigation season for Median and higher runoff. Lower Quartile or Lower Decile runoffs will result in reductions from full service of 2,600 and 3,600 cfs respectively after the July 1 storage check. Although the AOP simulations provide a comparison of typical flow support under varying runoff conditions, the actual rate of flow support for the 2010 navigation season will be based on actual System storage on March 15 and July 1, 2010.

All runoff simulations show no reduction in the normal 8-month navigation season length during 2010. The anticipated service level and season length for all runoff conditions simulated are shown in *Table II*.

**E. Power.** *Tables IV and V* give the estimated monthly System load requirements and hydropower supply of the Eastern Division, Pick-Sloan Missouri Basin Program (P-S MBP), from August 2009 through December 2010. 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 regulation 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 managed system. Improved runoff resulted in higher pool levels and better recreation access at the upper three reservoirs during 2009. Recreation access is expected to be at normal levels in 2010 with the exception of Fort Peck which still has two boat ramps that remain inaccessible due to the low reservoir level. If Lower Quartile or Lower Decile runoff were to occur in 2010,, boat ramps that were lowered and low water ramps that were constructed during the two recent drought periods will provide adequate reservoir access. Special regulation adjustments incorporating specific objectives for these purposes will be made to the extent reasonably possible. Conditions in the lower three reservoirs 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.

The effects of the simulated System regulation during 2010 on fish and wildlife are included in Chapter V, Section F, entitled, "Regulation Activities for T&E Species and Fish Propagation Enhancement."

**G. Historic and Cultural Properties.** As mentioned in Chapter V of this AOP, the regulation of the System during 2009 and 2010 will expose cultural sites due to erosion from the normal fluctuation of pool elevations. The Corps will work with the Tribes utilizing 36 CFR Part 800 and the PA to address the exposure of these sites. The objective of a PA is to deal "...with the potential adverse effects of complex projects or multiple undertakings..." The PA objective was to collaboratively develop a preservation program that would avoid, minimize and/or mitigate the adverse affects of the System operation. All tribes, whether signatory to the PA or not, may request government-to-government consultation on the regulation of the System and the resulting effect on historic and cultural properties and other resources.

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

2009	Estimated Committed Sales*	Expected C of E Capability					Expected Bureau Capability**					Expected Total System Capability				
		120%	Basic	80%			120%	Basic	80%			120%	Basic	80%		
Aug	2395	2340	2333	2330			211	212	211			2551	2545	2541		
Sep	2367	2332	2320	2314			210	211	209			2542	2531	2523		
Oct	2367	2315	2300	2291			211	212	208			2526	2512	2499		
Nov	2274	2280	2260	2249			210	211	207			2490	2471	2456		
Dec	2274	2282	2265	2251			206	206	203			2488	2471	2454		
<b>2010</b>																
Jan	2274	2304	2286	2270			202	202	200			2506	2488	2470		
Feb	2274	2313	2293	2276			198	199	197			2511	2492	2473		
		<u>U.D.</u>	<u>U.Q.</u>	<u>Med</u>	<u>L.Q.</u>	<u>L.D.</u>	<u>U.D.</u>	<u>U.Q.</u>	<u>Med</u>	<u>L.Q.</u>	<u>L.D.</u>	<u>U.D.</u>	<u>U.Q.</u>	<u>Med</u>	<u>L.Q.</u>	<u>L.D.</u>
Mar	2274	2329	2324	2301	2278	2275	194	195	196	196	199	2523	2519	2497	2474	2474
Apr	2301	2345	2340	2307	2275	2271	193	193	194	194	193	2538	2533	2501	2469	2464
May	2367	2358	2352	2311	2271	2266	196	196	201	199	196	2554	2548	2512	2470	2462
Jun	2367	2391	2390	2338	2284	2273	213	213	213	206	200	2604	2603	2551	2490	2473
Jul	2367	2385	2391	2339	2274	2257	213	213	213	206	205	2598	2604	2552	2480	2462
Aug	2367	2375	2384	2315	2254	2234	211	211	211	204	203	2586	2595	2526	2458	2437
Sep	2367	2362	2361	2305	2240	2217	209	209	211	204	203	2571	2570	2516	2444	2420
Oct	2367	2330	2335	2286	2218	2194	209	209	212	205	204	2539	2544	2498	2423	2398
Nov	2309	2284	2288	2248	2178	2153	207	207	210	203	203	2491	2495	2458	2381	2356
Dec	2309	2245	2248	2212	2143	2115	202	202	206	200	201	2447	2450	2418	2343	2316

\* Estimated sales, including system reserves. Power in addition to hydro production needed for these load requirements will 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 V  
ENERGY GENERATION AND SALES  
(Million kWh at plant)

2009	Estimated Committed Sales*	Expected C of E Generation					Expected Bureau Generation **					Expected Total System Generation				
		120%	Basic	80%			120%	Basic	80%			120%	Basic	80%		
Aug	844	833	845	858			90	70	67			923	915	925		
Sep	727	811	815	830			84	67	63			895	882	893		
Oct	724	686	685	694			84	68	62			770	753	756		
Nov	792	603	607	615			80	78	62			683	685	677		
Dec	899	505	495	489			84	80	63			589	575	552		
<b>2010</b>																
Jan	912	591	584	563			83	79	63			674	663	626		
Feb	882	513	509	494			75	71	55			588	580	549		
		<u>U.D.</u>	<u>U.Q.</u>	<u>Med</u>	<u>L.Q.</u>	<u>L.D.</u>	<u>U.D.</u>	<u>U.Q.</u>	<u>Med</u>	<u>L.Q.</u>	<u>L.D.</u>	<u>U.D.</u>	<u>U.Q.</u>	<u>Med</u>	<u>L.Q.</u>	<u>L.D.</u>
Mar	815	589	581	548	583	571	83	82	77	60	58	672	663	625	643	629
Apr	754	733	694	746	802	811	81	81	73	47	57	814	775	819	849	868
May	697	1035	963	900	927	938	145	137	96	39	39	1180	1100	996	966	977
Jun	758	1233	971	884	889	872	147	147	108	39	39	1380	1118	992	928	911
Jul	843	1363	1077	965	959	918	158	128	82	52	46	1521	1205	1047	1011	964
Aug	846	1367	1161	1001	955	916	96	92	74	57	46	1463	1253	1075	1012	962
Sep	725	1253	1141	887	836	791	92	87	71	55	44	1345	1228	958	891	835
Oct	725	1090	986	725	673	644	92	87	71	54	48	1182	1073	796	727	692
Nov	792	1063	963	627	645	540	89	86	82	60	49	1152	1049	709	705	589
Dec	900	<u>803</u>	<u>767</u>	<u>582</u>	<u>535</u>	<u>523</u>	<u>91</u>	<u>87</u>	<u>84</u>	<u>64</u>	<u>50</u>	<u>894</u>	<u>854</u>	<u>666</u>	<u>599</u>	<u>573</u>
CY TOT		11633	10408	8958	8861	8581	1233	1173	966	645	595	12866	11581	9924	9506	9176

\* 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.



The planned preservation program for this AOP is outlined by multiple stipulations in the PA. One of the stipulations, or program components, is the Five-Year Plan. This plan outlines how the Corps will accomplish its responsibilities under the PA and the National Historic Preservation Act. The "Draft Five Year Plan, dated February 2005" (see <https://www.nwo.usace.army.mil/CR/>) is currently being implemented. The plan includes inventory, testing and evaluation, mitigation and other specific activities that will allow the Corps to avoid, minimize and/or mitigate the adverse effects to cultural sites on Corps lands within the System. Many of the actions listed in the plan are within the elevation ranges that will occur with the implementation of the Master Manual criteria in 2009 and 2010. Two critical components of the Five-Year plan that are applicable to this AOP are monitoring and mitigation, which will be briefly discussed in the following paragraphs.

First, a collaboratively developed plan, entitled "Draft Monitoring and Enforcement Plan, dated April 2005" (see <https://www.nwo.usace.army.mil/CR/>) is in place. This monitoring plan outlines the sites that require monitoring and specifies a frequency for monitoring. The Corps is strategically monitoring sites, including those sites within the potential operating pool elevations, to document the effects of the implementation of the 2009-2010 AOP. Specific sites are identified in the draft Monitoring and Enforcement Plan for the monitoring team, comprised of Corps rangers and tribal monitors, to visit and document impacts. This focused monitoring is resulting in more accurate data on the current impacts to sites along the river plus it is assisting with the identification of sites for mitigation. Training for the monitoring teams was held in June 2006, July 2007, March 2008, April 2008, July 2008, and again in May 2009.

Secondly, mitigation or protection of sites that are being adversely impacted continues. During the reporting period for the 2008 Annual Report by the Corps on the implementation of the Programmatic Agreement eight sites were either completed, started, or in the design phase. The annual report is available at <https://www.nwo.usace.army.mil/CR/>. In addition the Corps has awarded a contract to develop an erosion model that will compare modeling data against actual erosion data, collected by the monitoring team, to assist in the prioritization of sites for protection. Work on the erosion model is continuing.

Results expected from the proposed monitoring and mitigation actions include more accurate horizontal and vertical data on existing cultural sites, detailed impact data, proactive protection and preservation of sites. The effects of the simulated System regulation during 2009-2010 on cultural sites are included in the Chapter V, section G., entitled, "Regulation Activities for Historic and Cultural Properties."

**H. System Storage.** If August 1, 2009 Basic runoff forecast verifies, System storage will decline to 53.1 MAF by the close of CY 2009. This would be 19.2 MAF higher than the all-time record low storage of 33.9 MAF set on February 9, 2007 and nearly 9.1 MAF higher than last year's storage of 44.0 MAF. This end-of-year storage is 0.6 MAF more than the 1967 to 2008 average. The record low storage during the 1988-1992 drought was 40.8 MAF in January 1991. The end-of-year System storages have ranged from a maximum of 60.9 MAF, in 1975, to the 2006 minimum of 34.4 MAF. Forecasted System storage on December 31, 2010 is presented in *Table VI* for the runoff scenarios simulated.

**I. Summary of Water Use by Functions.** Anticipated water use in CY 2009, under the regulation plan with the Basic forecast of water supply is shown in *Table VII*. Actual water use data for CY 2008 are included for information and comparison. Under the reservoir regulation simulations in this AOP, estimated water use in CY 2010 also is shown in *Table VII*.

**TABLE VI  
ANTICIPATED DECEMBER 31, 2010 SYSTEM STORAGE**

Water Supply Condition	Total (12/31/10)	Carryover Storage Remaining 1/	Unfilled Carryover Storage 2/	Total Change CY 2010
(Volumes in 1,000 Acre-Feet)				
Upper Decile	56,900	38,900	0	2,400
Upper Quartile	57,100	38,900	0	2,200
Median	53,400	35,500	3,400	300
Lower Quartile	48,000	30,100	8,800	-4,100
Lower Decile	45,900	28,000	10,900	-6,200

1/ Net usable storage above 17.9 MAF System minimum pool level established for power, recreation, irrigation diversions, and other purposes.

2/ System base of annual flood control zone containing 56.8 MAF.

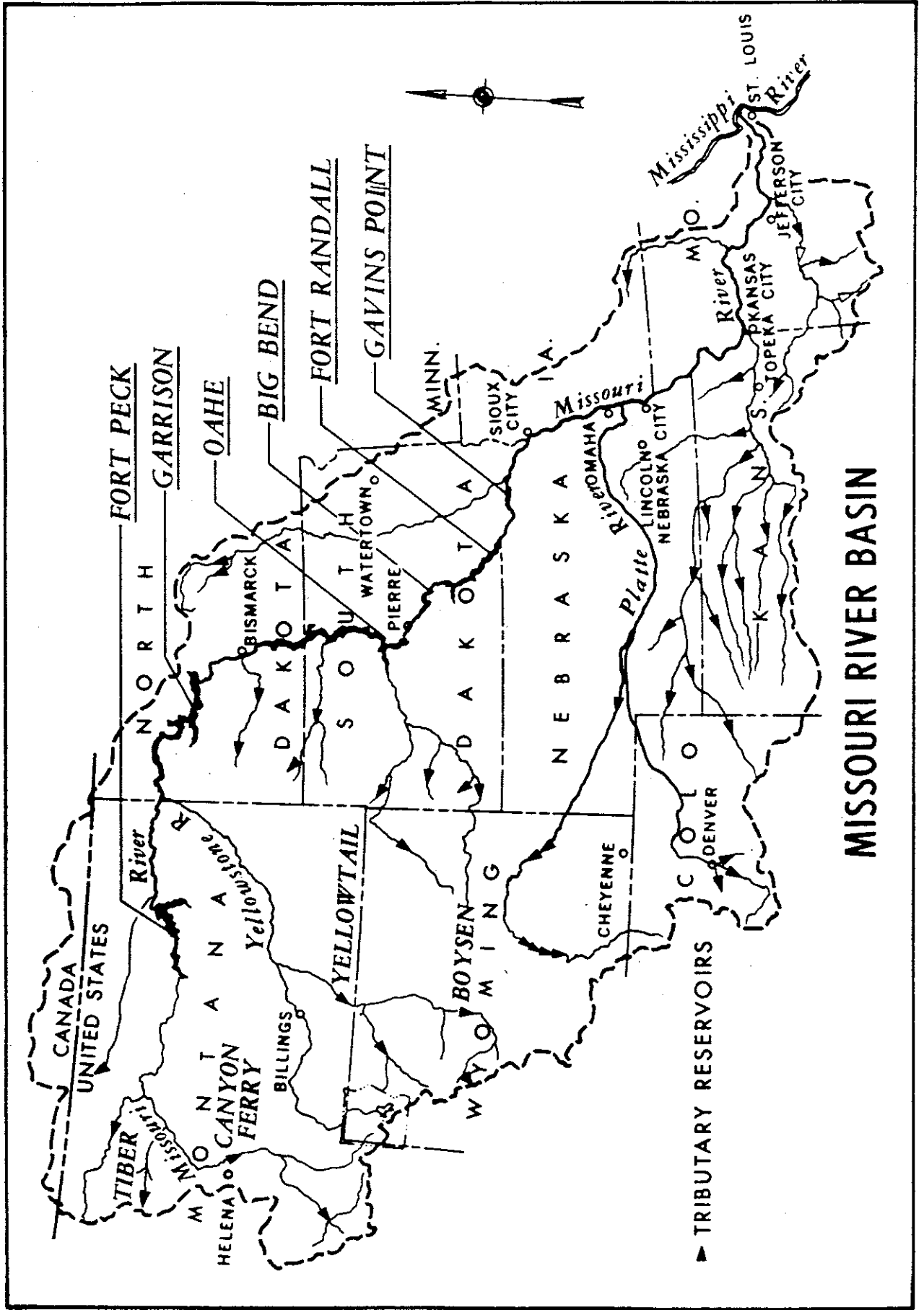
**TABLE VII**  
**MISSOURI RIVER MAINSTEM SYSTEM**  
**WATER USE FOR CALENDAR YEARS 2008, 2009, AND 2010 ABOVE SIOUX CITY, IOWA**  
**in Million Acre-Feet (MAF)**

	CY 2008 Actual	CY 2009 Basic Simulation	Simulations for Calendar Year 2010					
			Upper Decile	Upper Quartile	Median	Lower Quartile	Lower Decile	
Upstream Depletions (1)								
Irrigation, Tributary Reservoir Evaporation & Other Uses	2.5	1.3						
Tributary Reservoir Storage Change	<u>0.6</u>	<u>0.1</u>						
Total Upstream Depletions	3.1	1.4	2.4	2.3	2.5	2.5	2.3	
System Reservoir Evaporation (2)	2.5	2.5	1.2	1.2	1.7	2.0	1.9	
Sioux City Flows								
Navigation Season								
Unregulated Flood Inflows Between Gavins Point & Sioux City (3)	0.1	0.2						
Navigation Service Requirement (4)	9.7	14.5	18.2	17.3	15.9	15.29	14.5	
Supplementary Releases								
T&E Species (5)	0.5	1.5	0.6	0.6	0.5	0.3	0.3	
Flood Evacuation (6)	0.0	0.0	5.3	2.2	0.0	0.0	0.0	
Non-navigation Season								
Flows	3.5	3.1	3.8	3.7	3.5	3.3	3.3	
Flood Evacuation Releases (7)	0.0	0.0	0.4	0.4	0.0	0.0	0.0	
System Storage Change	<u>7.4</u>	<u>9.5</u>	<u>2.4</u>	<u>2.6</u>	<u>0.3</u>	<u>-4.0</u>	<u>-6.1</u>	
Total	26.8	32.7	34.3	30.3	24.4	19.3	16.2	
Project Releases								
Fort Peck	4.3	3.7	5.0	4.9	4.5	4.6	4.6	
Garrison	9.6	10.2	14.7	16.8	14.9	15.1	13.2	
Oahe	8.5	13.2	14.7	17.2	16.6	16.8	16.7	
Big Bend	7.9	12.8	14.2	19.1	17.6	16.6	16.6	
Fort Randall	9.0	14.1	15.5	20.2	17.2	16.9	16.8	
Gavins Point	10.6	15.5	17.6	22.1	18.6	18.1	17.8	

- (1) Tributary uses above the 1949 level of development including agricultural depletions and tributary storage effects.
- (2) Net evaporation is shown for 2010.
- (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) Estimated requirement for downstream water supply and water quality is approximately 6.0 MAF.
- (5) Increased releases required for endangered species regulation.
- (6) 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.
- (7) Releases for flood control storage evacuation in excess of a 17,000 cfs Gavins Point release.

**VII. TENTATIVE PROJECTION OF REGULATION THROUGH MARCH 2016**

(Not Completed Until Final Plan is Adopted.)



# MISSOURI RIVER BASIN

**Summary of Engineering Data -- Missouri River Mainstem System**

Item No.	Subject	Fort Peck Dam - Fort Peck Lake	Garrison Dam - Lake Sakakawea	Oahe Dam - Lake Oahe
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
<b><u>Dam and Embankment</u></b>				
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
<b><u>Spillway Data</u></b>				
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
<b><u>Reservoir Data (6)</u></b>				
26	Max. operating pool elev. & area	2250 msl                      241,000 acres	1854 msl                      380,000 acres	1620 msl                      374,000 acres
27	Max. normal op. pool elev. & area	2246 msl                      234,000 acres	1850 msl                      364,000 acres	1617 msl                      360,000 acres
28	Base flood control elev & area	2234 msl                      210,000 acres	1837.5 msl                      307,000 acres	1607.5 msl                      312,000 acres
29	Min. operating pool elev. & area	2160 msl                      89,000 acres	1775 msl                      128,000 acres	1540 msl                      117,000 acres
<b><u>Storage allocation &amp; capacity</u></b>				
30	Exclusive flood control	2250-2246                      971,000 a.f.	1854-1850                      1,489,000 a.f.	1620-1617                      1,102,000 a.f.
31	Flood control & multiple use	2246-2234                      2,704,000 a.f.	1850-1837.5                      4,222,000 a.f.	1617-1607.5                      3,201,000 a.f.
32	Carryover multiple use	2234-2160                      10,700,000 a.f.	1837.5-1775                      13,130,000 a.f.	1607.5-1540                      13,461,000 a.f.
33	Permanent	2160-2030                      4,088,000 a.f.	1775-1673                      4,980,000 a.f.	1540-1415                      5,373,000 a.f.
34	Gross	2250-2030                      18,463,000 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	17,700 a.f.                      1030 yrs.	25,900 a.f.                      920 yrs.	19,800 a.f.                      1170 yrs.
<b><u>Outlet Works Data</u></b>				
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
<b><u>Power Facilities and Data</u></b>				
45	Avg. gross head available in feet (14)	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'                      41,000 cfs	185'                      54,000 cfs
51	Generator nameplate rating in kW	1&3: 43,500; 2: 18,250; 4&5: 40,000	3 - 121,600, 2 - 109,250	112,290
52	Plant capacity in kW	185,250	583,300	786,030
53	Dependable capacity in kW (9)	181,000	388,000	534,000
54	Avg. annual energy, million kWh (12)	1,063	2,268	2,640
55	Initial generation, first and last unit	July 1943 - June 1961	January 1956 - October 1960	April 1962 - June 1963
56	Estimated cost September 1999 completed project (13)	\$158,428,000	\$305,274,000	\$346,521,000

**Summary of Engineering Data -- Missouri River Mainstem System**

Big Bend Dam - Lake Sharpe		Fort Randall Dam - Lake Francis Case		Gavins Point Dam - Lewis & Clark Lake		Total	Item No.	Remarks
21 miles upstream Chamberlain, SD		Near Lake Andes, SD		Near Yankton, SD			1	(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) Affected by level of Lake Francis case. Applicable to pool at elevation 1350. (11) Spillway crest. (12) 1967-2008 Average (13) Source: Annual Report on Civil Works Activities of the Corps of Engineers. Extract Report Fiscal Year 1999. (14) Based on Study 8-83-1985
Mile 887.4		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	30,000 acres	1,188,000 acres	26	
1422 msl	60,000 acres	1365 msl	95,000 acres	1208 msl	27,000 acres	1,140,000 acres	27	
1420 msl	57,000 acres	1350 msl	77,000 acres	1204.5 msl	23,000 acres	986,000 acres	28	
1415 msl	51,000 acres	1320 msl	38,000 acres	1204.5 msl	23,000 acres	446,000 acres	29	
1423-1422	60,000 a.f.	1375-1365	985,000 a.f.	1210-1208	57,000 a.f.	4,664,000 a.f.	30	
1422-1420	117,000 a.f.	1365-1350	1,309,000 a.f.	1208-1204.5	86,000 a.f.	11,639,000 a.f.	31	
		1350-1320	1,607,000 a.f.			38,898,000 a.f.	32	
1420-1345	1,621,000 a.f.	1320-1240	1,517,000 a.f.	1204.5-1160	307,000 a.f.	17,886,000 a.f.	33	
1423-1345	1,798,000 a.f.	1375-1240	5,418,000 a.f.	1210-1160	450,000 a.f.	73,087,000 a.f.	34	
November 1963		January 1953		August 1955			35	
25 March 1964		24 November 1953		22 December 1955			36	
5,300 a.f.	430 yrs.	18,400 a.f.	250 yrs.	2,600 a.f.	180 yrs.	89,700 a.f.	37	
None (7)		Left Bank		None (7)			38	
		4 - 22' diameter					39	
		1013					40	
		2 - 11' x 23' per conduit, vertical lift, cable suspension					41	
1385 (11)		1229		1180 (11)			42	
		Elev 1375					43	
		32,000 cfs - 128,000 cfs						
1351-1355(10)	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		2,501,200 kw	52	
497,000		293,000		74,000		1,967,000 kw	53	
976		1,736		728		9,412 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		\$1,166,404,000	56

## Plate 3 Summary of Master Manual Technical Criteria

### NAVIGATION TARGET FLOWS

<u>Location</u>	<u>Minimum Service (kcfs)</u>	<u>Full Service (kcfs)</u>
Sioux City	25	31
Omaha	25	31
Nebraska City	31	37
Kansas City	35	41

### RELATION OF SYSTEM STORAGE TO NAVIGATION SERVICE LEVEL

<u>Date</u>	<u>System Storage (MAF)</u>	<u>Navigation Service Level</u>
March 15	54.5 or more	35,000 cfs (full-service)
March 15	49.0 to 31	29,000 cfs (minimum-service)
March 15	31.0 or less	No navigation service
July 1	57.0 or more	35,000 cfs (full-service)
July 1	50.5 or less	29,000 cfs (minimum-service)

### RELATION OF SYSTEM STORAGE TO NAVIGATION SEASON LENGTH

<u>Date</u>	<u>System Storage (MAF)</u>	<u>Final Day of Navigation Support at Mouth of the Missouri River</u>
July 1	51.5 or more	November 30 (8-month season)
July 1	46.8 through 41.0	October 31 (7-month season)
July 1	36.5 or less	September 30 (6-month season)

### GAVINS POINT RELEASES NEEDED TO MEET TARGET FLOWS

		1950 to 1996 Data (kcfs)							
		<u>Median, Upper Quartile, Upper Decile Runoff</u>							
		Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
Full Service		26.7	28.0	27.9	31.6	33.2	32.6	32.0	31.1
Minimum Service		20.7	22.0	21.9	25.6	27.2	26.6	26.0	25.1
		<u>Lower Quartile, Lower Decile Runoff</u>							
		Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
Full Service		29.8	31.3	31.2	34.3	34.0	33.5	33.1	31.2
Minimum Service		23.8	25.3	25.2	28.3	28.0	27.5	27.1	25.2

### RESERVOIR UNBALANCING SCHEDULE

Year	Fort Peck		Garrison		Oahe	
	March 1	Rest of Year	March 1	Rest of Year	March 1	Rest of Year
1	High	Float	Low	Hold Peak	Raise & hold during spawn	Float
2	Raise & hold during spawn	Float	High	Float	Low	Hold peak
3	Low	Hold peak	Raise & hold during spawn	Float	High	Float

**Notes:** **Float year:** Normal regulation, then unbalance 1 foot during low pool years or 3 feet when System storage is near 57.0 MAF on March 1.

**Low year:** Begin low, then hold peak the remainder of the year.

**High year:** Begin high, raise and hold pool during spawn, then float.

### MRNRC RECOMMENDED RESERVOIR ELEVATION GUIDELINES FOR UNBALANCING

	Fort Peck	Garrison	Oahe
Implement unbalancing if March 1 pool is above this level.	2234 feet msl	1837.5 feet msl	1607.5 feet msl
Implement unbalancing if March 1 pool level is in this range <b>and</b> the pool is expected to raise more than 3 feet after March 1.	2227-2234 feet msl	1827-1837.5 feet msl	1600-1607.5 feet msl
Scheduling Criteria	Avoid pool level decline during spawn period which ranges from April 15 - May 30	Schedule after spawn period of April 20 - May 20	Schedule after spawn period of April 8 - May 15



## Plate 3 (cont'd) Summary of Master Manual Technical Criteria

### TECHNICAL CRITERIA FOR SPRING PULSES FROM GAVINS POINT DAM

#### Criteria Applicable to Both the March and May Spring Pulses

Flood Control Constraints	No change from current levels
---------------------------	-------------------------------

#### Criteria Applicable to the March Spring Pulse

Drought Preclude	40.0 MAF or below measured on March 1.
Drought Proration of Pulse Magnitude*	None, 5 kcfs added to navigation releases, but no greater than 35 kcfs.
Initiation of Pulse	Extend the stepped System release increases that precede the beginning of the navigation season.
Rate of Rise before Peak	Approximately 5 kcfs for 1 day.
Duration of Peak	Two days.
Rate of Fall after Peak	Drop over 5 days to navigation target release.

#### Criteria Applicable to Time Period Between the Bimodal Pulses

Release	Existing Master Manual Criteria
---------	---------------------------------

#### Criteria Applicable to the May Spring Pulse

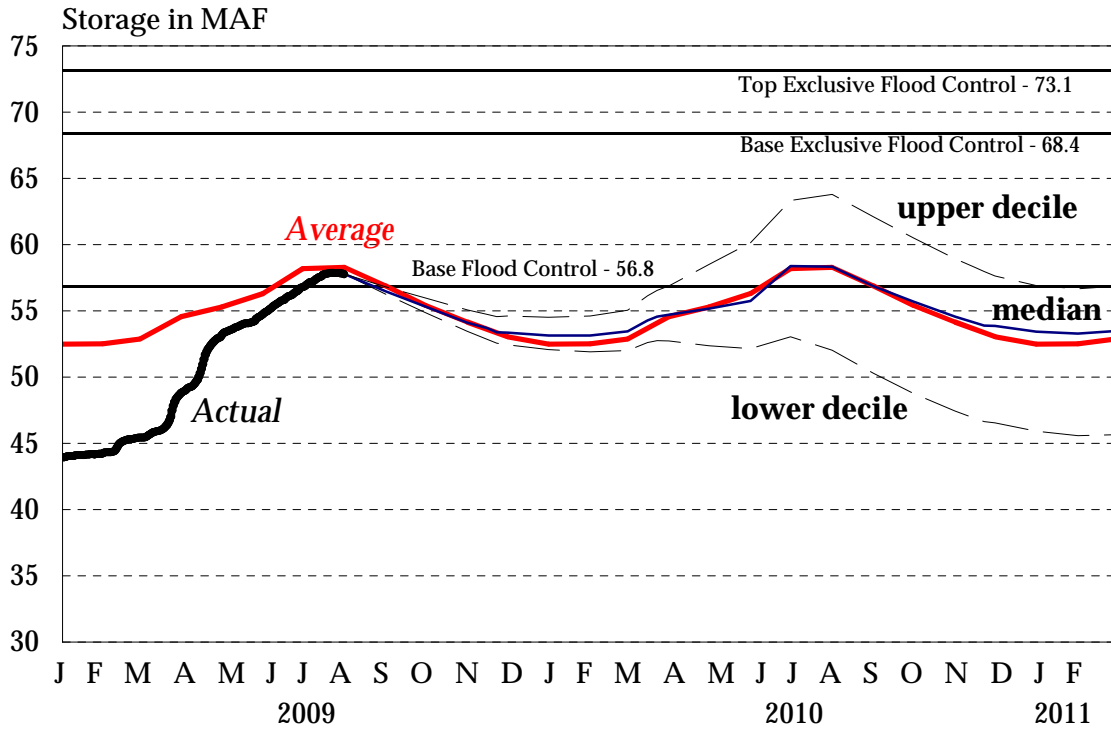
Drought Preclude	40.0 MAF or below measured on May 1.
Proration of Pulse Magnitude Based On System Storage*	Prorated from 16 kcfs based on a May 1 System Storage check; 100% at 54.5 MAF; straight line interpolation to 75% at 40.0 MAF.
Proration of Pulse Magnitude Based On Projected Runoff*	After the proration of the spring pulse magnitude for System Storage, the resultant magnitude would be further adjusted either up or down based on the May CY runoff forecast; 100% for Median; straight-line interpolation to 125% at Upper Quartile runoff; 125% for runoff above Upper Quartile; straight-line interpolation to 75% at Lower Quartile runoff; 75% for runoff below Lower Quartile.
Initiation of Pulse	Between May 1 to May 19, depending on Missouri River water temperature immediately below Gavins Point Dam. If possible, pulse will be initiated after the second daily occurrence of a 16 degree Celsius water temperature; however, the decision will be informed by the potential for 'take' of Threatened and Endangered bird species.
Rate of Rise before Peak	Approximately 6 kcfs per day.
Duration of Peak	Two days.
Rate of Fall after Peak	Approximately 30% drop over 2 days followed by a proportional reduction in releases back to the existing Master Manual criteria over an 8-day period.

#### Spring Pulse Downstream Flow Limits

Omaha	41,000 cfs
Nebraska City	47,000 cfs
Kansas City	71,000 cfs

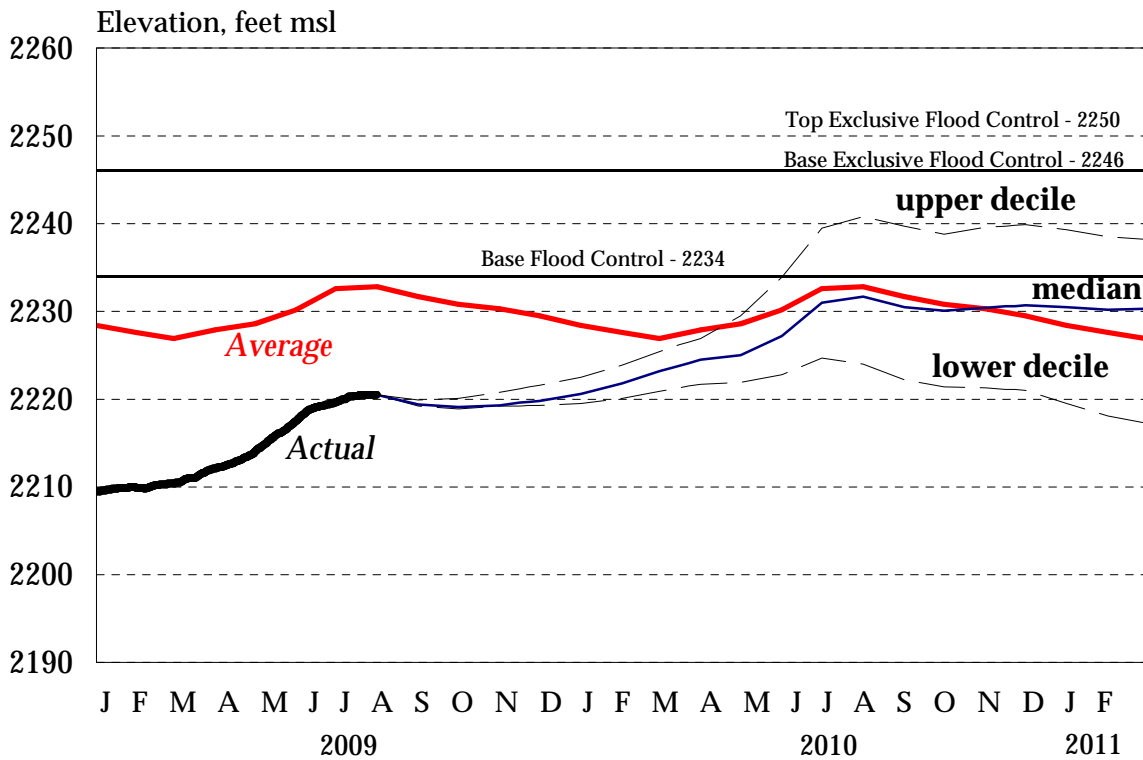
\* Spring pulse magnitudes will be determined by taking the difference between pre-pulse Gavins Point releases and the peak pulse Missouri River flows measured just downstream of the mouth of the James River.

# System Storage 2009-2010 Draft AOP



Average: 1967-2008

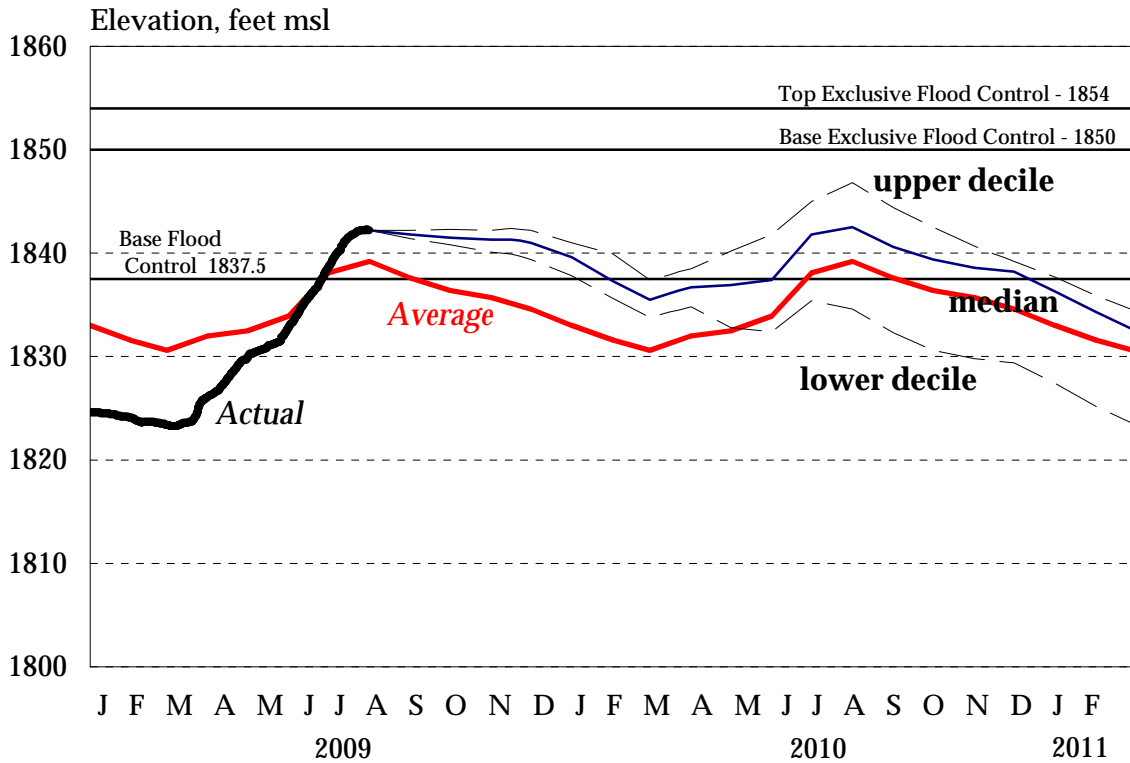
# Fort Peck 2009-2010 Draft AOP



Average: 1967-2008

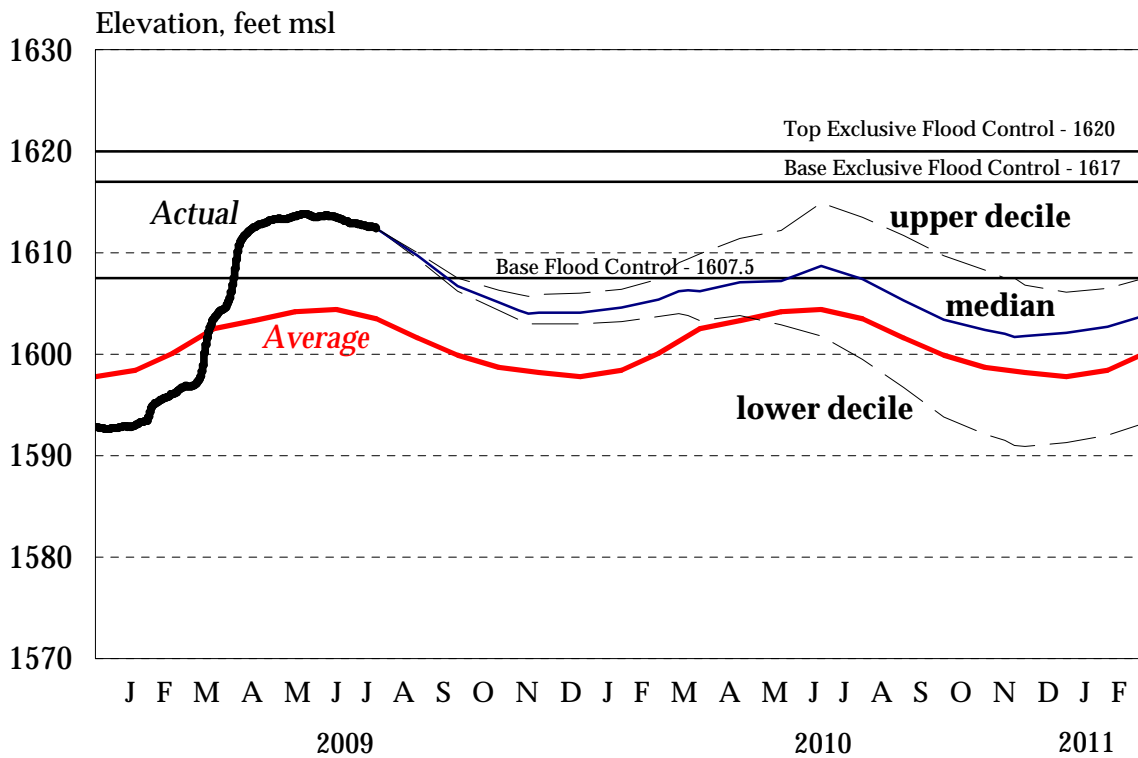
# Garrison

## 2009-2010 Draft AOP

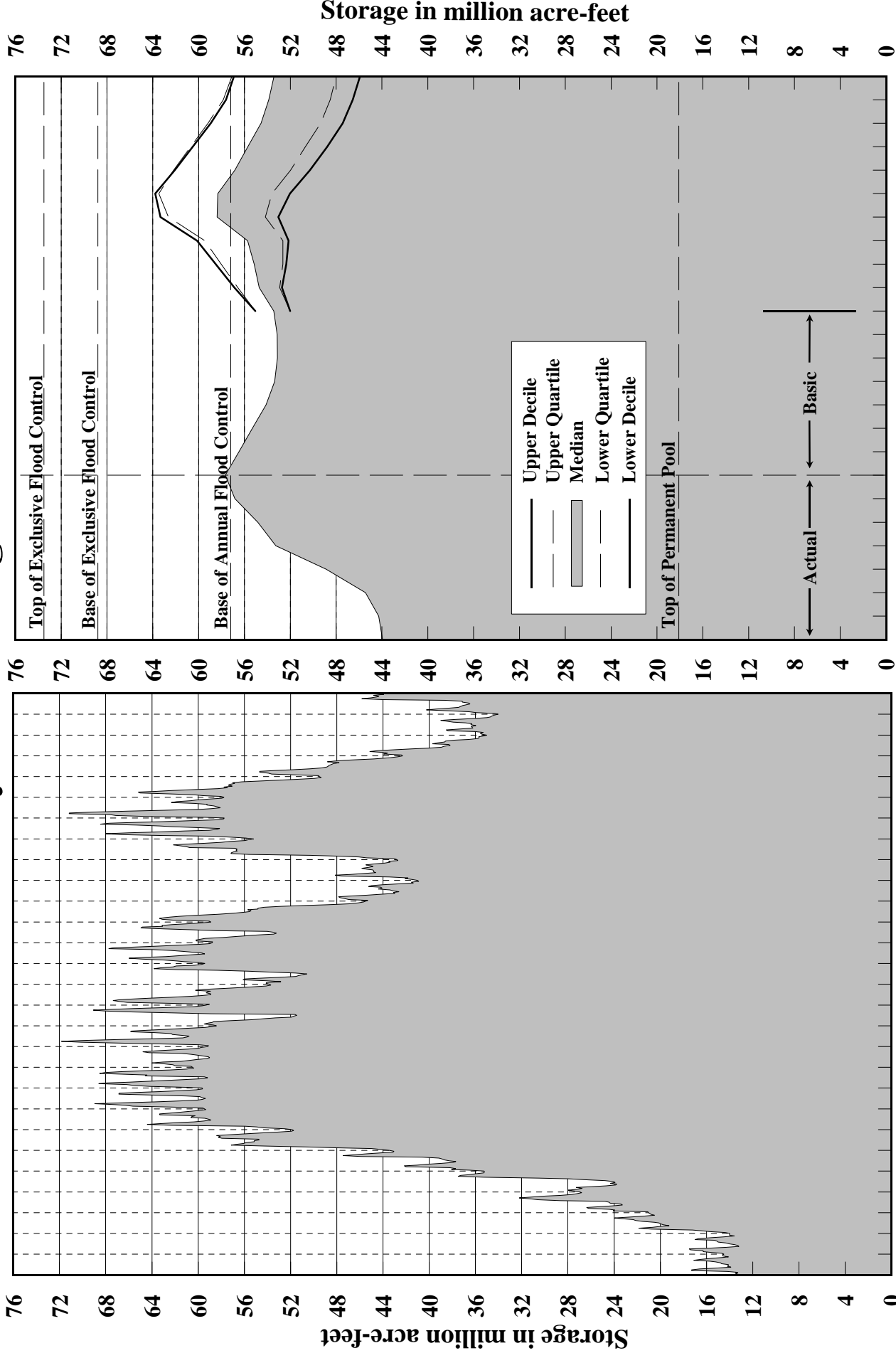


# Oahe

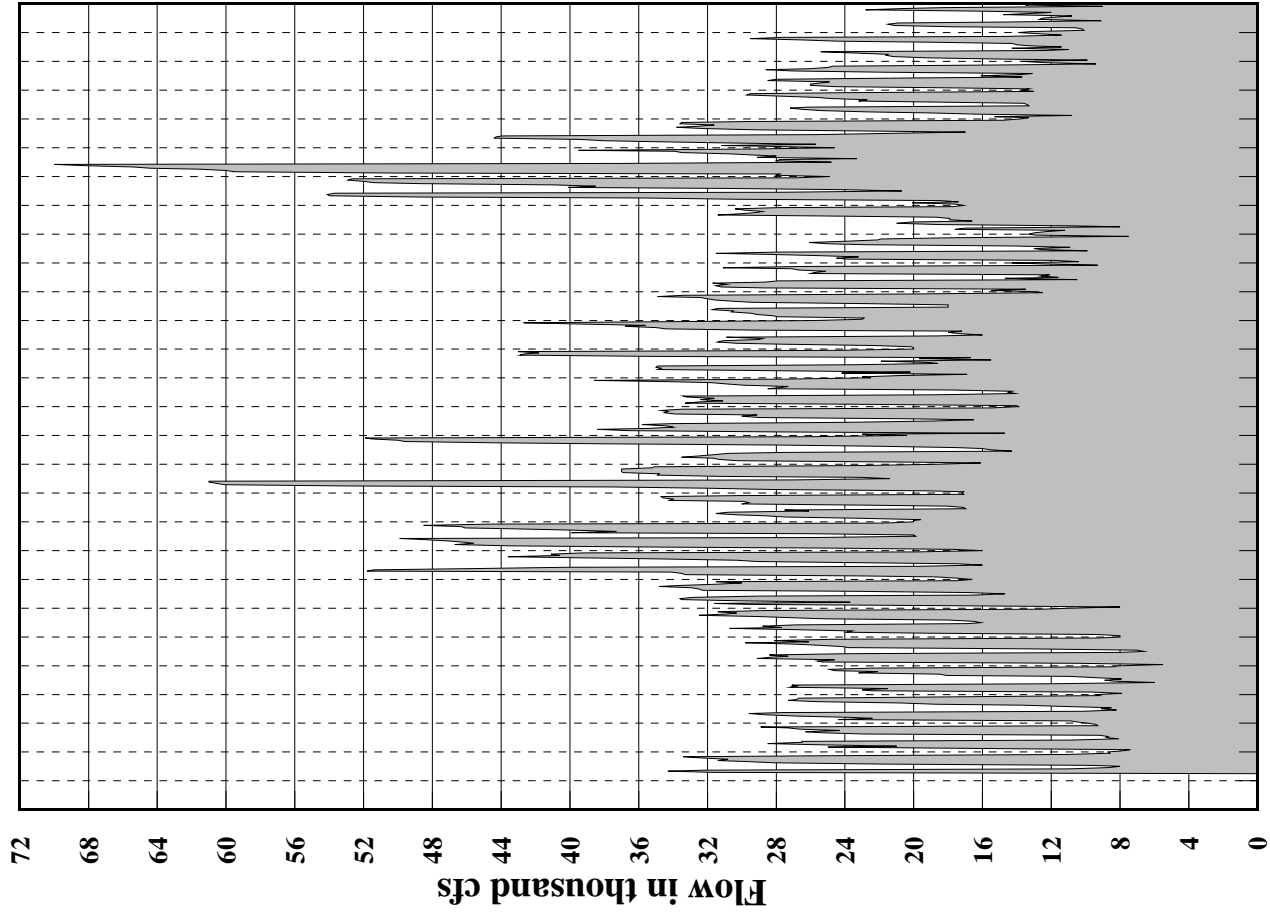
## 2009-2010 Draft AOP



# System Storage

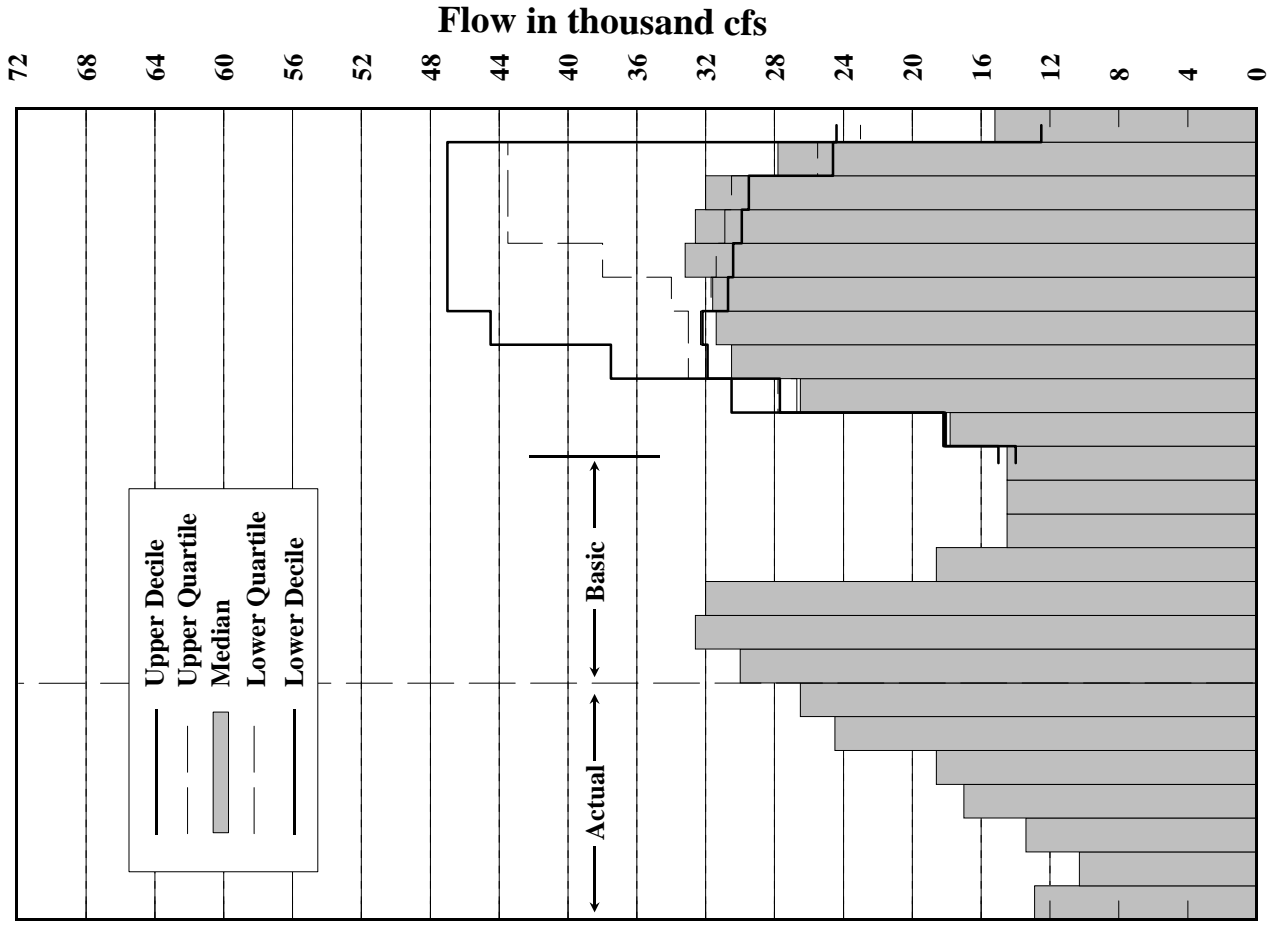


# Gavins Point Releases



53 55 57 59 61 63 65 67 69 71 73 75 77 79 81 83 85 87 89 91 93 95 97 99 01 03 05 07

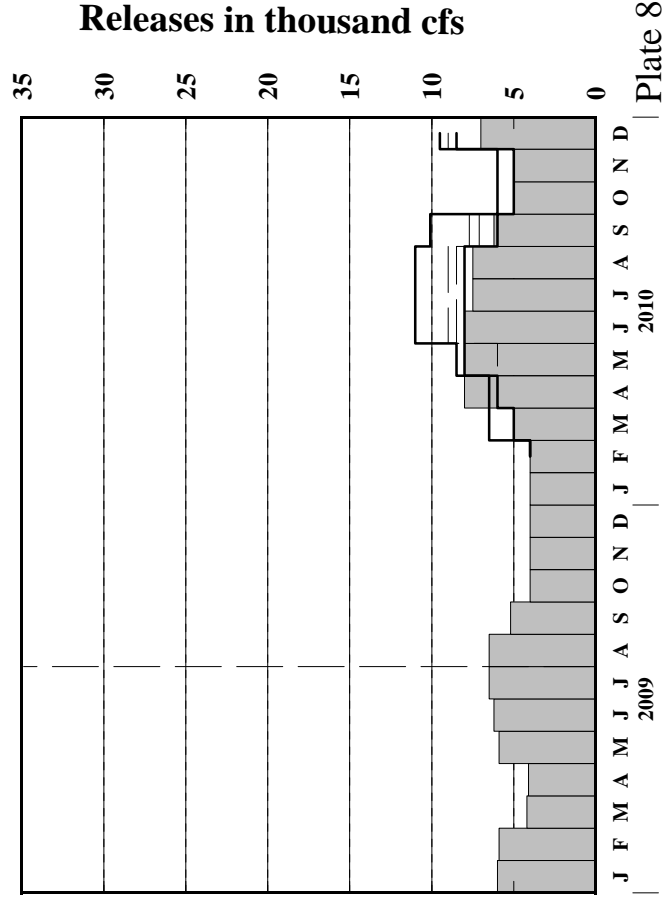
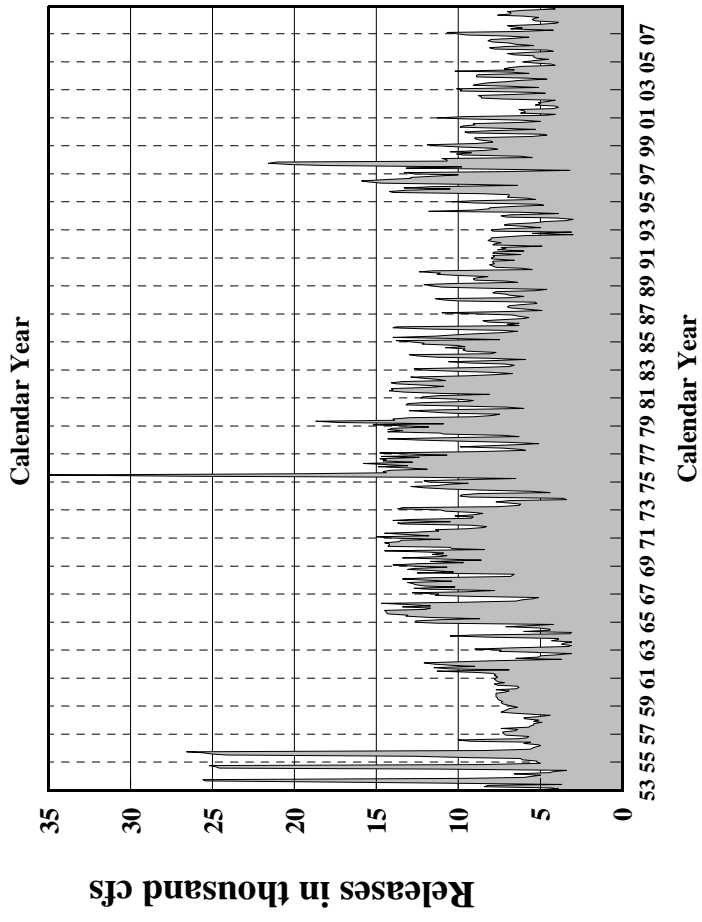
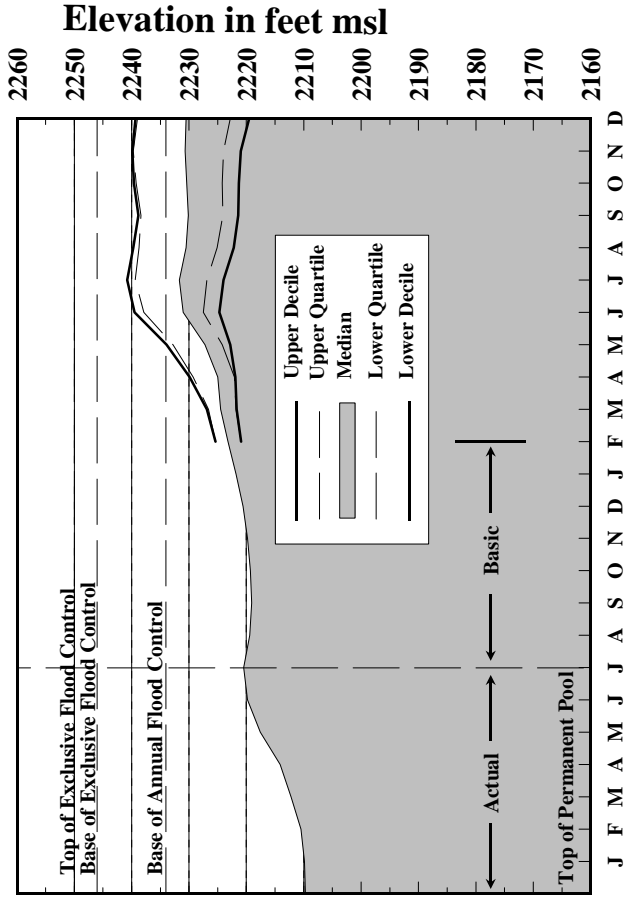
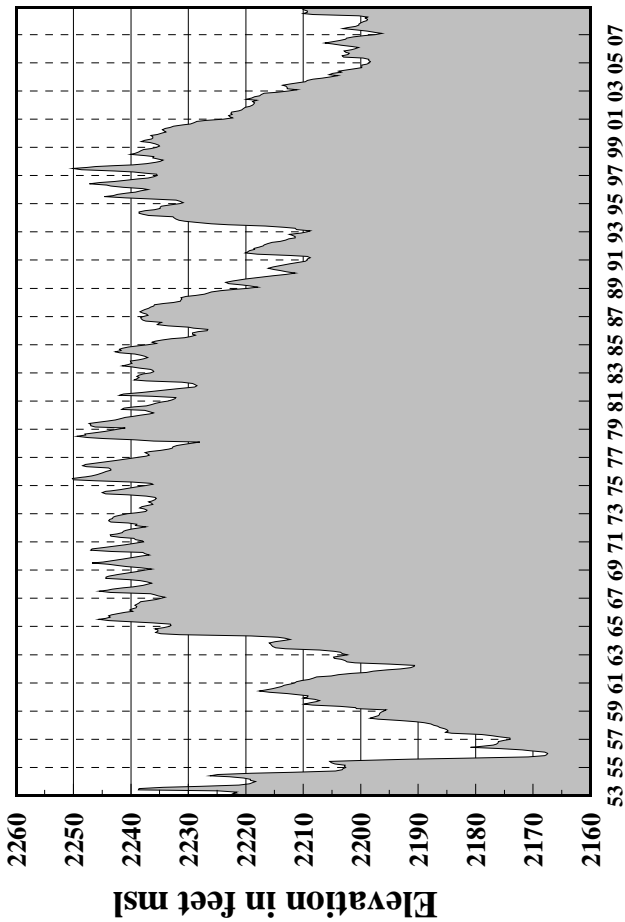
Calendar Year



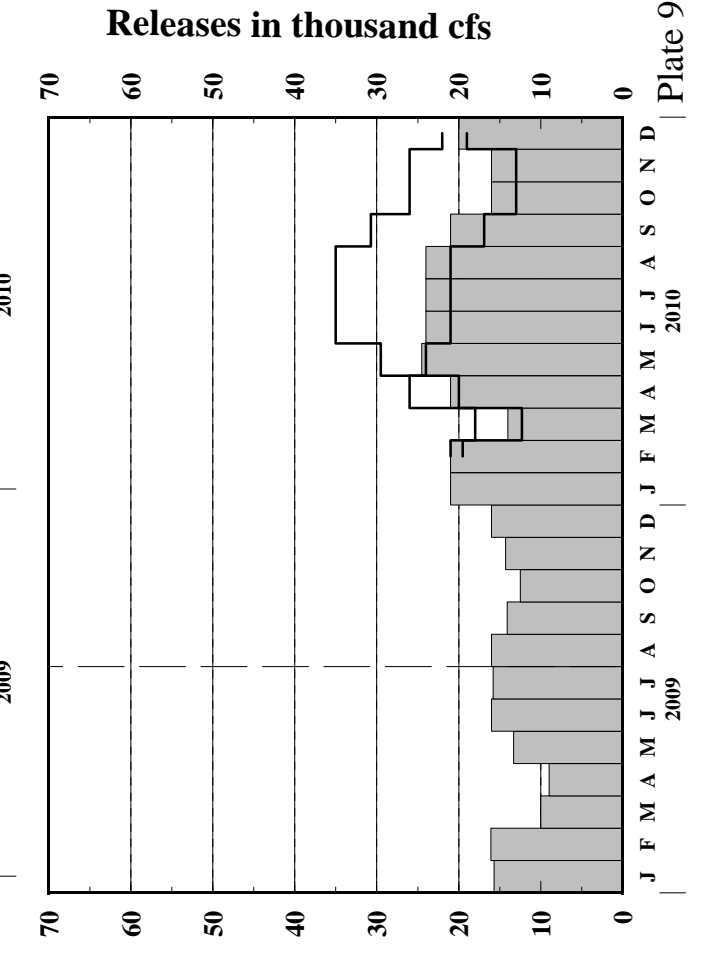
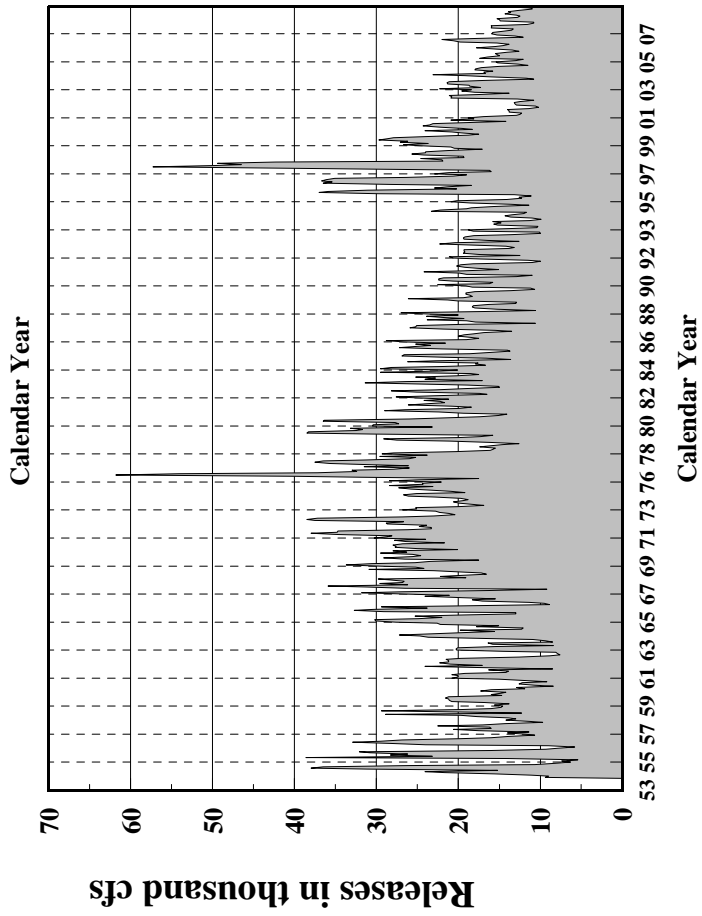
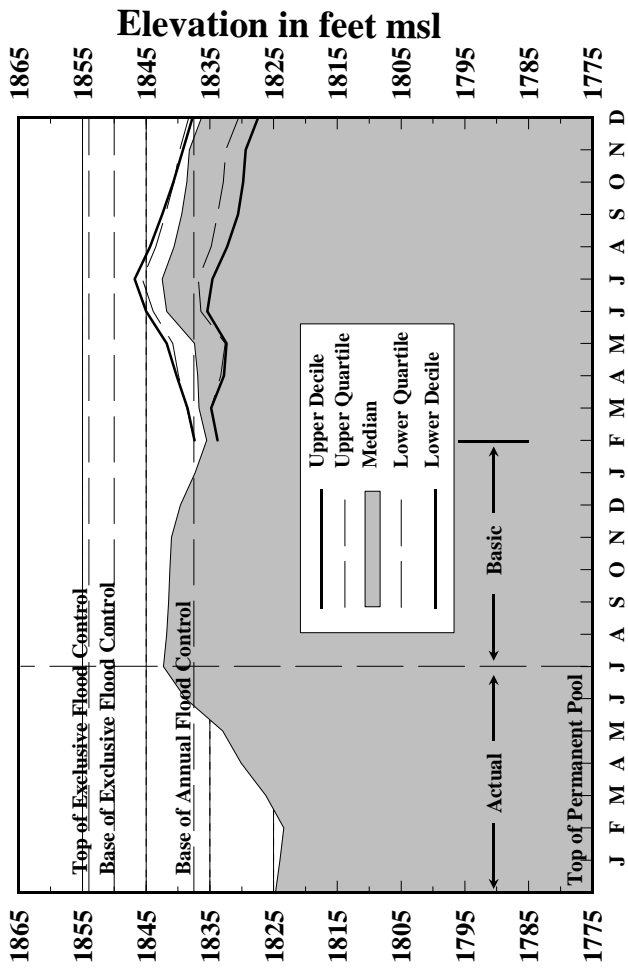
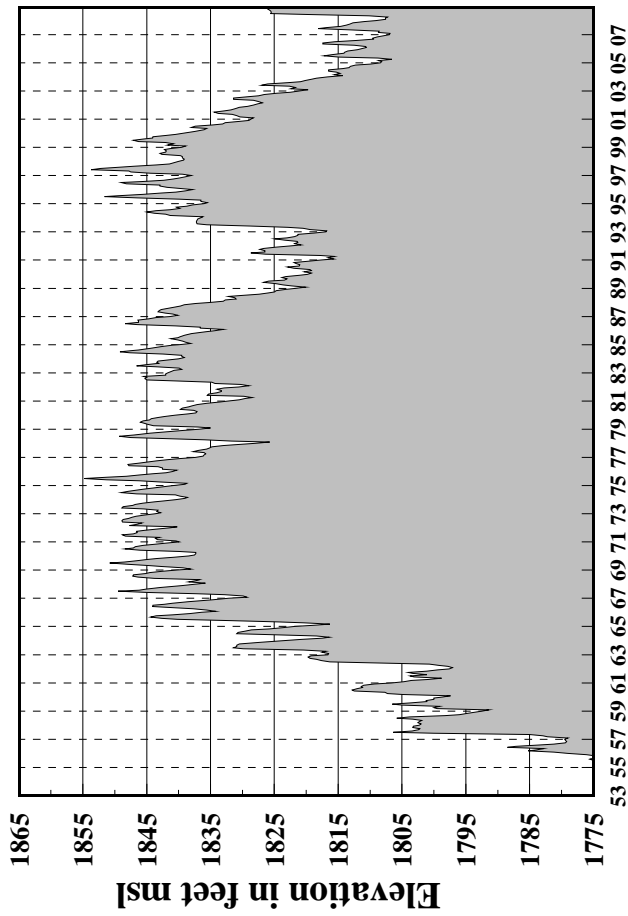
J F M A M J J A S O N D 2009 2010

Plate 7

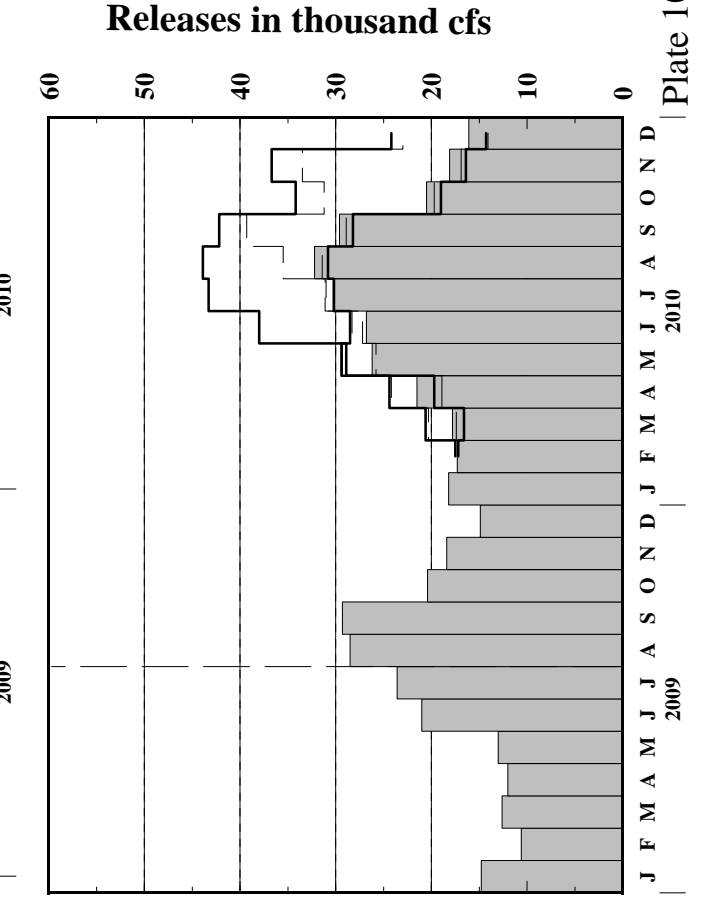
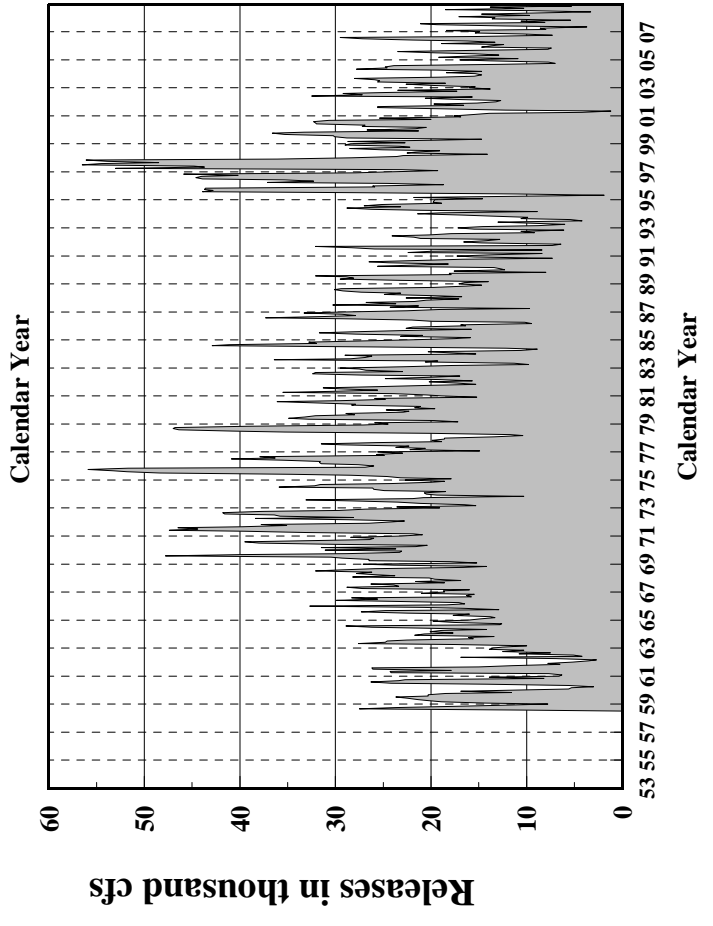
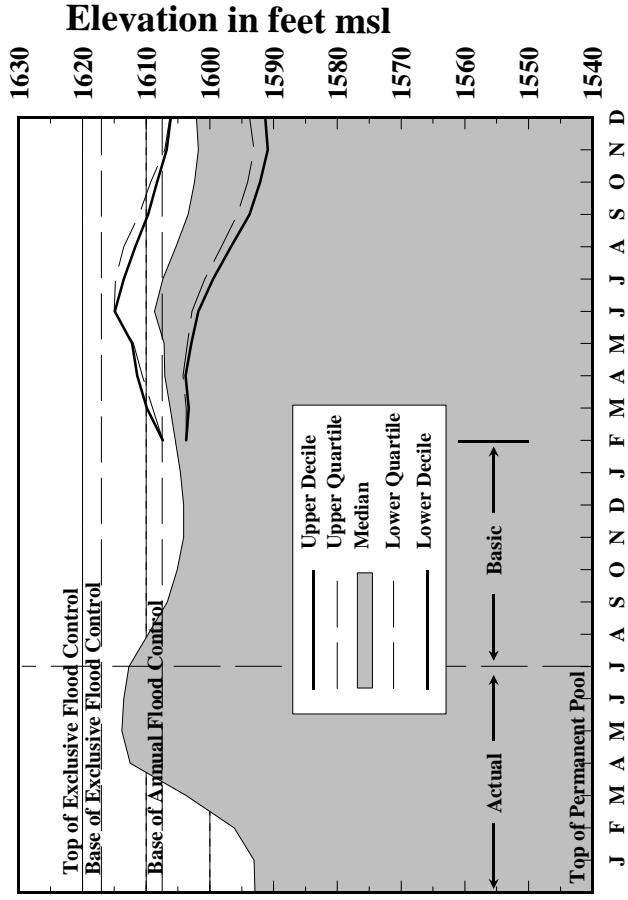
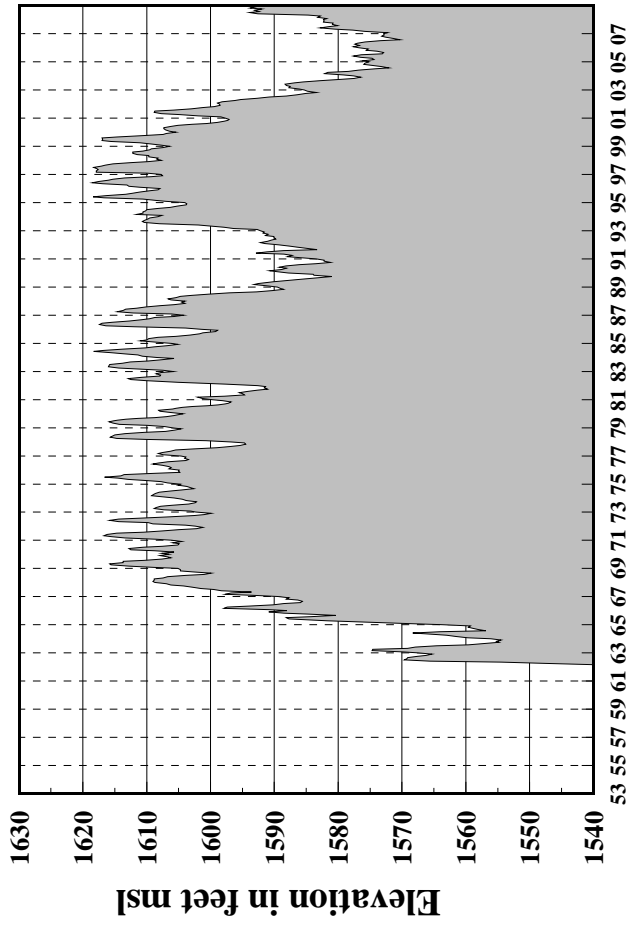
# Fort Peck Elevations and Releases



# Garrison Elevations and Releases

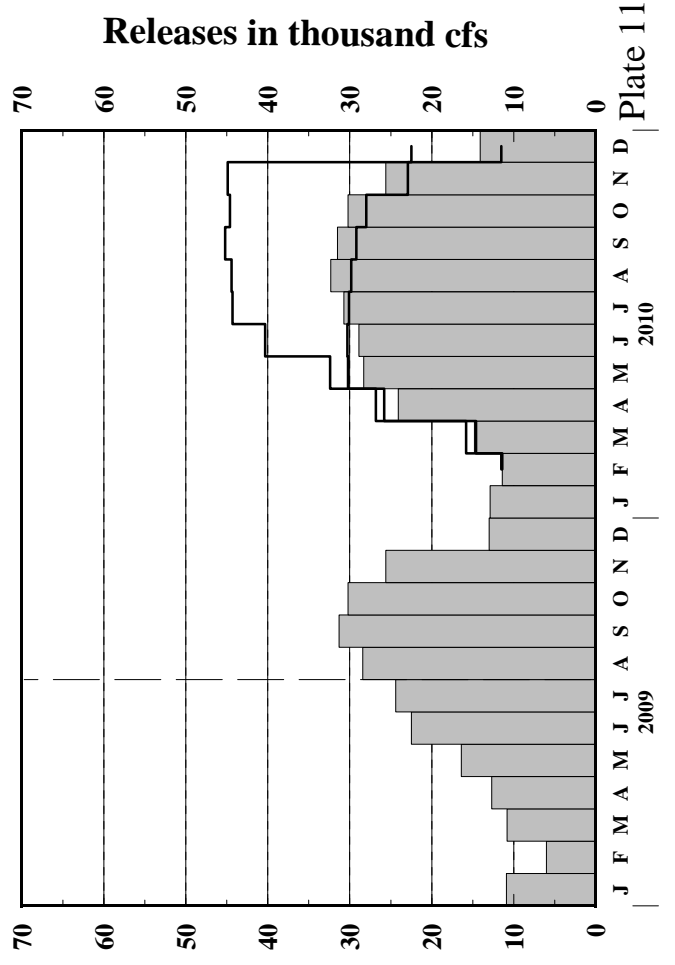
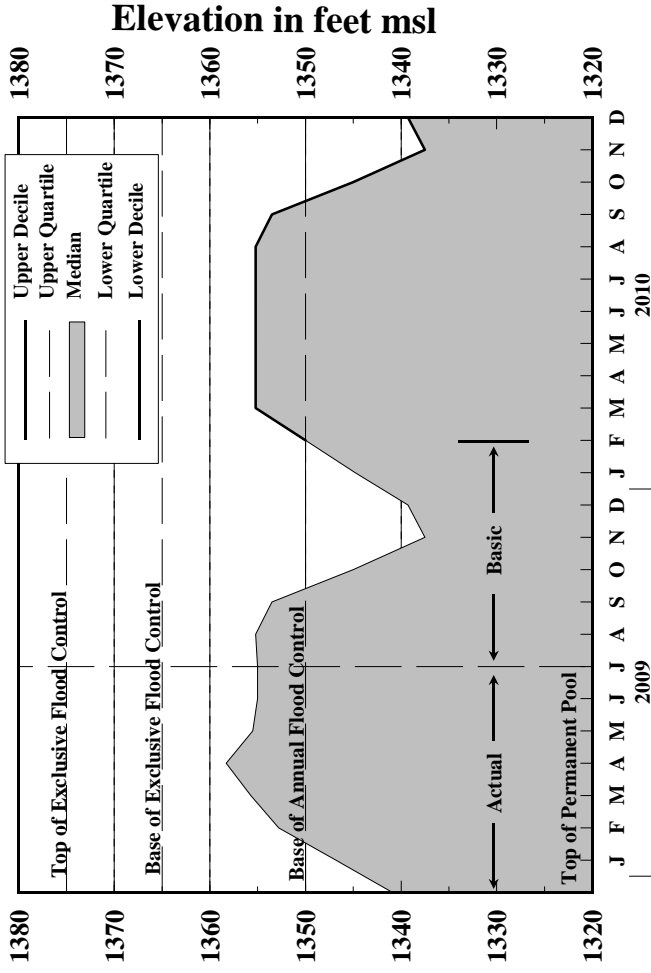
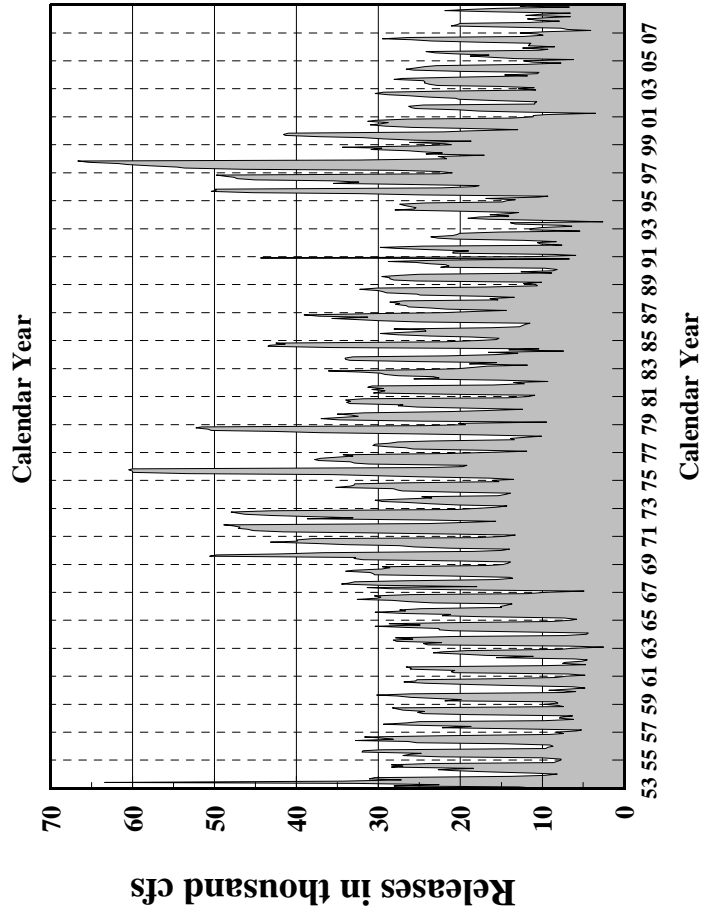
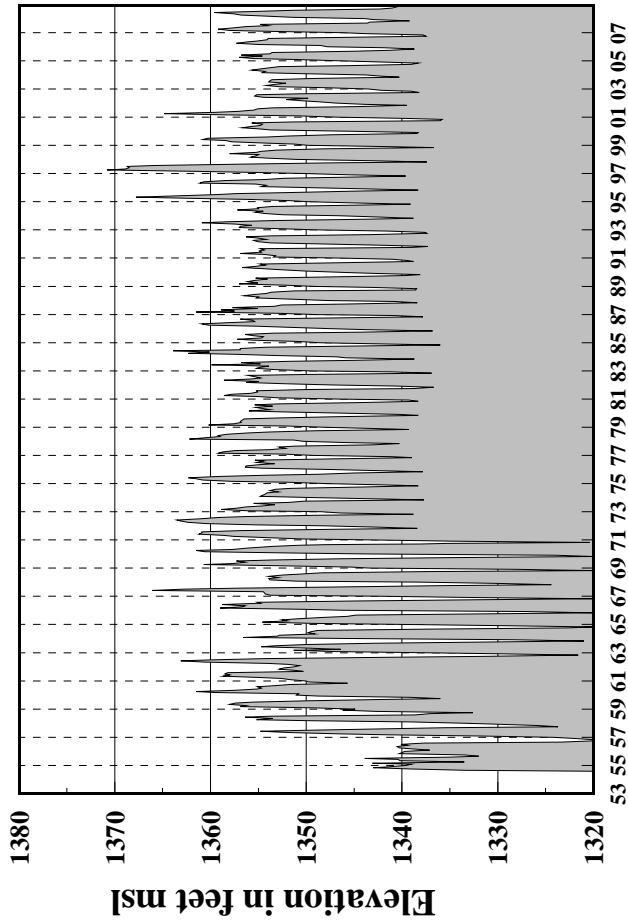


# Oahe Elevations and Releases



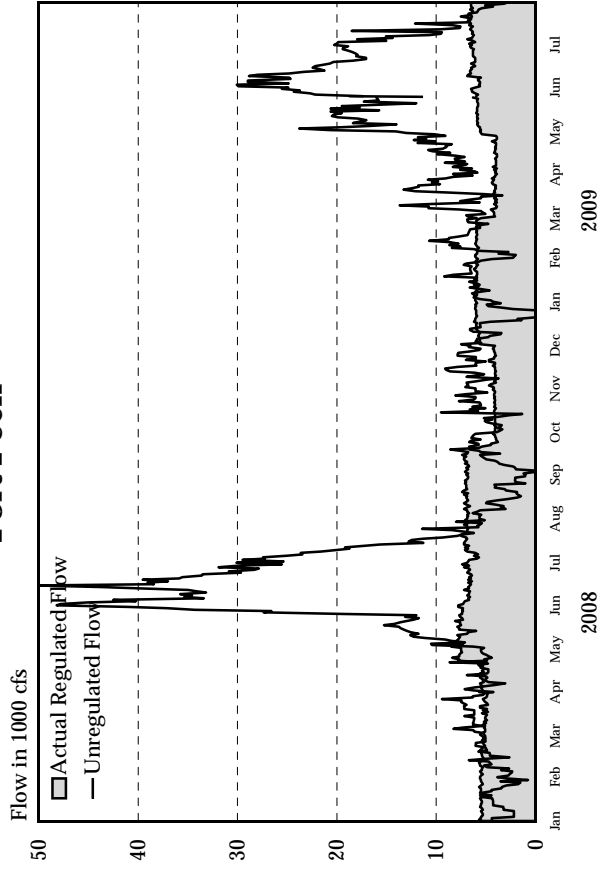


# Fort Randall Elevations and Releases

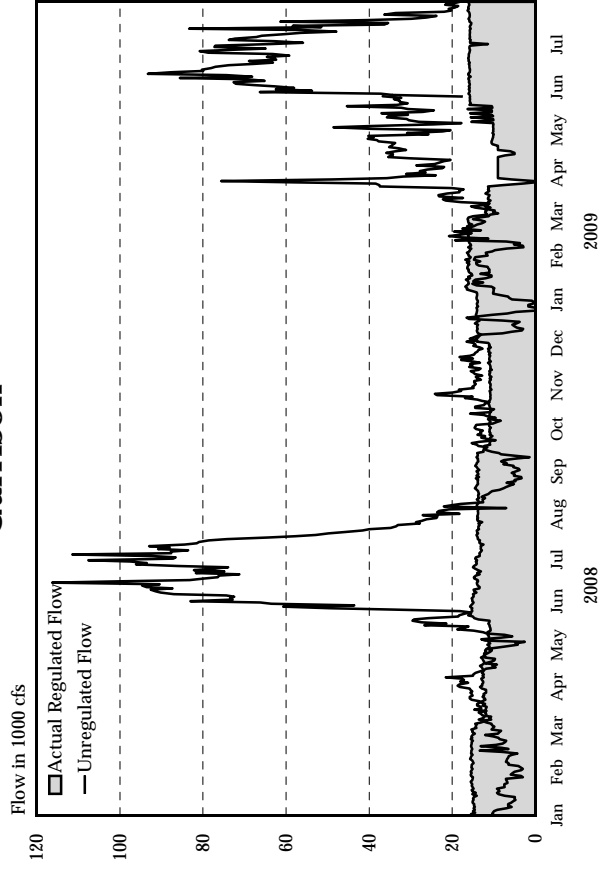


# Reservoir Release and Unregulated Flow

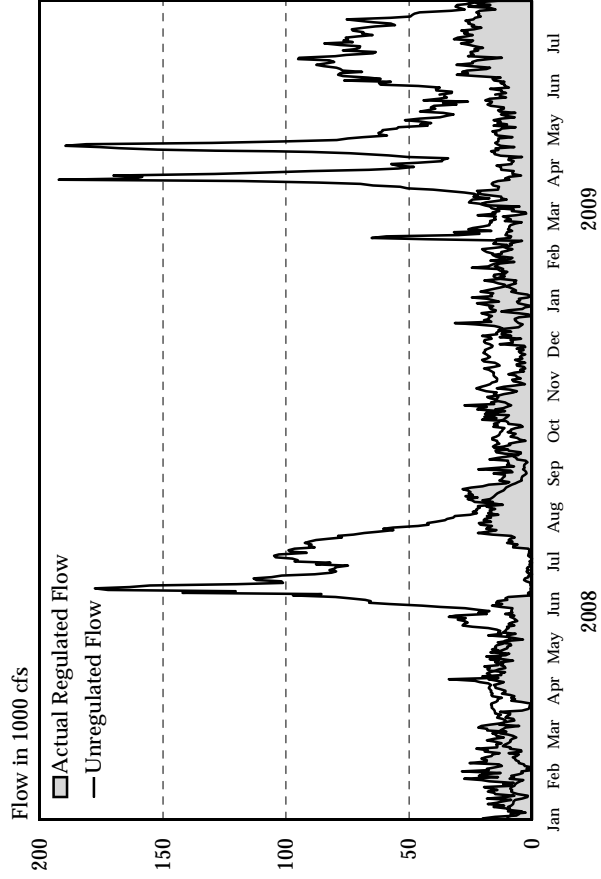
## Fort Peck



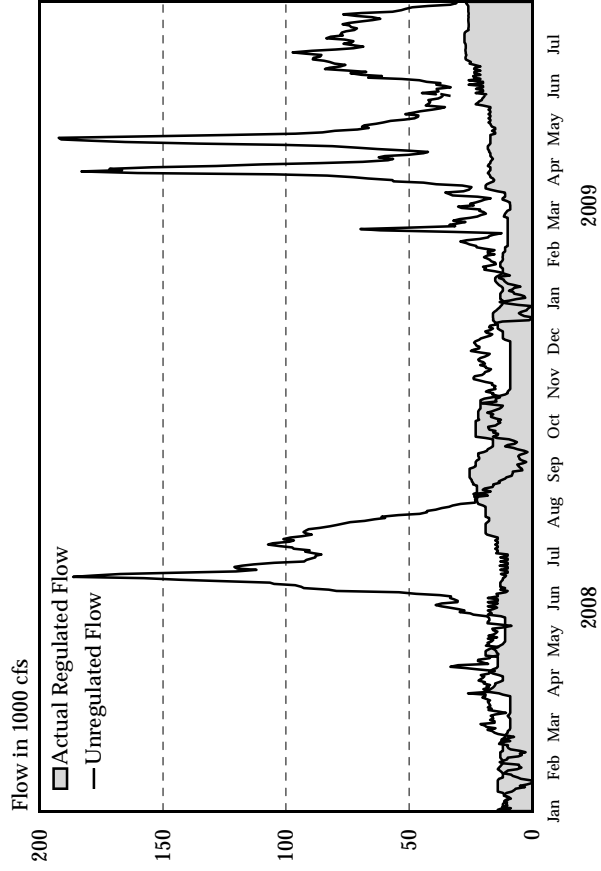
## Garrison



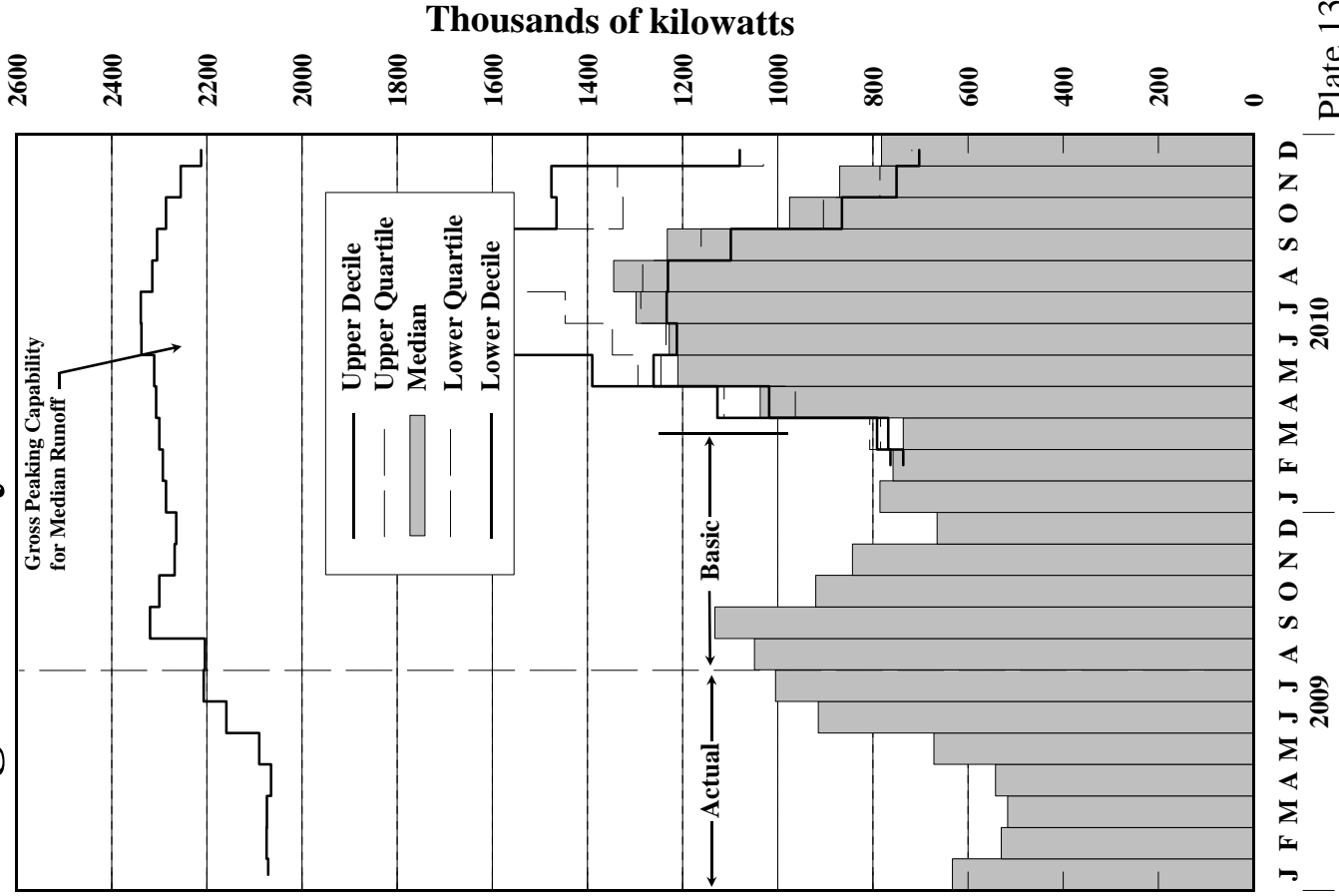
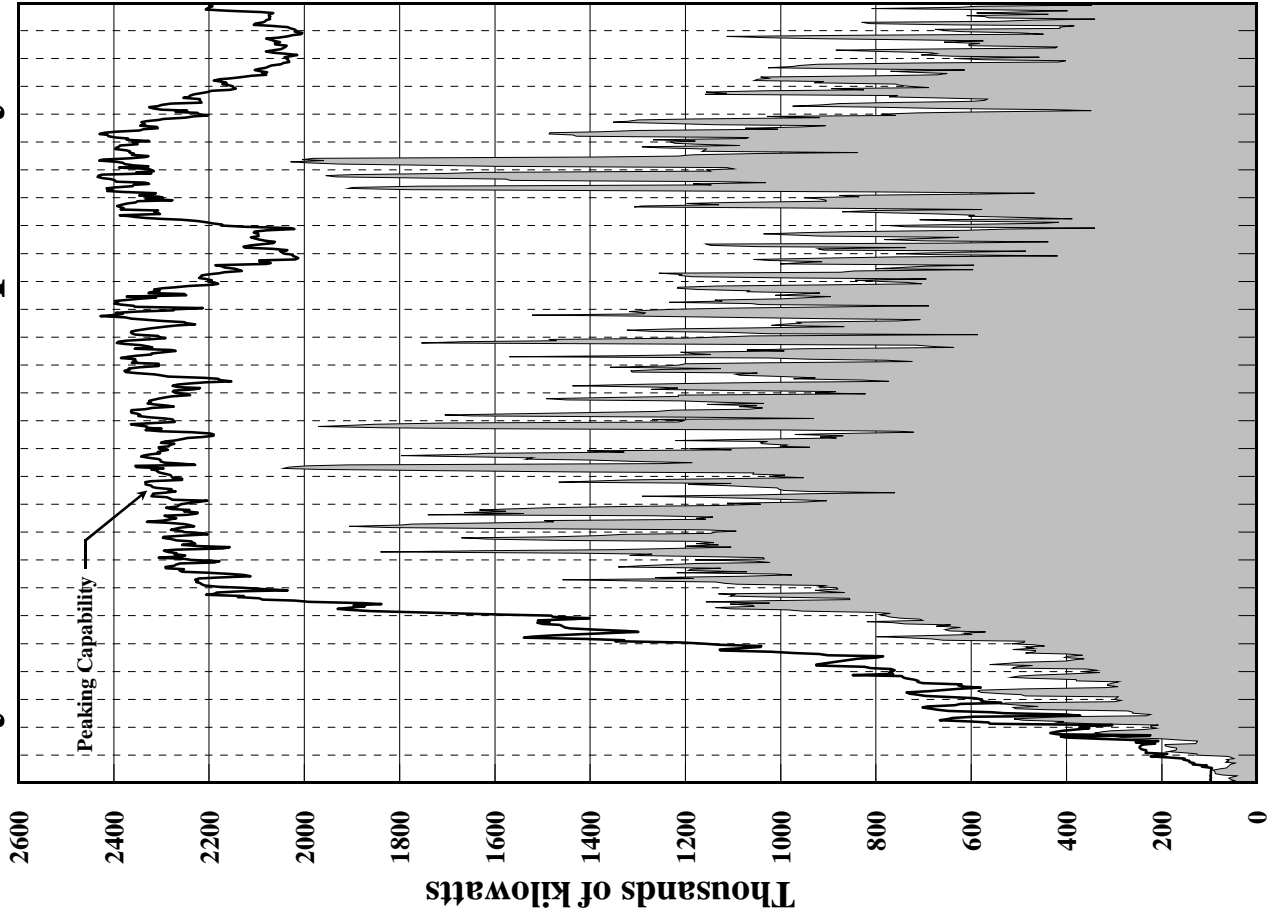
## Oahe



## Gavins Point



# System Gross Capability and Average Monthly Generation

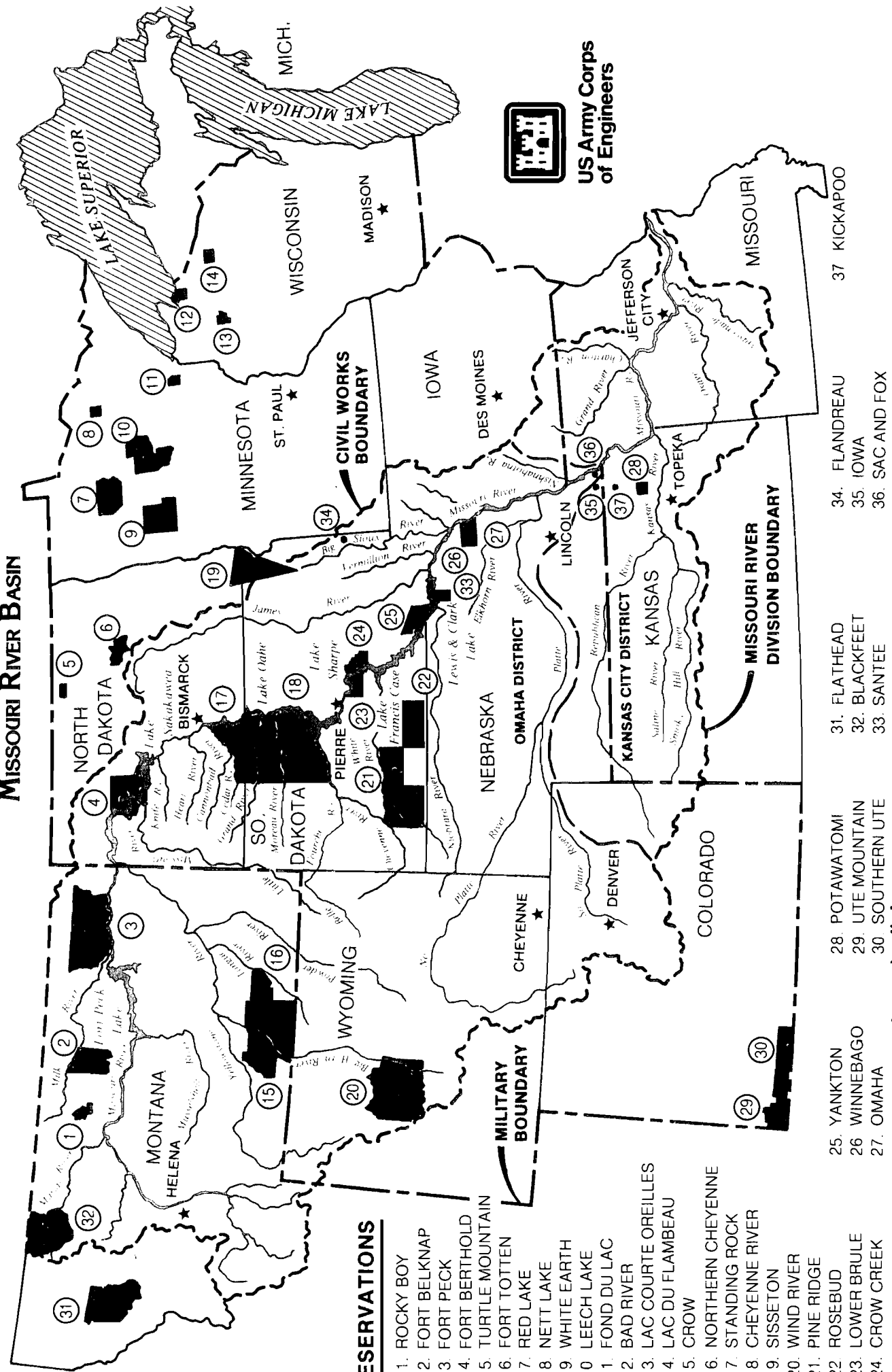


53 55 57 59 61 63 65 67 69 71 73 75 77 79 81 83 85 87 89 91 93 95 97 99 01 03 05 07

Calendar Year

# AMERICAN INDIAN RESERVATIONS

## Missouri River Basin



US Army Corps of Engineers

### RESERVATIONS

- 1. ROCKY BOY
- 2. FORT BELKNAP
- 3. FORT PECK
- 4. FORT BERTHOLD
- 5. TURTLE MOUNTAIN
- 6. FORT TOTTEN
- 7. RED LAKE
- 8. NETT LAKE
- 9. WHITE EARTH
- 10. LEECH LAKE
- 11. FOND DU LAC
- 12. BAD RIVER
- 13. LAC COURTE OREILLES
- 14. LAC DU FLAMBEAU
- 15. CROW
- 16. NORTHERN CHEYENNE
- 17. STANDING ROCK
- 18. CHEYENNE RIVER
- 19. SISSETON
- 20. WIND RIVER
- 21. PINE RIDGE
- 22. ROSEBUD
- 23. LOWER BRULE
- 24. CROW CREEK
- 25. YANKTON
- 26. WINNEBAGO
- 27. OMAHA
- 28. POTAWATOMI
- 29. UTE MOUNTAIN
- 30. SOUTHERN UTE
- 31. FLATHEAD
- 32. BLACKFEET
- 33. SANTEE
- 34. FLANDREAU
- 35. IOWA
- 36. SAC AND FOX
- 37. KICKAPOO

For illustrative purposes. No legal boundaries are implied.

TIME OF STUDY 07:46:58

FULL SERV, SHTN NAV SEAS 0 DAYS  
VALUES IN 1000 AF EXCEPT AS INDICATED

STUDY NO 1

	31JUL09	31AUG	30SEP	31OCT	15NOV	22NOV	30NOV	31DEC	31JAN	28FEB	2010
	INI-SUM										
<b>--FORT PECK--</b>											
NAT INFLOW	2212	300	290	330	165	77	88	290	312	360	
DEPLETION	-552	24	-63	-34	-38	-18	-20	-128	-158	-118	
EVAPORATION	360	73	92	80	36	17	19	42			
MOD INFLOW	2404	203	261	284	166	77	89	376	470	478	
RELEASE	1907	400	309	246	119	56	63	246	246	222	
STOR CHANGE	497	-197	-48	38	47	22	25	130	224	256	
STORAGE	12153	11956	11909	11946	11994	12016	12041	12170	12394	12650	
ELEV FTMSL	2220.5	2219.4	2219.1	2219.3	2219.6	2219.7	2219.8	2220.6	2221.8	2223.2	
DISCH KCFS	6.5	6.5	5.2	4.0	4.0	4.0	4.0	4.0	4.0	4.0	
POWER											
AVE POWER MW		84	67	52	52	52	52	52	52	53	
PEAK POW MW		150	149	150	150	150	150	151	152	154	
ENERGY GWH	300.0	62.7	48.4	38.6	18.7	8.7	10.0	38.7	38.9	35.3	
<b>--GARRISON--</b>											
NAT INFLOW	2887	650	452	523	199	93	106	247	261	356	
DEPLETION	-459	108	-124	-24	-105	-49	-56	-97	-72	-41	
CHAN STOR	24		13	12							
EVAPORATION	500	102	128	112	50	23	27	57			
REG INFLOW	4777	840	770	693	372	174	199	533	579	619	
RELEASE	6881	984	839	769	372	222	254	984	1291	1166	
STOR CHANGE	-2104	-144	-70	-76	0	-48	-55	-451	-712	-547	
STORAGE	19610	19466	19396	19320	19321	19272	19217	18766	18053	17506	
ELEV FTMSL	1842.2	1841.8	1841.5	1841.3	1841.3	1841.2	1841.0	1839.6	1837.3	1835.5	
DISCH KCFS	15.8	16.0	14.1	12.5	12.5	16.0	16.0	16.0	21.0	21.0	
POWER											
AVE POWER MW		204	179	159	159	203	203	202	262	259	
PEAK POW MW		483	483	482	482	481	480	476	467	461	
ENERGY GWH	1048.6	151.5	129.2	118.3	57.2	34.1	38.9	150.5	195.1	174.0	
<b>--OAHE--</b>											
NAT INFLOW	426	80	111	66	34	16	18		12	90	
DEPLETION	196	106	26	-8	2	1	1	15	20	33	
CHAN STOR	-22	-1	7	6			-14		-21		
EVAPORATION	476	103	124	104	46	21	24	53			
REG INFLOW	6613	855	808	745	357	201	246	916	1263	1223	
RELEASE	8840	1752	1742	1254	569	300	224	916	1120	963	
STOR CHANGE	-2227	-897	-934	-510	-212	-99	22	0	142	261	
STORAGE	20427	19530	18596	18086	17874	17775	17797	17797	17939	18200	
ELEV FTMSL	1612.4	1609.7	1606.7	1605.1	1604.3	1604.0	1604.1	1604.1	1604.6	1605.4	
DISCH KCFS	23.6	28.5	29.3	20.4	19.1	21.6	14.1	14.9	18.2	17.3	
POWER											
AVE POWER MW		374	378	261	244	274	179	189	232	221	
PEAK POW MW		720	704	695	691	689	690	690	692	697	
ENERGY GWH	1374.8	278.0	272.5	194.4	87.7	46.0	34.4	140.9	172.3	148.6	
<b>--BIG BEND--</b>											
EVAPORATION	97	20	25	22	10	5	5	11			
REG INFLOW	8743	1732	1717	1233	560	295	219	905	1120	963	
RELEASE	8762	1751	1717	1233	560	295	219	905	1120	963	
STORAGE	1640	1621	1621	1621	1621	1621	1621	1621	1621	1621	
ELEV FTMSL	1420.3	1420.0	1420.0	1420.0	1420.0	1420.0	1420.0	1420.0	1420.0	1420.0	
DISCH KCFS	21.7	28.5	28.9	20.0	18.8	21.3	13.8	14.7	18.2	17.3	
POWER											
AVE POWER MW		134	137	98	95	107	70	74	90	83	
PEAK POW MW		509	517	538	538	538	538	538	538	529	
ENERGY GWH	514.0	99.3	98.5	73.2	34.0	17.9	13.4	55.2	66.6	55.9	
<b>--FORT RANDALL--</b>											
NAT INFLOW	190	55	38	5	3	1	2	12	25	49	
DEPLETION	34	15	7	1	1	0	1	3	3	3	
EVAPORATION	109	25	31	25	9	4	4	10			
REG INFLOW	8810	1766	1717	1212	552	292	216	904	1142	1009	
RELEASE	9215	1745	1863	1855	873	408	242	801	792	635	
STOR CHANGE	-405	21	-146	-643	-321	-116	-26	103	350	374	
STORAGE	3528	3549	3403	2760	2438	2322	2296	2399	2749	3123	
ELEV FTMSL	1354.9	1355.2	1353.5	1345.0	1340.0	1338.0	1337.5	1339.3	1344.8	1350.0	
DISCH KCFS	24.4	28.4	31.3	30.2	29.4	29.4	15.3	13.0	12.9	11.4	
POWER											
AVE POWER MW		239	262	242	222	215	111	96	98	91	
PEAK POW MW		356	350	319	296	287	285	293	319	339	
ENERGY GWH	888.6	177.7	188.3	179.7	79.8	36.1	21.4	71.4	72.9	61.3	
<b>--GAVINS POINT--</b>											
NAT INFLOW	794	115	111	120	59	28	31	100	100	130	
DEPLETION	28	10	-5	2	5	2	3	10	1		
CHAN STOR	24	-7	-6	2	2	0	26	4	0	3	
EVAPORATION	34	7	9	8	3	2	2	4			
REG INFLOW	9971	1836	1965	1968	925	432	295	892	892	767	
RELEASE	9993	1845	1940	1968	925	432	295	892	892	805	
STOR CHANGE	-22	-9	25							-38	
STORAGE	364	355	380	380	380	380	380	380	380	342	
ELEV FTMSL	1206.9	1206.5	1207.5	1207.5	1207.5	1207.5	1207.5	1207.5	1207.5	1206.0	
DISCH KCFS	26.5	30.0	32.6	32.0	31.1	31.1	18.6	14.5	14.5	14.5	
POWER											
AVE POWER MW		102	109	108	106	106	66	51	51	51	
PEAK POW MW		115	117	117	117	117	117	117	117	114	
ENERGY GWH	414.5	76.0	78.3	80.6	38.3	17.9	12.6	38.3	38.3	34.3	
<b>--GAVINS POINT - SIOUX CITY--</b>											
NAT INFLOW	607	170	99	78	38	18	20	52	40	92	
DEPLETION	122	36	23	10	6	3	3	13	14	14	
REGULATED FLOW AT SIOUX CITY											
KAF	10478	1979	2016	2036	957	447	312	931	918	883	
KCFS		32.2	33.9	33.1	32.2	32.2	19.7	15.1	14.9	15.9	
<b>--TOTAL--</b>											
NAT INFLOW	7116	1370	1101	1122	498	232	265	701	750	1077	
DEPLETION	-631	299	-136	-53	-128	-60	-68	-184	-192	-109	
CHAN STOR	26	-8	15	20	1	-14	27	4	-20	3	
EVAPORATION	1576	329	408	350	156	72	82	178			
STORAGE	57722	56477	55305	54114	53628	53386	53352	53133	53137	53442	
SYSTEM POWER											
AVE POWER MW		1136	1132	920	877	957	681	665	785	758	
PEAK POW MW		2333	2320	2300	2274	2263	2260	2265	2286	2293	
ENERGY GWH	4540.7	845.4	815.2	684.7	315.6	160.8	130.7	494.9	584.0	509.4	
DAILY GWH		27.3	27.2	22.1	21.0	23.0	16.3	16.0	18.8	18.2	
	INI-SUM	31AUG	30SEP	31OCT	15NOV	22NOV	30NOV	31DEC	31JAN	28FEB	

31JUL09	2009	VALUES IN 1000 AF EXCEPT AS INDICATED									
INI-SUM	31AUG	30SEP	31OCT	15NOV	22NOV	30NOV	31DEC	31JAN	28FEB	2010	
<b>--FORT PECK--</b>											
NAT INFLOW	2654	360	348	396	198	92	106	348	374	432	
DEPLETION	-420	9	-76	-36	-7	-3	-3	-103	-122	-79	
EVAPORATION	247	55	69	61	15	7	8	32			
MOD INFLOW	2827	296	355	371	190	89	101	419	496	511	
RELEASE	1906	400	308	246	119	56	63	246	246	222	
STOR CHANGE	921	-104	46	125	71	33	38	173	250	289	
STORAGE	12153	12049	12096	12221	12292	12325	12363	12535	12785	13074	
ELEV FTMSL	2220.5	2219.9	2220.1	2220.8	2221.2	2221.4	2221.6	2222.5	2223.9	2225.4	
DISCH KCFS	6.5	6.5	5.2	4.0	4.0	4.0	4.0	4.0	4.0	4.0	
POWER											
AVE POWER MW		84	67	52	52	52	52	52	53	53	
PEAK POW MW		150	150	151	152	152	152	153	154	156	
ENERGY GWH	301.7	62.8	48.4	38.8	18.8	8.8	10.1	39.1	39.3	35.7	
<b>--GARRISON--</b>											
NAT INFLOW	3464	780	542	628	239	112	127	296	313	427	
DEPLETION	-489	112	-131	-28	-108	-50	-57	-103	-84	-40	
CHAN STOR	24		13	11							
EVAPORATION	344	77	97	85	20	9	11	44			
REG INFLOW	5539	991	897	828	445	208	237	601	643	689	
RELEASE	7063	984	884	830	402	229	262	1015	1291	1166	
STOR CHANGE	-1524	7	12	-2	44	-21	-24	-414	-648	-477	
STORAGE	19610	19617	19629	19628	19671	19650	19625	19212	18563	18086	
ELEV FTMSL	1842.2	1842.2	1842.3	1842.2	1842.4	1842.3	1842.2	1841.0	1839.0	1837.4	
DISCH KCFS	15.8	16.0	14.9	13.5	13.5	16.5	16.5	21.0	21.0	21.0	
POWER											
AVE POWER MW		204	190	172	172	210	210	210	265	262	
PEAK POW MW		489	489	489	491	490	489	480	473	468	
ENERGY GWH	1082.8	151.7	136.5	128.2	62.1	35.3	40.4	155.9	196.8	175.9	
<b>--OAHE--</b>											
NAT INFLOW	510	96	133	79	40	19	21		14	108	
DEPLETION	196	106	26	-8	2	1	1	15	20	33	
CHAN STOR	-21	-1	4	5			-12		-18		
EVAPORATION	330	78	94	80	19	9	10	41			
REG INFLOW	7025	896	902	843	421	226	272	958	1267	1241	
RELEASE	8657	1704	1696	1216	543	288	210	920	1126	954	
STOR CHANGE	-1632	-808	-794	-373	-122	-62	62	39	141	287	
STORAGE	20427	19619	18824	18451	18329	18267	18328	18367	18508	18795	
ELEV FTMSL	1612.4	1610.0	1607.5	1606.3	1605.9	1605.7	1605.9	1606.0	1606.4	1607.4	
DISCH KCFS	23.6	27.7	28.5	19.8	18.3	20.7	13.3	15.0	18.3	17.2	
POWER											
AVE POWER MW		364	370	255	234	265	170	192	235	221	
PEAK POW MW		721	708	701	699	698	699	700	702	707	
ENERGY GWH	1354.4	270.7	266.0	189.5	84.3	44.6	32.7	142.8	174.9	148.8	
<b>--BIG BEND--</b>											
EVAPORATION	66	15	19	16	4	2	2	9			
REG INFLOW	8591	1689	1677	1200	539	286	208	911	1126	954	
RELEASE	8610	1708	1677	1200	539	286	208	911	1126	954	
STORAGE	1640	1621	1621	1621	1621	1621	1621	1621	1621	1621	
ELEV FTMSL	1420.3	1420.0	1420.0	1420.0	1420.0	1420.0	1420.0	1420.0	1420.0	1420.0	
DISCH KCFS	21.7	27.8	28.2	19.5	18.1	20.6	13.1	14.8	18.3	17.2	
POWER											
AVE POWER MW		130	134	96	91	103	66	75	90	82	
PEAK POW MW		509	517	538	538	538	538	538	538	529	
ENERGY GWH	505.2	96.9	96.2	71.2	32.8	17.4	12.7	55.6	66.9	55.4	
<b>--FORT RANDALL--</b>											
NAT INFLOW	228	66	46	6	4	2	2	14	30	59	
DEPLETION	34	15	7	1	1	0	1	3	3	3	
EVAPORATION	75	19	24	18	4	2	2	7			
REG INFLOW	8729	1740	1693	1186	538	286	209	915	1153	1010	
RELEASE	9134	1719	1839	1829	859	402	235	812	803	636	
STOR CHANGE	-405	21	-146	-643	-321	-116	-26	102	350	374	
STORAGE	3528	3549	3403	2760	2438	2322	2296	2399	2749	3123	
ELEV FTMSL	1354.9	1355.2	1353.5	1345.0	1340.0	1338.0	1337.5	1339.3	1344.8	1350.0	
DISCH KCFS	24.4	28.0	30.9	29.8	28.9	28.9	14.8	13.2	13.1	11.5	
POWER											
AVE POWER MW		235	258	238	218	212	108	97	99	91	
PEAK POW MW		356	350	319	296	287	285	293	319	339	
ENERGY GWH	880.8	175.2	185.9	177.3	78.5	35.6	20.7	72.3	73.9	61.4	
<b>--GAVINS POINT--</b>											
NAT INFLOW	953	138	133	144	71	33	38	120	120	156	
DEPLETION	28	10	-5	2	5	2	3	10	1		
CHAN STOR	24	-7	-6	2	2	0	26	3	0	3	
EVAPORATION	23	5	6	6	1	1	1	3			
REG INFLOW	10060	1836	1965	1968	925	432	295	922	922	795	
RELEASE	10082	1845	1940	1968	925	432	295	922	922	833	
STOR CHANGE	-22	-9	25							-38	
STORAGE	364	355	380	380	380	380	380	380	380	342	
ELEV FTMSL	1206.9	1206.5	1207.5	1207.5	1207.5	1207.5	1207.5	1207.5	1207.5	1206.0	
DISCH KCFS	26.5	30.0	32.6	32.0	31.1	31.1	18.6	15.0	15.0	15.0	
POWER											
AVE POWER MW		102	109	108	106	106	66	53	53	53	
PEAK POW MW		115	117	117	117	117	117	117	117	114	
ENERGY GWH	418.3	76.0	78.3	80.6	38.3	17.9	12.6	39.6	39.6	35.5	
<b>--GAVINS POINT - SIOUX CITY--</b>											
NAT INFLOW	728	204	119	94	46	21	24	62	48	110	
DEPLETION	122	36	23	10	6	3	3	13	14	14	
REGULATED FLOW AT SIOUX CITY											
KAF	10688	2013	2036	2052	965	450	316	971	956	929	
KCFS		32.7	34.2	33.4	32.4	32.4	19.9	15.8	15.6	16.7	
<b>--TOTAL--</b>											
NAT INFLOW	8537	1644	1321	1347	597	279	318	840	899	1292	
DEPLETION	-529	288	-156	-59	-100	-47	-53	-165	-168	-69	
CHAN STOR	27	-7	12	19	1	-12	27	3	-18	3	
EVAPORATION	1085	248	309	267	63	29	33	136			
STORAGE	57722	56810	55953	55060	54731	54565	54614	54514	54607	55042	
SYSTEM POWER											
AVE POWER MW		1120	1127	921	874	950	673	679	795	763	
PEAK POW MW		2340	2332	2315	2293	2282	2280	2282	2304	2313	
ENERGY GWH	4543.1	833.3	811.4	685.6	314.7	159.5	129.1	505.3	591.4	512.7	
DAILY GWH		26.9	27.0	22.1	21.0	22.8	16.1	16.3	19.1	18.3	
INI-SUM	31AUG	30SEP	31OCT	15NOV	22NOV	30NOV	31DEC	31JAN	28FEB		

TIME OF STUDY 09:33:15 FULL SERV, SHTN NAV SEAS 0 DAYS STUDY NO 3

	31JUL09	2009									
	INI-SUM	31AUG	30SEP	31OCT	15NOV	22NOV	30NOV	31DEC	31JAN	28FEB	2010
--FORT PECK--											
NAT INFLOW	1770	240	232	264	132	62	70	232	250	288	
DEPLETION	-661	-31	-137	-124	-43	-20	-23	-112	-99	-73	
EVAPORATION	449	91	114	100	45	21	24	53			
MOD INFLOW	1982	180	255	288	129	60	69	291	349	361	
RELEASE	1905	400	307	246	119	56	63	246	246	222	
STOR CHANGE	77	-220	-52	42	10	5	5	45	103	139	
STORAGE	12153	11933	11881	11923	11933	11938	11943	11988	12091	12230	
ELEV FTMSL	2220.5	2219.2	2218.9	2219.2	2219.2	2219.3	2219.3	2219.5	2220.1	2220.9	
DISCH KCFS	6.5	6.5	5.2	4.0	4.0	4.0	4.0	4.0	4.0	4.0	
POWER											
AVE POWER MW		84	67	52	52	52	52	52	52	52	
PEAK POW MW		150	149	149	150	150	150	150	150	151	
ENERGY GWH	299.0	62.7	48.1	38.5	18.7	8.7	10.0	38.6	38.7	35.0	
--GARRISON--											
NAT INFLOW	2310	520	362	418	159	74	85	198	209	285	
DEPLETION	-513	75	-141	-17	-105	-49	-56	-96	-72	-52	
CHAN STOR	24		13	11							
EVAPORATION	620	128	160	138	62	29	33	70			
REG INFLOW	4132	717	663	554	321	150	171	470	527	559	
RELEASE	6733	984	867	769	372	222	254	984	1199	1083	
STOR CHANGE	-2602	-267	-204	-215	-51	-72	-83	-514	-672	-524	
STORAGE	19610	19343	19139	18924	18873	18801	18718	18204	17532	17008	
ELEV FTMSL	1842.2	1841.4	1840.8	1840.1	1839.9	1839.7	1839.4	1837.8	1835.6	1833.8	
DISCH KCFS	15.8	16.0	14.6	12.5	12.5	16.0	16.0	16.0	19.5	19.5	
POWER											
AVE POWER MW		203	185	158	158	202	202	201	241	238	
PEAK POW MW		482	480	477	477	476	475	469	461	455	
ENERGY GWH	1020.0	151.4	133.0	117.7	56.9	33.9	38.7	149.2	179.3	159.9	
--OAHE--											
NAT INFLOW	342	64	89	53	27	13	14		10	72	
DEPLETION	196	106	26	-8	2	1	1	15	20	33	
CHAN STOR	-16	-1	6	8			-15		-15		
EVAPORATION	593	129	155	130	58	27	30	66			
REG INFLOW	6270	812	781	708	339	193	237	903	1174	1122	
RELEASE	9008	1799	1788	1293	588	308	233	912	1115	971	
STOR CHANGE	-2738	-987	-1007	-585	-248	-116	3	-9	60	151	
STORAGE	20427	19440	18433	17848	17600	17485	17488	17479	17538	17689	
ELEV FTMSL	1612.4	1609.4	1606.2	1604.3	1603.4	1603.0	1603.0	1603.0	1603.2	1603.7	
DISCH KCFS	23.6	29.3	30.1	21.0	19.7	22.2	14.7	14.8	18.1	17.5	
POWER											
AVE POWER MW		384	388	268	250	280	186	187	229	221	
PEAK POW MW		718	701	691	686	684	684	684	685	688	
ENERGY GWH	1395.1	285.3	279.0	199.6	90.1	47.1	35.7	139.5	170.2	148.6	
--BIG BEND--											
EVAPORATION	121	25	31	27	12	6	7	14			
REG INFLOW	8887	1775	1757	1266	575	303	227	898	1115	971	
RELEASE	8906	1794	1757	1266	575	303	227	898	1115	971	
STORAGE	1640	1621	1621	1621	1621	1621	1621	1621	1621	1621	
ELEV FTMSL	1420.3	1420.0	1420.0	1420.0	1420.0	1420.0	1420.0	1420.0	1420.0	1420.0	
DISCH KCFS	21.7	29.2	29.5	20.6	19.3	21.8	14.3	14.6	18.1	17.5	
POWER											
AVE POWER MW		137	140	101	97	109	72	74	89	84	
PEAK POW MW		509	517	538	538	538	538	538	538	529	
ENERGY GWH	522.3	101.8	100.8	75.1	35.0	18.4	13.8	54.8	66.3	56.4	
--FORT RANDALL--											
NAT INFLOW	152	44	30	4	3	1	1	10	20	39	
DEPLETION	34	15	7	1	1	0	1	3	3	3	
EVAPORATION	136	32	39	31	12	5	5	12			
REG INFLOW	8888	1791	1741	1238	565	298	223	893	1132	1007	
RELEASE	9293	1770	1887	1881	886	414	249	791	782	633	
STOR CHANGE	-405	21	-146	-643	-321	-116	-26	103	350	374	
STORAGE	3528	3549	3403	2760	2438	2322	2296	2399	2749	3123	
ELEV FTMSL	1354.9	1355.2	1353.5	1345.0	1340.0	1338.0	1337.5	1339.3	1344.8	1350.0	
DISCH KCFS	24.4	28.8	31.7	30.6	29.8	29.8	15.7	12.9	12.7	11.4	
POWER											
AVE POWER MW		242	265	245	225	218	114	95	97	91	
PEAK POW MW		356	350	319	296	287	285	293	319	339	
ENERGY GWH	896.2	180.3	190.7	182.2	80.9	36.7	22.0	70.4	72.0	61.2	
--GAVINS POINT--											
NAT INFLOW	635	92	89	96	47	22	25	80	80	104	
DEPLETION	28	10	-5	2	5	2	3	10	1		
CHAN STOR	24	-8	-6	2	1	0	26	5	0	2	
EVAPORATION	42	8	11	10	4	2	2	5			
REG INFLOW	9882	1836	1965	1968	925	432	295	861	861	740	
RELEASE	9904	1845	1940	1968	925	432	295	861	861	778	
STOR CHANGE	-22	-9	25							-38	
STORAGE	364	355	380	380	380	380	380	380	380	342	
ELEV FTMSL	1206.9	1206.5	1207.5	1207.5	1207.5	1207.5	1207.5	1207.5	1207.5	1206.0	
DISCH KCFS	26.5	30.0	32.6	32.0	31.1	31.1	18.6	14.0	14.0	14.0	
POWER											
AVE POWER MW		102	109	108	106	106	66	50	50	49	
PEAK POW MW		115	117	117	117	117	117	117	117	114	
ENERGY GWH	410.8	76.0	78.3	80.6	38.3	17.9	12.6	37.0	37.0	33.1	
--GAVINS POINT - SIOUX CITY--											
NAT INFLOW	486	136	79	62	31	14	16	42	32	74	
DEPLETION	122	36	23	10	6	3	3	13	14	14	
REGULATED FLOW AT SIOUX CITY											
KAF	10268	1945	1996	2020	950	443	308	890	879	838	
KCFS		31.6	33.5	32.8	31.9	31.9	19.4	14.5	14.3	15.1	
--TOTAL--											
NAT INFLOW	5695	1096	881	897	398	186	212	562	601	862	
DEPLETION	-794	211	-227	-136	-134	-62	-71	-167	-133	-75	
CHAN STOR	33	-9	13	22	1	-15	27	5	-14	2	
EVAPORATION	1962	412	510	436	193	89	102	220			
STORAGE	57722	56241	54857	53456	52846	52546	52447	52071	51912	52014	
SYSTEM POWER											
AVE POWER MW		1152	1153	932	888	968	692	658	757	736	
PEAK POW MW		2330	2314	2291	2264	2252	2249	2251	2270	2276	
ENERGY GWH	4543.4	857.5	829.9	693.7	319.8	162.6	132.8	489.4	563.4	494.3	
DAILY GWH		27.7	27.7	22.4	21.3	23.2	16.6	15.8	18.2	17.7	
INI-SUM		31AUG	30SEP	31OCT	15NOV	22NOV	30NOV	31DEC	31JAN	28FEB	









TIME OF STUDY 09:33:15

STUDY NO

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	VALUES IN 1000 AF EXCEPT AS INDICATED												STUDY NO				
	28FEB10 INI-SUM	15MAR	2010 22MAR	31MAR	30APR	31MAY	30JUN	31JUL	31AUG	30SEP	31OCT	15NOV	22NOV	2011 30NOV	31DEC	31JAN	28FEB
--FORT PECK--																	
NAT INFLOW	6000	203	95	122	485	955	1480	665	285	255	340	165	77	88	260	220	305
DEPLETION	344	-27	-12	-16	74	192	354	223	1	-97	-74	-17	-8	-9	-95	-102	-43
EVAPORATION	501							31	97	120	105	47	22	25	54		
MOD INFLOW	5155	230	107	138	411	763	1126	411	187	232	309	135	63	72	301	322	348
RELEASE	5127	149	69	89	357	369	506	523	523	420	307	149	69	79	523	523	472
STOR CHANGE	28	81	38	49	54	394	620	-112	-335	-188	2	-14	-7	-7	-222	-201	-124
STORAGE	12230	12311	12349	12398	12452	12846	13466	13355	13019	12831	12833	12819	12812	12805	12583	12382	12258
ELEV FTMSL	2220.9	2221.3	2221.5	2221.8	2222.1	2224.2	2227.5	2226.9	2225.1	2224.1	2224.2	2224.1	2224.0	2224.0	2222.8	2221.7	2221.0
DISCH KCF5	4.0	5.0	5.0	5.0	6.0	6.0	8.5	8.5	8.5	7.1	5.0	5.0	5.0	5.0	8.5	8.5	8.5
POWER																	
AVE POWER MW		65	65	65	79	79	113	113	113	93	66	66	66	66	112	111	111
PEAK POW MW		152	152	152	152	155	157	157	156	155	155	155	154	154	153	152	151
ENERGY GWH	818.2	23.5	11.0	14.1	56.6	58.8	81.3	84.4	84.0	67.3	49.2	23.8	11.1	12.7	83.2	82.8	74.5
--GARRISON--																	
NAT INFLOW	9200	423	198	254	705	1110	2635	1585	505	390	420	165	77	88	150	220	275
DEPLETION	1035	5	2	3	7	144	670	565	116	-108	19	-106	-49	-56	-86	-57	-34
CHAN STOR	-46	-10			-10		-25	0		14	21			0	-35		0
EVAPORATION	597							37	116	144	124	56	26	30	64		
REG INFLOW	12650	557	265	340	1045	1335	2445	1506	796	789	605	363	170	194	659	800	781
RELEASE	14652	417	194	250	1488	1537	1339	1383	1383	1104	861	417	194	222	1230	1383	1250
STOR CHANGE	-2002	141	70	90	-443	-202	1107	122	-588	-315	-256	-53	-25	-28	-571	-584	-469
STORAGE	17008	17149	17219	17310	16867	16665	17772	17894	17306	16991	16735	16682	16657	16629	16058	15474	15006
ELEV FTMSL	1833.8	1834.3	1834.5	1834.8	1833.3	1832.6	1836.4	1836.8	1834.8	1833.8	1832.9	1832.7	1832.6	1832.5	1830.5	1828.4	1826.7
DISCH KCF5	19.5	14.0	14.0	14.0	25.0	25.0	22.5	22.5	22.5	18.6	14.0	14.0	14.0	14.0	20.0	22.5	22.5
POWER																	
AVE POWER MW		171	171	171	303	301	274	277	276	226	170	169	169	169	239	265	262
PEAK POW MW		456	457	458	453	450	464	466	458	454	451	450	450	450	442	435	428
ENERGY GWH	2140.4	61.5	28.8	37.0	218.2	223.9	197.2	206.4	205.4	162.7	126.4	61.0	28.4	32.5	177.9	197.2	175.9
--OAHE--																	
NAT INFLOW	1300	203	95	122	180	130	275	140	65	75	15	13	6	7	-90	-10	75
DEPLETION	666	24	11	14	49	70	142	169	112	27	-10	1	0	1	12	17	27
CHAN STOR	-14	23			-45		10			17	20			0	-28	-11	
EVAPORATION	545							35	108	132	112	50	23	26	58		
REG INFLOW	14728	619	278	358	1573	1597	1482	1319	1228	1037	794	378	177	202	1043	1345	1298
RELEASE	16765	454	330	464	1443	1799	1683	1908	1932	1719	1211	516	276	211	866	1062	891
STOR CHANGE	-2038	165	-52	-106	130	-202	-201	-589	-704	-682	-416	-138	-99	-9	176	283	407
STORAGE	17689	17854	17802	17696	17827	17625	17424	16835	16131	15449	15032	14894	14795	14786	14962	15245	15652
ELEV FTMSL	1603.7	1604.3	1604.1	1603.7	1604.2	1603.5	1602.8	1600.8	1598.2	1595.7	1594.1	1593.6	1593.2	1593.1	1593.8	1594.9	1596.5
DISCH KCF5	17.5	15.3	23.8	26.0	24.2	29.3	28.3	31.0	31.4	28.9	19.7	17.4	19.9	13.3	14.1	17.3	16.0
POWER																	
AVE POWER MW		194	301	328	307	369	356	387	387	351	237	208	237	159	169	208	194
PEAK POW MW		691	690	688	690	687	683	672	659	647	639	636	634	634	638	643	651
ENERGY GWH	2505.1	69.8	50.6	71.0	220.9	274.9	256.2	288.0	288.0	252.9	176.6	74.9	39.9	30.5	125.6	154.7	130.7
--BIG BEND--																	
EVAPORATION	129							8	24	31	27	12	6	7	14		
REG INFLOW	16637	454	330	464	1443	1799	1683	1900	1908	1688	1184	504	270	204	852	1062	891
RELEASE	16637	454	330	464	1443	1799	1683	1900	1908	1688	1184	504	270	204	852	1062	891
STORAGE	1621	1621	1621	1621	1621	1621	1621	1621	1621	1621	1621	1621	1621	1621	1621	1621	1621
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 KCF5	17.5	15.3	23.8	26.0	24.2	29.3	28.3	30.9	31.0	28.4	19.2	16.9	19.5	12.9	13.9	17.3	16.0
POWER																	
AVE POWER MW		72	111	122	113	137	132	145	145	134	94	85	98	65	70	85	77
PEAK POW MW		517	509	509	509	509	509	509	509	517	538	538	538	538	538	538	529
ENERGY GWH	959.2	26.0	18.7	26.3	81.7	101.9	95.3	107.6	108.0	96.8	70.3	30.7	16.4	12.5	52.0	63.2	51.7
--FORT RANDALL--																	
NAT INFLOW	450	73	34	44	90	65	125	35	25		-20	-8	-4	-4	-30	-15	40
DEPLETION	80	1	1	1	4	9	12	18	15		1	1	0	1	3	3	3
EVAPORATION	146							10	32	39	31	12	5	5	12		
REG INFLOW	16860	525	363	506	1529	1855	1796	1907	1886	1642	1132	483	261	195	807	1044	928
RELEASE	16859	233	229	506	1529	1855	1796	1907	1886	1775	804	377	221	704	694	554	
STOR CHANGE	1	292	134					0	0	-146	-643	-321	-116	-26	103	350	374
STORAGE	3123	3415	3549	3549	3549	3549	3549	3549	3549	3403	2760	2439	2323	2297	2400	2750	3124
ELEV FTMSL	1350.0	1353.6	1355.2	1355.2	1355.2	1355.2	1355.2	1355.2	1355.2	1353.5	1345.0	1340.0	1338.0	1337.5	1339.3	1344.8	1350.0
DISCH KCF5	11.4	7.8	16.5	28.4	25.7	30.2	30.2	31.0	30.7	30.1	28.9	27.0	27.2	13.9	11.5	11.3	10.0
POWER																	
AVE POWER MW		65	139	239	217	254	254	261	258	251	231	204	199	102	84	86	80
PEAK POW MW		351	356	356	356	356	356	356	356	350	319	296	287	285	293	319	339
ENERGY GWH	1672.5	23.4	23.4	51.6	156.1	189.0	182.9	194.2	192.1	180.9	172.1	73.6	33.4	19.5	62.8	64.0	53.6
--GAVINS POINT--																	
NAT INFLOW	1300	87	41	52	125	140	150	85	75	80	110	53	25	28	75	75	100
DEPLETION	114	0	0	0	5	19	24	39	10	-5	2	5	2	3	10	1	
CHAN STOR	1	7	-17	-23	5	-9	0	-2	1	1	2	3	0	25	5	0	2
EVAPORATION	45							3	8	11	10	4	2	2	5		
REG INFLOW	18002	327	253	536	1654	1968	1922	1949	1944	1864	1875	851	397	268	769	769	656
RELEASE	18002	327	253	536	1654	1968	1922	1949	1931	1839	1875	851	397	268	769	769	694
STOR CHANGE								13	25								-38
STORAGE	342	342	342														

