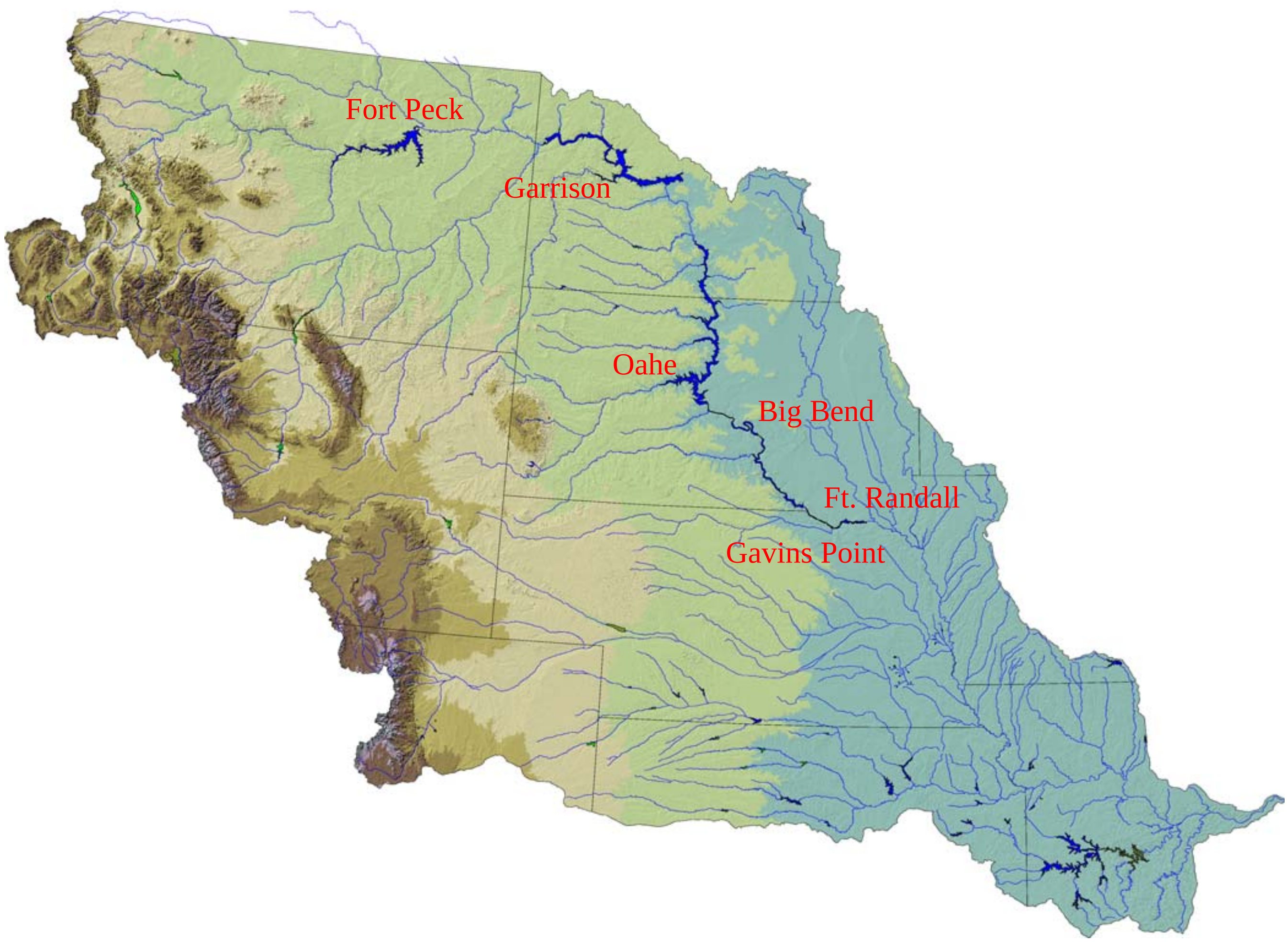
US Army Corps of Engineers

Northwestern Division

Missouri River Mainstem Reservoir System

Summary of Actual 2006 Regulation

Missouri River Basin



Reservoir Control Center
U.S. Army Corps of Engineers
Northwestern Division - Missouri River Basin
Omaha, Nebraska

March 2007

MISSOURI RIVER MAINSTEM RESERVOIRS

Summary of Actual 2006 Regulation

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LIST OF ABBREVIATIONS AND ACRONYMS

ACHP	Advisory Council on Historic Preservation
AOP	annual operating plan
AF	acre-feet
B	Billion
BOR	U.S. Bureau of Reclamation
cfs	cubic feet per second
COE	Corps of Engineers
Council	National Council Lewis and Clark Expedition Bicentennial
CWA	Clean Water Act
CY	calendar year (January 1 to December 31)
EA	Environmental Assessment
EIS	Environmental Impact Statement
elev	elevation
ESA	Endangered Species Act of 1973
ft	feet
ft msl	feet above mean sea level
FY	fiscal year (October 1 to September 30)
GIS	Geographic Information System
GWh	gigawatt hour
KAF	1,000 acre-feet
Kcfs	1,000 cubic feet per second
kW	kilowatt
kWh	kilowatt hour
M	million
MAF	million acre-feet
MRBA	Missouri River Basin Association
MRNRC	Missouri River Natural Resources Committee
MRBWMD	Missouri River Basin Water Management Division
msl	mean sea level
MW	megawatt
MWh	megawatt hour
NEPA	National Environmental Policy Act
OPPD	Omaha Public Power District
PA	2004 Programmatic Agreement
plover	piping plover
pp	powerplant
P-S MBP	Pick-Sloan Missouri Basin Program
RCC	Reservoir Control Center
RM	river mile
Service	U.S. Fish and Wildlife Service
SHPO	State Historic Preservation Officer
SR-FTT	Steady Release – Flow-to-Target

tern	interior least tern
THPO	Tribal Historic Preservation Officer
TMDL	Total Maximum Daily Load
tw	tailwater
USBR	U.S. Bureau of Reclamation
USGS	United States Geological Survey
VERS	Visitation Estimation Reporting System
WCSC	Waterborne Commerce Statistics Center
Western	Western Area Power Administration
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. Conversely, 1.5 cfs for 24 hours is approximately 1 million gallon per day (MGD)

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

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

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

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

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

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

MISSOURI RIVER MAINSTEM RESERVOIR SYSTEM

Summary of Actual 2006 Regulation

I. FOREWORD

This document contains a summary of the actual regulation of the Missouri River Mainstem Reservoir System (System) for the 2006 Calendar Year (CY). Two other reports related to System regulation are also available, the "System Description and Operation", and "2005-2006 Annual Operating Plan". All three reports can be obtained by contacting the Missouri River Basin Water Management Division at 12565 West Center Road, Omaha, Nebraska 68144-3869, phone (402) 697-2676. The reports are also available on the Northwestern Division website at www.nwd-mr.usace.army.mil/rcc.

A basin map is presented on ***Plate 1*** and the pertinent data for the Missouri River System is shown on ***Plate 2.***

II. REVIEW OF REGULATION – JANUARY-DECEMBER 2006

A. General

During CY 2006 the System was regulated in accordance with the applicable provisions of the 2005-2006 Annual Operating Plan (AOP), which was made available for review and comment by representatives of State and Federal agencies, Tribes, the general public, and specific interest groups. A summary of the significant events during 2006 is given in the following paragraphs.

B. Precipitation and Water Supply Available in 2006

The 2006 runoff year was the seventh consecutive drought year experienced in the Missouri River basin. ***Table 1*** shows the runoff total for CY 2006 above Sioux City, IA as well as runoff in reaches from Sioux City to Hermann, MO. ***Table 2*** shows the CY 2006 monthly runoff for selected reaches.

1. Plains Snowpack

November 2005 began with warm weather across most of the Missouri River basin. Some scattered light snow early in the month was reported, with Glasgow, MT receiving 3.7 inches on November 3-4. Mid-November brought more warm weather, including seven record high temperature in North Dakota and eight new record highs in Nebraska. Numerous record highs were set in South Dakota as well. Only light snow dusted parts of the basin during mid-November. During late November, an early-season blizzard brought snow and bitterly cold air. In Huron, SD November 27-28 precipitation totaled 3.54 inches, where freezing rain was followed by 14 inches of snow. Snowfall reached

20 inches in Kennebec, SD. Farther north Great Falls, MT received 19.8 inches of snow during the last five days of the month, nudging the monthly total to 23.2 inches, just past the November 1955 record of 22.1 inches. Great Falls also set a 3-day snowfall record of 18.1 inches. Additional snow fell on November 30, with 6.6 inches in Sioux Falls and 5 inches in Huron, SD.

Table 1
2006 Calendar Year Runoff for Selected Reaches

Reach	1898 – 1998 Average Runoff Volume (in 1000 AF)	Calendar Year 2006 Runoff Volume (in 1000 AF)	Percent of Average Runoff
Above Fort Peck	7,395	5,965	81
Fort Peck to Garrison	10,840	6,776	63
Garrison to Oahe	2,430	946	39
Oahe to Fort Randall	910	389	43
Fort Randall to Gavins Point	1,675	1,461	87
Gavins Point to Sioux City	1,940	2,988	154
TOTAL ABOVE SIOUX CITY	**25,190**	**18,525**	**74**
	1967–2006 Average Runoff		
Sioux City to Nebraska City*	7,430	4,750	64
Nebraska City to Kansas City*	11,420	3,570	31
Kansas City to Hermann*	23,410	5,560	24
TOTAL BELOW SIOUX CITY*	**42,260**	**13,880**	**33**

** Runoff in the reaches from Sioux City to Hermann is not adjusted to 1949 depletion levels. Averages are taken from USGS Water Data Reports for the period 1967-2006.*

Snowfall continued into the early part of December. In Montana, Billings collected measurable snowfall on 11 consecutive days (totaling 11.1 inches) from November 25 to December 6. Daily record snowfall totals for December 5 reached 7.1 inches in Kalispell and 4.8 inches in Havre. Waterloo, IA netted 11 inches of snow from November 30 to December 3, reporting at least an inch a day. In the snow's wake, frigid weather settled across the region. In South Dakota, Huron's minimum temperatures fell to -10°F or lower during the first five days of November, including a record low of -15°F on December 2. Cold conditions prevailed into mid-December. A widespread blanket of snow covered much of the upper basin, although western Nebraska's snow cover remained shallow and patchy. In late December, snow once again blanketed upper parts of the region with Watertown, SD posting daily records for precipitation (0.89 inches) and snowfall (6 inches) on December 29. Parts of the basin had warmer-than-normal weather near the end of December.

Table 2

Missouri River Basin
Calendar Year 2006 Runoff above Sioux City, IA

3-Jan-07

Values in 1000 Acre Feet

Reach Above	Fort Peck	Garrison	Oahe	Fort Randall	Gavins Point	Sioux City	Summation above Gavins Point	Summation above Sioux City	Accumulated Summation above Sioux City
	Historic								
JAN 2006	413	440	93	87	156	195	1,189	1,384	1,384
NORMAL	315	260	10	20	100	35	705	740	740
DEPARTURE	98	180	83	67	56	160	484	644	644
% OF NORM	131%	169%	930%	435%	156%	557%	169%	187%	187%
FEB 2006	224	253	32	14	77	289	600	889	2,273
NORMAL	365	360	90	50	125	85	990	1,075	1,815
DEPARTURE	-141	-107	-58	-36	-48	204	-390	-186	458
% OF NORM	61%	70%	36%	28%	62%	340%	61%	83%	125%
MAR 2006	446	494	110	67	135	252	1,252	1,504	3,777
NORMAL	610	1,010	580	220	205	300	2,625	2,925	4,740
DEPARTURE	-164	-516	-470	-153	-70	-48	-1,373	-1,421	-963
% OF NORM	73%	49%	19%	30%	66%	84%	48%	51%	80%
APR 2006	725	813	144	109	219	771	2,010	2,781	6,558
NORMAL	665	1,115	500	145	180	340	2,605	2,945	7,685
DEPARTURE	60	-302	-356	-36	39	431	-595	-164	-1,127
% OF NORM	109%	73%	29%	75%	122%	227%	77%	94%	85%
MAY 2006	885	1,021	106	10	121	485	2,143	2,628	9,186
NORMAL	1,120	1,280	320	145	185	275	3,050	3,325	11,010
DEPARTURE	-235	-259	-214	-135	-64	210	-907	-697	-1,824
% OF NORM	79%	80%	33%	7%	65%	176%	70%	79%	83%
JUN 2006	1,348	1,822	62	-3	102	297	3,332	3,629	12,815
NORMAL	1,655	2,715	435	160	180	270	5,145	5,415	16,425
DEPARTURE	-307	-893	-373	-163	-78	27	-1,814	-1,787	-3,611
% OF NORM	81%	67%	14%	-2%	57%	110%	65%	67%	78%
JUL 2006	539	802	99	-47	61	130	1,454	1,584	14,399
NORMAL	835	1,815	180	60	135	215	3,025	3,240	19,665
DEPARTURE	-296	-1,013	-81	-107	-74	-85	-1,571	-1,656	-5,267
% OF NORM	65%	44%	55%	-78%	45%	60%	48%	49%	73%
AUG 2006	187	74	72	58	106	120	497	617	15,016
NORMAL	360	625	65	40	115	130	1,205	1,335	21,000
DEPARTURE	-173	-551	7	18	-9	-10	-708	-718	-5,985
% OF NORM	52%	12%	111%	145%	92%	92%	41%	46%	72%
SEP 2006	193	100	130	27	110	138	560	698	15,714
NORMAL	345	470	115	40	110	95	1,080	1,175	22,175
DEPARTURE	-152	-370	15	-13	0	43	-520	-477	-6,462
% OF NORM	56%	21%	113%	68%	100%	145%	52%	59%	71%
OCT 2006	338	425	33	-50	140	84	886	970	16,684
NORMAL	400	525	70	10	120	75	1,125	1,200	23,375
DEPARTURE	-62	-100	-37	-60	20	9	-239	-230	-6,692
% OF NORM	85%	81%	47%	-500%	117%	112%	79%	81%	71%
NOV 2006	360	367	54	-3	82	101	860	961	17,645
NORMAL	390	410	65	10	120	75	995	1,070	24,445
DEPARTURE	-30	-43	-11	-13	-38	26	-135	-109	-6,801
% OF NORM	92%	90%	83%	-30%	68%	135%	86%	90%	72%
DEC 2006	307	165	11	119	152	126	754	880	18,525
NORMAL	335	255	0	10	100	45	700	745	25,190
DEPARTURE	-28	-90	11	109	52	81	54	135	-6,666
% OF NORM	92%	65%	2750%	1190%	152%	280%	108%	118%	74%
Calendar Year Totals									
	5,965	6,776	946	389	1,461	2,988	15,537	18,525	
NORMAL	7,395	10,840	2,430	910	1,675	1,940	23,250	25,190	
DEPARTURE	-1,430	-4,064	-1,484	-522	-214	1,048	-7,714	-6,666	
% OF NORM	81%	63%	39%	43%	87%	154%	67%	74%	

In early January the warm weather continued to spread across the region. Daily record highs were set at many locations, including Rapid City, SD and McCook, NE. At Billings, MT the period from December 21 - January 15 was the warmest such period on record. During that period Billings received snowfall totaling just 0.1 inch, second only to a trace from December 21, 1954 - January 15, 1955. Above normal temperatures continued to prevail for the remainder of the month. Soil moisture shortages became more apparent as far north as South Dakota and Nebraska. Daily record high temperatures were again reported in Montana, South Dakota, and Nebraska, and monthly temperatures were much above normal. Snow cover was generally light across the majority of the basin near the end of the month.

Cooler weather returned in early February. Locally heavy snow blanketed Nebraska and nearby areas prior to the arrival of the bitterly cold weather. Cooler-than-normal conditions continued into mid-February, when record low temperatures were reported in many parts of the basin. Heavy snow developed in a narrow band, producing 16.8 inches in Lander, WY and 14.4 inches in Scottsbluff, NE. Light snow fell across the northern part of the basin in late February. Snow depth was generally less than 2 inches across most of the basin at the end of February.

Much-above-normal temperatures returned in early March, with little or no snowfall. In mid-March some snow boosted topsoil moisture in parts of South Dakota and Nebraska. Late winter storms generated a variety of conditions, including severe thunderstorms, heavy snow, and flooding. Daily record totals for March 12 included 8.3 inches of snow in Casper, WY and 7.9 inches in Rapid City, SD. Great Falls, MT netted a 2-day total of 11 inches of snow on March 18-19. In Nebraska, March 18-21 snowfall totals included 21.6 inches in Grand Island, 21.2 inches in Hastings, 17.5 inches in Norfolk, 16.7 inches in Kearney, and 15.3 inches in Valentine. Unofficial Nebraska totals reached 30 inches in Greeley County, 29 inches in Holt County, and 26 inches in Valley County. Grand Island set records for its greatest 1-day snowfall (17.8 inches on March 20; previously 13.0 inches on March 16, 1971) and 2-day total (20.7 inches on March 19-20; previously 15.1 inches on February 17-18, 1984). Records for the same two periods were also broken in Hastings (17.4 inches on March 20 and 20.3 inches on March 19-20, respectively), where former standards were 14.0 inches on March 18, 1984 and 17.4 inches on October 25-26, 1997. Elsewhere, Rapid City, SD netted 17.3 inches of snow from March 18-21, while Goodland, KS measured 13.5 inches on March 20. For Goodland it was the seventh-highest single-day total on record and greatest snowfall since October 25, 1997, when 19.3 inches fell. Plains snowfall was also very wet, resulting in daily-record precipitation total on March 20 in locations such as Goodland (1.73 inches) and Grand Island (1.61 inches). See ***Plate 3*** for a snow depth radar image of the event. By the end of March, only small areas of plains snow, with 4 inches or less of snow depth, remained in Montana and North Dakota.

In early April, mild mostly dry weather melted most of the snow cover on the northern and central plains. However, the occasional snowstorm brought additional snow. On April 6-7, blizzard conditions briefly engulfed parts of the High Plains and adjacent Black Hills, where 10.0 inches of snow fell in Custer, SD. By mid-month stormy weather gradually expanded and blizzard conditions developed in the Black Hills. From April 17-20, Lead, SD received 64.9 inches of snow, which was equivalent to 5.73 inches of precipitation. Lander, WY reported 11 inches during that same storm. Scattered storms continued into late April, with 6 inches of snow in Valentine, NE and 5.5 inches in Rapid City, SD on April 24. March-April precipitation totaled 8.84 inches (198% of normal) in Sioux Falls, second only to 9.89 inches in 1995. Great Falls and Helena, MT completed their wettest October-April periods since 1992-1993. Great Falls measured 8.4 inches (145 percent of normal), and Helena received 6.35 inches (157 percent of normal). By late April, most of the snow cover was melted by warmer-than-normal temperatures.

2. Mountain Snowpack

a. Fall 2005

In Montana, the snowfall season got off to a much better start than the previous year. December precipitation was near normal. Mountain snow water content was 99 percent of average and 140 percent of the previous year.

In Wyoming, snow water equivalent (SWE) across the state was generally above average. The SWE average for the state was 112 percent of normal. In December precipitation was above average across all of Wyoming.

The 2005 year ended with the mountain snowpack 99 percent of normal in the reach above Fort Peck and 91 percent of normal in the reach from Fort Peck to Garrison.

b. January 2006

January continued the warm weather pattern that began in December. Temperatures remained cool enough in the mountains to prevent premature melting of the snowpack. Mountain precipitation for January was generally above average. Normally about 60 percent of the seasonal snowpack is in place by the end of January. State-wide, mountain snowpack was 108 percent of average and 176 percent of the previous year.

In Wyoming SWE across the state was above average. The SWE in the northwestern portion of the state was about 108 percent of normal, and the northeastern portion was 81 percent of normal. The southeast and southwest areas were 122 and 121 percent of normal, respectively. January’s precipitation was quite varied across the state. Basin precipitation ranged from 62 percent of average to 149 percent of average in certain basins.

The month of January ended with the mountain snowpack 112 percent of normal in the reach above Fort Peck and 99 percent of normal in the reach from Fort Peck to Garrison.

c. February 2006

Mountain precipitation in Montana was 98 percent of average in February. Mountain precipitation in the Missouri River headwaters was 96 percent of normal, and the Yellowstone was 86 percent of normal. Montana mountain snowpack was 99 percent of average and 165 percent of the previous year.

In Wyoming SWE amounts across the state were slightly above average for February at 104 percent of normal. The SWE varied from 91 percent of normal in the northeastern portion of the state to 114 percent in southwestern Wyoming. December to February storms covered the mountains with snow, especially in the western and southern mountains. Year-to-date precipitation was above average for the year.

The month of February ended with the mountain snowpack 105 percent of normal in the reach above Fort Peck and 96 percent of normal in the reach from Fort Peck to Garrison.

d. March 2006

Mountain precipitation in Montana during March was generally below to well below average. Mountain snowpack decreased an average of 3 percent. Snowmelt occurred at lower elevations and warm-facing mountain exposures, but snowmelt was near average for that time of year. Snowpack was 101 percent of average and 190 percent of last year.

During March the SWE across Wyoming was near average at 101 percent of normal. It ranged from 85 percent of normal in northeastern Wyoming to 112 percent of normal in the southwestern portion of the state. Precipitation varied across all of Wyoming. The Wind River basin had the lowest precipitation for the month at 63 percent.

The month of March ended with the mountain snowpack 104 percent of normal in the reach above Fort Peck and 92 percent of normal in the reach from Fort Peck to Garrison.

e. April 2006

In Montana, mountain precipitation during April was 117 percent of normal. April temperatures were 3 to 5 degrees above average. Mountain snowpack was about average at the end of April.

The SWE across Wyoming dropped significantly during April, with water content about 81 percent of average. Across the state SWE ranged from 58 percent in the northeast portion of the state to 90 percent in the southwest part of Wyoming. April's precipitation was below average across most of Wyoming and down considerably from March.

The month of April ended with the mountain snowpack 93 percent of normal in the reach above Fort Peck and 75 percent of normal in the reach from Fort Peck to Garrison.

f. May 2006

In Montana, May was generally warm, with below to well below average precipitation. Mountain precipitation was only 58 percent of average. Remaining mountain snowpack was well below average near the end of the month but well above the previous year. Mid-May temperatures were well above average, which resulted in early rapid snowmelt.

The SWE across Wyoming dropped significantly during May. Snowfall during May was below average and temperatures were above normal across the state. The SWE across Wyoming was below average at 37 percent of normal. Precipitation was down across almost all of Wyoming. The Wind River had the lowest precipitation for the month, 29 percent of average.

As the month of May ended, the mountain snowpack was 27 percent of normal in the reach above Fort Peck and 32 percent of normal in the reach from Fort Peck to Garrison, representing an early melt of the snowpack as well as a below-normal snowpack .

g. Summary

Overall snow water content totals recorded during the entire snow season ending July 1, 2006 were near normal. The mountain snowpack in the reach above Fort Peck peaked on April 20 at 108 percent of the normal peak accumulation. The mountain snowpack in the reach between Fort Peck and Garrison peaked on April 3 at 88 percent of the normal peak accumulation. The normal date for snow accumulation to peak is April 15. The 2005-2006 mountain snow accumulation and melt for the reaches above Fort Peck and Fort Peck to Garrison are illustrated in ***Figure 1***.

3. Weather Conditions

The following weather summaries are from the USDA Weekly Weather and Crop Bulletins. ***Figure 2*** displays the drought magnitude and ***Figure 3*** displays percent of normal precipitation experienced by the basin at 3-month increments during the calendar year. In general, the year began with only moderate drought in the basin, but lack of precipitation throughout the spring and summer intensified the drought and expanded the areal extent.

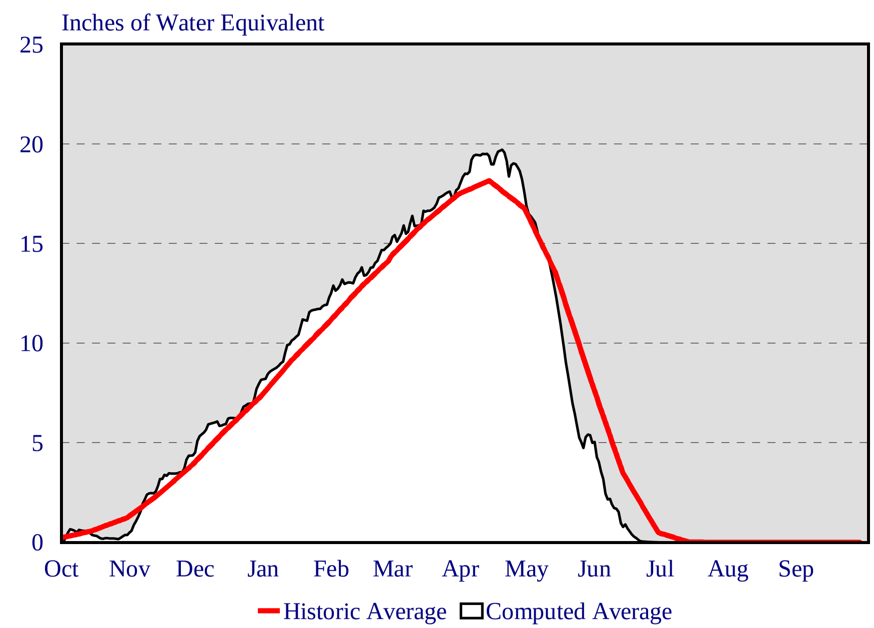
a. January 2006

The year began with temperatures 20°F above normal across portions of the northern Plains. On January 7 daily record highs were set in Scottsbluff, NE (67°F) and Denver, CO (69°F). On January 14 Valentine, NE came within 1°F of its monthly record high (72°F on January 12, 1987). On the same day daily records were set or tied at about three

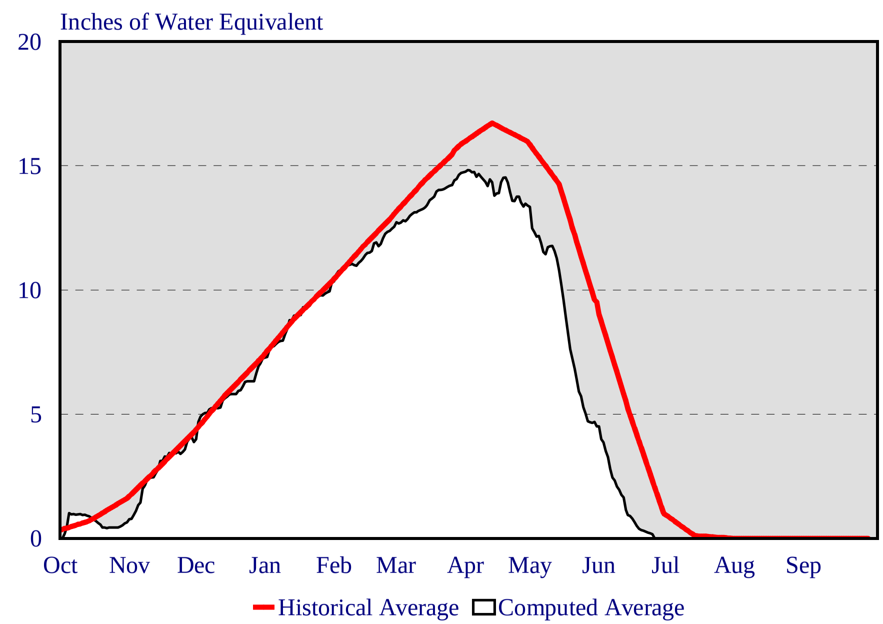
Figure 1

Missouri River Basin Mountain Snowpack Water Content 2005-2006

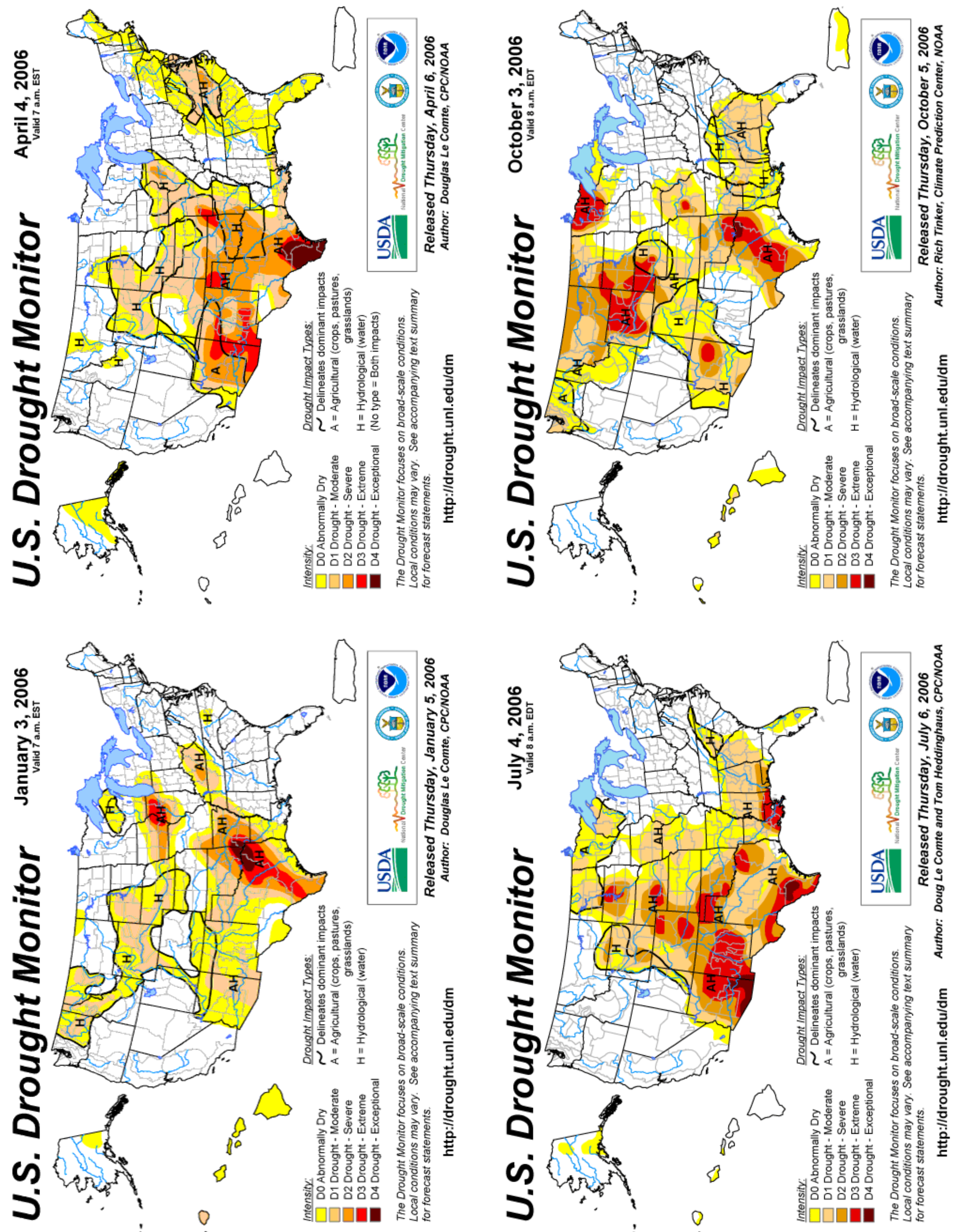
Total Above Fort Peck



Total Fort Peck to Garrison



The mountain snowpack in the reach above Fort Peck peaked at 108% of the normal peak accumulation on April 20. The mountain snowpack in the reach between Fort Peck and Garrison peaked at 88% of the normal peak accumulation on April 13. The Missouri River basin mountain snowpack normally peaks near April 15.



U.S. Drought Monitor
January 3, 2006
Valid 7 a.m. EST
Intensity:
D0 Abnormally Dry
D1 Drought - Moderate
D2 Drought - Severe
D3 Drought - Extreme
D4 Drought - Exceptional
Drought Impact Types:
Delineates dominant impacts
A = Agricultural (crops, pastures, grasslands)
H = Hydrological (water)
The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. See accompanying text summary for forecast statements.
http://drought.unl.edu/dm
USDA
Released Thursday, January 5, 2006
Author: Douglas Le Comte, CPC/NOAA
U.S. Drought Monitor
April 4, 2006
Valid 7 a.m. EST
Intensity:
D0 Abnormally Dry
D1 Drought - Moderate
D2 Drought - Severe
D3 Drought - Extreme
D4 Drought - Exceptional
Drought Impact Types:
Delineates dominant impacts
A = Agricultural (crops, pastures, grasslands)
H = Hydrological (water)
(No type = Both impacts)
The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. See accompanying text summary for forecast statements.
http://drought.unl.edu/dm
USDA
Released Thursday, April 6, 2006
Author: Douglas Le Comte, CPC/NOAA
U.S. Drought Monitor
July 4, 2006
Valid 8 a.m. EDT
Intensity:
D0 Abnormally Dry
D1 Drought - Moderate
D2 Drought - Severe
D3 Drought - Extreme
D4 Drought - Exceptional
Drought Impact Types:
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http://drought.unl.edu/dm
USDA
Released Thursday, July 6, 2006
Author: Doug Le Comte and Tom Heddinghaus, CPC/NOAA
U.S. Drought Monitor
October 3, 2006
Valid 8 a.m. EDT
Intensity:
D0 Abnormally Dry
D1 Drought - Moderate
D2 Drought - Severe
D3 Drought - Extreme
D4 Drought - Exceptional
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http://drought.unl.edu/dm
USDA
Released Thursday, October 5, 2006
Author: Rich Tinker, Climate Prediction Center, NOAA

Figure 2

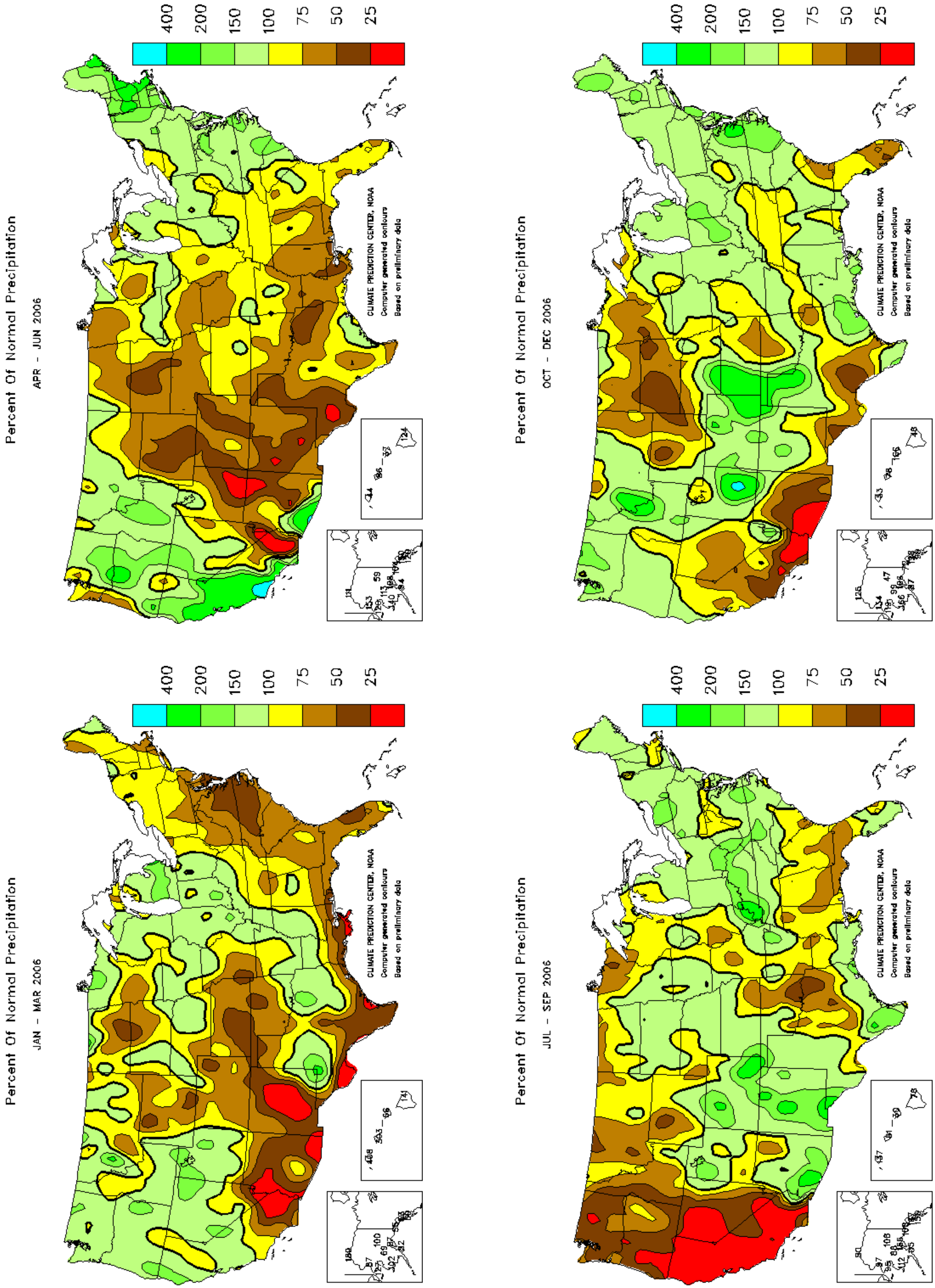

Percent Of Normal Precipitation
JAN - MAR 2006
Percent Of Normal Precipitation
APR - JUN 2006
Percent Of Normal Precipitation
JUL - SEP 2006
Percent Of Normal Precipitation
OCT - DEC 2006
400
200
150
100
75
50
25
CLIMATE PREDICTION CENTER, NOAA
Computer generated contours
Based on preliminary data

Figure 3

dozen locations from the Plains westward, including Rapid City, SD (69°F) and McCook, NE (70°F). The period from December 21 – January 15 was the warmest such period on record in Billings, MT, where the 26-day average temperature of 40.5°F supplanted its 1980-1981 standard of 37.0°F. On January 15 highs soared to 70°F as far north as Norfolk and Grand Island, NE. In Montana, Glasgow's daily average temperatures were at least 10°F above normal on 31 consecutive days from December 21 – January 20. Sioux City, IA recorded highs of 30°F or higher on 32 consecutive days (December 21 – January 21), eclipsing its 1931-1932 winter standard. The unusually warm weather continued through the month as Great Falls and Cut Bank, MT both recorded record high temperatures of 62°F on January 25. Rapid City, SD posted a daily-record high of 66°F on January 25. In doing so, Rapid City extended its streak to 40 days of above-normal daily average temperatures, behind only a 48-day warm spell in November – December 1939. Temperatures reached or exceeded 60°F on nine January days in North Platte, NE where the previous record of six days was achieved in 1906, 1935, and 2003. January average temperature records were established in many locations in the Plains. Monthly temperatures averaged more than 18°F above normal in some northern Plains locations, including Williston, ND (26.6°F, or 18.6°F above normal; previously 24.5°F in 1931) and Havre, MT (33.7°F, or 19.1°F above normal; previously 31.2°F in 1986).

b. February 2006

February began with significantly warmer-than-normal weather (as much as 10°F above normal), still affecting the northern Plains. In mid-February cold weather overspread much of the Nation, ending a 2-month spell of record-setting warmth. On February 17-18, temperatures plunged -30°F or lower in parts of Montana. Daily-record lows for February 17 included -33°F in Neihart, MT and -32°F in Casper, WY. Casper's low also set a monthly record, previously established with a low of -30°F on February 24, 2003. Record lows for February 18 were set in Denver, CO (-18°F), Wisdom, MT (-43°F) and Alliance, NE (-36°F). Very cold weather lingered in mid-February. Alliance, NE posted five consecutive daily-record lows (-30, -36, -16, -16, and -9°F) from February 17-21, including its fifth lowest temperature since 1890. In Alliance, NE a daily-record high of 75°F was recorded on February 28. On the same day a monthly-record high was set in Denver, CO (77°F). In Kansas, monthly record-tying temperatures on February 28 included 86°F in Hill City and 81°F in Goodland.

c. March 2006

The March 11-12 severe weather outbreak, which included well over 100 tornadoes, smashed the Nation's 2-day record for tornadoes in March (previous record was 68 tornadoes on March 19-20, 1970). In Missouri alone, the March 11-12 outbreak was responsible for nine deaths and approximately 42 tornadoes. In addition to the tornadoes, heavy snow resulted in daily-record total for March 12 in Casper, WY (8.3 inches) and Rapid City, SD (7.9 inches). On March 18, Great Falls, MT netted a daily-record snowfall of 4.2 inches en route to a 2-day total of 11.0 inches. Refer to the previous section "Plains Snowpack" in Section II.B.1 for detailed information regarding the March

18-21 snowstorm that raged across parts of the Plains. After the storm, cold weather set in. A daily record was set in Valentine, NE (-2°F) on March 24. More than two dozen tornadoes were spotted from the east-central Plains into the Midwest on March 30-31, boosting the preliminary monthly tally, which exceeded the cumulative March tornado count during the preceding 3 years. Daily-record rainfall total for March 30 included 1.20 inches in Miles City, MT. It was Miles City's second-highest total for any March day behind a 1.40-inch sum on March 24, 1942.

d. April 2006

In Montana, Butte narrowly missed its April daily rainfall record (1.09 inches on April 5; previously, 1.10 inches on April 22, 1899, and April 27, 1911), while Missoula reported its wettest day for any month (1.87 inches on April 6; previously, 1.83 inches on May 25, 1980). Sioux Falls, SD tallied consecutive daily records (1.60 and 1.79 inches on April 6 and 7, respectively). On April 6-7 blizzard conditions briefly engulfed parts of the High Plains and adjacent Black Hills, where 10.0 inches of snow fell in Custer, SD. See ***Plate 4*** for a radar image of the precipitation totals for the storm over western Nebraska and South Dakota. By mid-month a heat wave expanded across the Plains. Sioux City, IA collected a record high of 91°F on April 13, its fourth-earliest 90-degree reading behind March 30, 1968, April 4, 1929, and April 6, 1991. Farther south, Medicine Lodge, KS (100°F on April 13), recorded its earliest triple-digit heat by more than 2 weeks and tied its April record high (previously, 100°F on April 29, 1910). Helena, MT was among many sites in Montana reporting near-record precipitation totals for April. Helena's April 1-22 sum of 2.90 inches was just shy of its April 1975 standard of 3.00 inches. As stormy weather gradually expanded across the northern Plains and upper Midwest, blizzard conditions developed in the Black Hills. From April 17-20 Lead, SD received 64.9 inches of snow and 5.73 inches of liquid equivalent, but nearby Rapid City noted just 1.0 inch of snow and 0.72 inch of liquid. Elsewhere, storm-total snowfall reached 11.0 inches in Lander, WY and 30.0 inches in Ekalaka, MT. High winds accompanied the storm, with gusts reaching 60 m.p.h. or higher in locations such as North Platte, NE (60 m.p.h. on April 19), Meeker, CO (65 m.p.h. on April 17), and Rapid City, SD (69 m.p.h. on April 19). April 24 snowfall totaled 6.0 inches in Valentine, NE and 5.5 inches in Rapid City, SD. More than two dozen daily-record lows were reported across the Plains and Midwest on April 26. Records included Sidney, NE (20°F) and Tribune, KS (22°F).

e. May 2006

A daily-record low temperature was set on May 10 at Laramie, WY (16°F). Elsewhere in Wyoming, Rawlins (13 and 19°F) collected consecutive daily-record lows on May 10-11. The only lower May temperature in Rawlins occurred on May 9, 2002, when the low was 11°F. Below-normal temperatures lingered on the High Plains, where Sidney, NE, posted consecutive daily-record lows (30 and 31°F) on May 15-16. Just a few days later Medicine Lodge, KS (101°F on May 19) recorded a daily-record high. Denver, CO (91°F), posted a daily-record high for May 21, followed the next day by records in Nebraska locations such as Imperial (94°F) and North Platte (93°F). On May

27 daily-record highs were reached at Garden City, KS (101°F) and Broken Bow, NE 100°F). Elsewhere on May 27 in Nebraska, North Platte (99°F) tied its monthly record originally set on May 8, 1934, while McCook (103°F) fell 1°F short of its May standard.

f. June 2006

In western Nebraska, Sidney reported a daily-record high of 100°F on June 7, followed by a thunderstorm with wind gusts up to 61 m.p.h. Other records in Nebraska for June 7 included 103°F in Scottsbluff and 102°F in Alliance. Triple-digit daily records for June 9 reach 104°F in Hill City, SD, 102°F in Norfolk, NE, and 100°F in Sioux City, IA. On June 14, Denver, CO posted a daily-record high of 102°F and shattered a record for its earliest triple-digit heat (previously, 102°F on June 23, 1954). Other High Plains daily-record highs for June 14 include 108°F in Imperial, NE. Two days later thunderstorms erupted over the northern Plains to the mid-South, producing daily-record totals in locations such as Sioux City, IA (2.71 inches on June 16). In Nebraska, June 15-17 totals included 3.17 inches in North Platte and 3.05 inches in Grand Island. Unusually warm weather ended the month with a record high being recorded for June 28 at Havre, MT (100°F). Temperatures reached or exceeded 90°F on 19 June days in Denver, CO, edging its June 2002 record of 17 days. In addition, Denver completed its third-hottest, fifth-driest June on record and received precipitation totaling just 2.72 inches (34 percent of normal) during the first half of 2006.

g. July 2006

Local heavy showers in the High Plains led to a July 3 daily-record high at Cheyenne, WY (1.92 inches). This was Cheyenne's greatest calendar-day rainfall since a record-setting 6.06-inch deluge on August 1, 1985. It was also Cheyenne's third-wettest July day behind 3.65 inches on July 15, 1896 and 3.41 inches on July 19, 1973. In South Dakota the first half of 2006 was the driest on record in locations such as Mobridge (2.23 inches, or 25 percent of normal) and Timber Lake (3.61 inches, or 35 percent). Record lows for July 6 included 51°F in Norfolk, NE. Temperatures averaged at least 8°F above normal across the northern Plains during the second week of July. Records for July 12 included 105°F in Bismarck, ND and 98°F in Harlem, MT. From July 14-16, three consecutive daily-record highs were established in several locations, including Chadron, NE (104, 112, and 109°F). In portions of Nebraska and South Dakota, all-time-record highs were established on July 15. Chadron's high of 112°F eclipses an all-time record (110°F) that had survived since July 12, 1954. South Dakota highs included 117°F in Pierre (previously, 115°F on July 20, 1934, and July 23, 1940) and 116°F in Mobridge (previously, 116°F on July 16, 1936). All-time records were also broken on July 15 in South Dakota locations such as Cottonwood (117°F; previously 116°F on July 20, 1910), Philip (116°F; previously 113°F on August 26, 1970), and Rapid City (111°F; previously, 110°F on July 6, 1973, and July 8, 1989). A high temperature of 120°F was recorded near Usta (Perkins County), SD, on July 15, tying the State record set at Gann Valley (Buffalo County) on July 5, 1936. Meanwhile in North Dakota, Fargo's high of 101°F on July 15 represented its hottest day since July 5, 1989 (103°F) and its first triple-digit day since June 17, 1995 (100°F). Douglas, WY notched an all-time-record high of 105°F on July 18, followed the next day in Russell, KS with 111°F, the highest reading since July 14, 1980. In Nebraska, July 19 maximum of 109°F in Grand Island, 106°F in Kearney, and 108°F in Lincoln were the stations' highest readings since the summers of 1983, 1990, and 1995, respectively. In Montana, Glasgow's highs reached or exceeded 90°F on 14 days in a row from July 5-18, the longest such streak there since a record-setting 20-day hot spell from July 14 – August 2, 1936. On July 29, Casper, WY (104°F) tied its all-time record originally set on July 12, 1954 and tied just last year on July 16. On July 30, Mount Rushmore, SD posted an all-time record-tying high of 100°F, previously achieved on July 10 and 11, 1985, and three earlier dates. Elsewhere in South Dakota, highs again topped 110°F in locations such as Mobridge (112°F) and Pierre (111°F). Farther north Bismarck, ND (112°F on July 30) noted its highest reading since July 6, 1936, when an all-time-record high of 114°F occurred. Fargo, ND (102°F on July 30) experienced its highest temperatures since July 5, 1989, when it was 103°F. In Montana, Glasgow's streak of maximum temperatures of 85°F or higher ended at 30 days (July 1-30). It was Glasgow's second-longest such warm spell on record behind a 39-day streak from July 12 – August 9, 2003. During the 20-day period from July 12-31, more than 800 daily-record highs and at least 20 all-time-record highs were set or tied across the Lower 48 States. Many of the all-time records were set in South Dakota (July 15 and 28-30). The National Climatic Data Center reported that the contiguous United States experienced its second-hottest July on record. The Nation's July average temperature at 77.2°F (2.9°F above normal) ranked behind only a 77.5°F average in 1936.

h. August 2006

Warm weather continued into August. In Chadron, NE a daily-record, triple-digit high was observed (106°F on August 11). Sisseton, SD (2.77 inches on August 12), received more rain in 1 day than during the preceding 72 days. From June 1 – August 11, Sisseton's rainfall totaled 2.66 inches (36 percent of normal). On August 18, daily records were established in South Dakota locations such as Kennebec (1.20 inches) and Pierre (0.89 inch). Norfolk, NE set a record for its wettest August 1-18 period on record (6.08 inches; previously, 5.71 inches in 1923). Ironically, Norfolk recently completed its second-driest July on record (0.22 inch, or 6 percent of normal).

i. September 2006

The month began with chilly weather settling across the central Plains. In Nebraska, Alliance (31 and 32°F) notched consecutive daily-record lows on September 2 and 3. Similarly, Casper, WY reported daily-record lows from September 2-4 (33, 33, and 34°F, respectively). Scattered daily rainfall records across the central Plains included 1.76 inches (on September 9) in Kearney, NE and 1.89 inches (also on September 9) in Hill City, KS. In Missouri, Vichy-Rolla (4.37 inches on September 11) experienced its wettest September day (previously 3.48 inches on September 23, 1970). It was Vichy-Rolla's third-wettest day on record, behind 5.60 inches on November 11, 1972, and 4.57 inches on October 4, 1959. Billings, MT (1.83 inches of rain from September 15-17) experienced its 11th-wettest 3-day period on record in September. Billings also received more rain from September 15-17 than during the preceding 110 days. From May 28 – September 14, Billings' rainfall totaled just 1.53 inches (less than one-third of normal). Elsewhere in Montana, Glasgow followed its driest summer on record (1.73 inches, or 33 percent of normal; previously 1.90 inches in June-August 1930) with a 1.22-inch rainfall from September 15-17. Snow briefly fell on the Montana High Plains; Great Falls netted 1.54 inches of precipitation from September 14-16, along with a daily-record snowfall of 1.3 inches on the 16th. From September 15-17 in Montana, Glasgow's 1.22-inch total represented its highest 3-day sum since June 6-8, 2005, when 1.39 inches fell. On September 17 Grand Junction, CO (32°F) noted its second-earliest freeze on record behind a 32°F reading on September 15, 1903. Other lows included 25°F (on September 19) in Williston, ND and 26°F (on September 20) in Aberdeen, SD. Daily-record precipitation records for September 22 were set in Glasgow, MT (0.96 inch) and Rapid City, SD (0.87 inch). The month ended with chilly weather spreading across the Plains. Alliance, NE (22°F) posted a daily-record low for September 28.

j. October 2006

The first few days of October featured record-setting warmth across the Plains. Russell, KS opened October with a monthly record high of 97°F (previously, 96°F on October 5, 1956, October 8, 1991, and October 2, 1997), then attained 99°F on October 3. Other monthly record highs set or tied on October 3 included 98°F in Dodge City, KS (previously 96°F on October 14, 1968) and 94°F in St. Louis, MO (tied 94°F on October 2, 1953 and October 11, 1963). Kansas City, MO (94, 95, and 95°F from October 1-3) achieved high of 90°F or greater on 3 consecutive October days for the first time since 1963. Daily-record highs for October 7 included 88°F in both Kearney, NE and Aberdeen, SD. In Lewistown, MT, a daily rainfall record was set on October 7 (1.05 inches). Consecutive daily-record lows were established on October 12-13 in Montana locations such as Miles City (19 and 21°F) and Glasgow (17 and 18°F). In Nebraska, consecutive daily-record lows for October 13-14 were set in Chadron (20 and 16°F). In Wyoming, Cheyenne noted a daily-record snowfall of 4.3 inches on October 17, followed the next day by daily-record lows in locations such as Laramie (2°F) and Rawlins (3°F). Valentine, NE measured daily-record snowfall totals on 3 of 4 days from October 17-20, totaling 2.6 inches. Other snowfall records include 1.4 inches (on October 18) in Sioux Falls, SD. On October 30 Bozeman, MT received a daily-record snowfall of 6.0 inches. The last day of October featured daily-record lows at Aberdeen, SD (8°F) and Bozeman, MT (-6°F).

k. November 2006

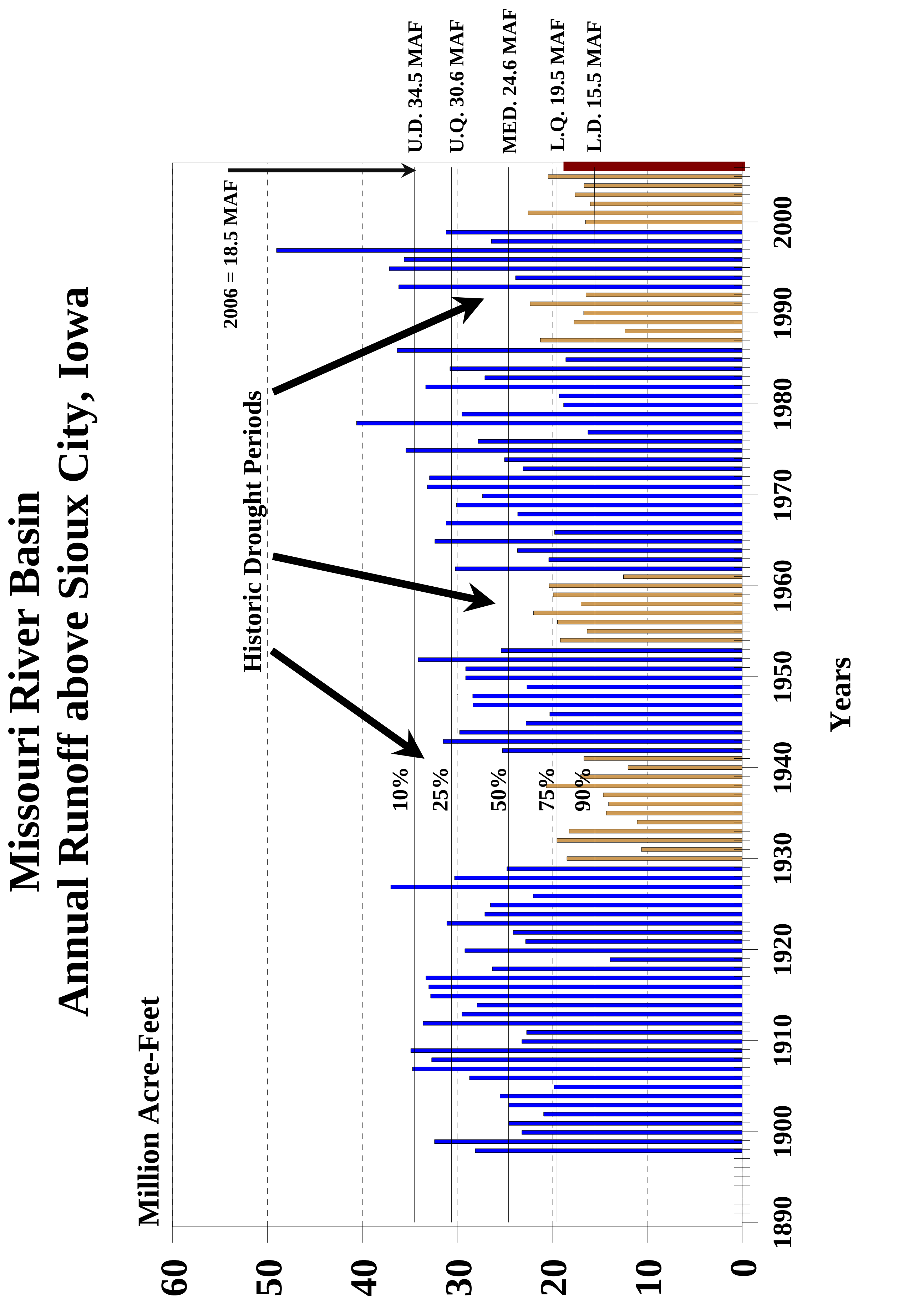
On November 1 record lows were set in Sioux City, IA (11°F) and Norfolk, NE (13°F). The second week of November saw temperatures rebound to above-normal levels across the Plains and upper Midwest. Daily-records were set on November 8 in Hays, KS (90°F), Sioux City, IA (82°F), and Denver, CO (80°F). Denver attained 80°F on a record-late date (previously, October 30, 1950). Meanwhile in western South Dakota, 8.2 inches of snow blanketed East Rapid City on November 9-10. Daily records were set on November 20 at Sheridan, WY (73°F) and Denver, CO (72°F). In Nebraska, consecutive daily-record highs were set on November 21-22 in Hastings (69 and 71°F) and Kearney (68°F both days). Highs topped 70°F as far north as South Dakota, where Kennebec (75°F on November 22) posted a daily record. Sioux City, IA (68°F) also posted a November 22 daily record. The month ended with a large snowstorm blanketing the eastern half of Missouri. Columbia, MO totaled 15.3 inches of snow from November 29 – December 1. The storm total in St. Louis, MO for that 3-day period consisted of 3.62 inches of precipitation, including ice accumulation and 4.2 inches of snow and sleet.

l. December 2006

The first few weeks of December were unusually warm in the Missouri River basin. On December 14, a daily-record high of 55°F was established in Miles City, MT. A week later blizzard conditions engulfed the central High Plains and adjacent Rockies (December 20-21). Heavy snow blanketed the central High Plains, while ice accumulations were particularly severe in central Nebraska. In southeastern Wyoming, Cheyenne (12.5 inches on December 20) experienced its snowiest December day during the 92-year period from 1915-2006, surpassing the 11.6-inch standard establish on December 27, 1979. Farther south 20.7 inches on snow buried Denver, CO in a 24-hour period on December 20-21, representing the city's greatest storm total since March 17-19, 2003, when 31.8 inches fell. It was also Denver's second-highest December storm total behind the 23.8 inches that mostly fell on December 24, 1982. In addition, northerly winds gusted to 55 m.p.h. in Denver and 54 m.p.h. in Cheyenne at the height of the storm on December 20. In Nebraska, North Platte noted its third-wettest December day (1.39 inches, including freezing rain and 2.6 inches of snow) on the 20th, behind 1.99 inches on December 21, 1877 and 1.41 inches on December 5, 1913. North Platte's December 19-21 storm-total precipitation reached 1.88 inches, including 8.1 inches of snow and as much as 0.5 inch of ice. Elsewhere in Nebraska, the 20th was the second-wettest December day on record in locations such as Kearney (1.16 inches, behind only 2.53 inches on December 2, 1933) and Broken bow (1.11 inches, behind only 2.14 inches on December 5, 1913). The majority of the Midwest received rain from the major storm. In eastern Nebraska, Omaha and Norfolk continue to await measurable snowfall and set records for the latest date of the season's first accumulation. Previous records were established in Omaha on December 23, 1939, and in Norfolk on December 22, 2001. On December 29, snowfall included 8.2 inches in North Platte, NE and 11.3 inches in Bismarck, ND. Denver experienced its third-snowiest December (29.4 inches, or 338 percent of normal) behind 57.4 inches in 1913 and 30.8 inches in 1973. Cheyenne, WY set a December snowfall record (24.4 inches), edging its 1913 standard of 21.4 inches.

4. 2006 Calendar Year Runoff

Runoff for the period January through December 2006 for the basin above Sioux City, Iowa, totaled 18.5 MAF, 74 percent of normal runoff based on the historical period of 1898-1998, as shown in ***Table 1***. The 18.5 MAF in 2006 represents a runoff slightly lower than the lower quartile (19.5 MAF) runoff as shown on ***Figure 4***. Monthly runoff during 2006 above Sioux City, IA varied from a low of 46 percent of normal in August to

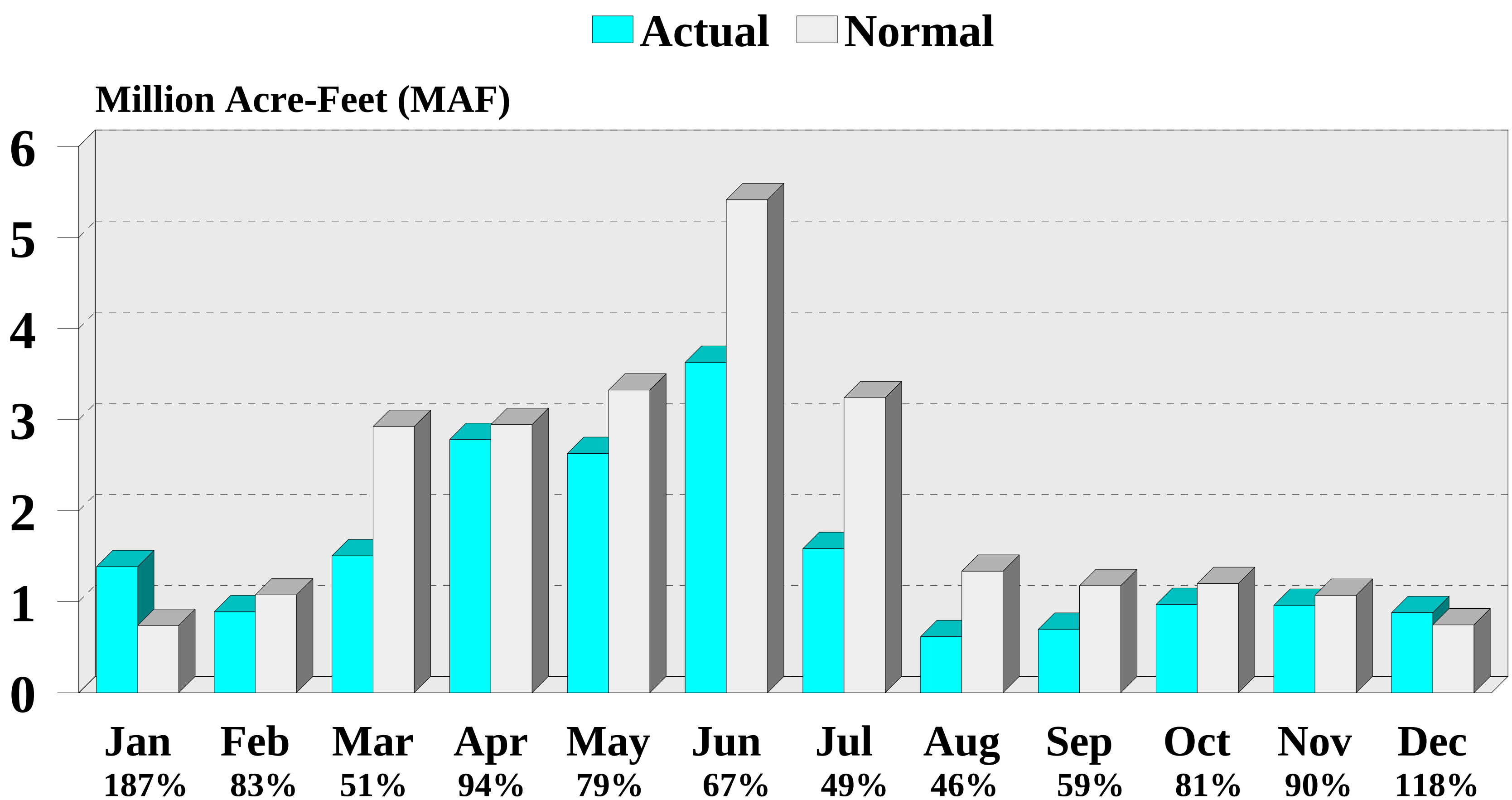


Missouri River Basin
Annual Runoff above Sioux City, Iowa
Million Acre-Feet
60
50
40
30
20
10
0
1890
1900
1910
1920
1930
1940
1950
1960
1970
1980
1990
2000
Years
U.D. 34.5 MAF
U.Q. 30.6 MAF
MED. 24.6 MAF
L.Q. 19.5 MAF
L.D. 15.5 MAF
10%
25%
50%
75%
90%
Historic Drought Periods
2006 = 18.5 MAF

Figure 4

Figure 5

Missouri River Basin
2006 Monthly Runoff above Sioux City, Iowa



2006 Runoff : 18.5 MAF - 74% of normal
Normal Runoff: 25.2 MAF

a high of 118 percent of normal in December. ***Figure 5*** indicates the monthly variation of runoff for CY 2006.

The observed monthly runoffs for 2006 from Fort Peck downstream to Sioux City, IA by major river reach are presented in ***Table 2***. The table lists the runoff by month and reach and is the basic compilation of the runoff into the System. This forecast forms a basis for intra-system balancing of storage accumulated in the System and is updated by the Reservoir Control Center (RCC) on the first of each month to forecast the runoff for the remainder of the year. The monthly accumulation of actual runoff is shown under the "Accumulated Summation above Sioux City" column. As the season progresses and the actual runoff is accumulated, the forecast becomes more reliable. The majority of the annual runoff has usually occurred by the end of July, and the remainder of the year can be estimated with a greater degree of accuracy.

C. System Regulation

1. System Regulation – January to December 2006

System storage on January 1, 2006 was 36.0 MAF, 0.8 MAF more than the System storage on January 1, 2005. Winter Gavins Point releases were continued at 12,000 cfs, the minimum releases providing adequate water supply downstream of the System. System storage increased slightly during January. February 1 System storage was 36.4 MAF. The System storage on March 1 was 36.4 MAF, which was 0.1 MAF below the minimum System storage level of 36.5 MAF needed to conduct the March pulse as per the terms of the Master Manual. Therefore, the March pulse was not conducted.

The plan for System releases to support 2006 navigation season during the T&E tern and plover nesting season was a steady release-flow-to-target (SR-FTT) plan, which is discussed in detail in the 2005-2006 AOP. Based on previous year's nesting season results, sufficient habitat was expected above the anticipated release rates to provide for successful nesting. An analysis of previous drought years indicated a System release of 30,000 cfs would provide at least minimum service at Kansas City 90 percent of the time.

Flow support for the 2006 navigation season began on March 23 at Sioux City, IA; March 25 at Omaha, NE; March 26 at Nebraska City, NE; March 28 at Kansas City, MO; and April 1 at the mouth of the Missouri River near St. Louis, MO. System releases on March 21 were 20,000 cfs in order to meet minimum service flow targets at the downstream target locations of Nebraska City (31,000 cfs) and Kansas City (35,000 cfs). As a water conservation measure, the flow targets at Sioux City (25,000 cfs) and Omaha (25,000 cfs) were not met in late March and early April since there was no barge traffic in those reaches.

On April 1 System storage was 36.9 MAF, 1.3 MAF more than the previous year's April 1 System storage (35.6 MAF). The May 1 System storage was 37.9 MAF, which was 1.4 MAF above the minimum System storage level of 36.5 MAF needed to conduct the initial May pulse. Therefore, the May pulse was conducted in 2006; however a

System storage level of at least 40.0 MAF will be required to initiate a pulse in future years. On May 1, the Corps announced that the planned pulse would be delayed until later in the month. Factors that were weighed in the decision on its timing included the water temperature below Gavins Point, current and forecasted downstream river flows, actual and forecasted precipitation and nesting activity of the protected terns and plovers. System releases were increased on May 13 for the May pulse. See Section II.D.2. of this report for a detailed description of the May pulse.

Plains snowmelt produced a March-April runoff of 4.3 MAF above Sioux City, which is 73% of normal. Runoff volumes above Sioux City for May, June, and July were 2.6, 3.6, and 1.6 MAF, respectively. Normal runoff for those months is 3.3, 5.4, and 3.2 MAF, respectively. Mountain snowpack was about normal; however, lack of rain during May and June resulted in the May-July runoff above Sioux City of only 7.8 MAF, 65% of normal.

System storage peaked on June 24, 2006 at 39.1 MAF; the peak for the previous year was 38.9 MAF. The end-of-July System storage was 37.7 MAF, 21.4 MAF less than 1967-2006 average (59.1 MAF). System storage began a steady decline through the late summer, then held nearly steady during the fall. End-of-month storages were: August, 36.2 MAF; September, 35.0 MAF; October, 34.7 MAF; November, 34.6 MAF; and December, 34.4 MAF. The end of December System storage was 1.6 MAF less than the previous year and 18.8 MAF less than 1967-2006 average. The end-of-year storage of 34.4 MAF was the lowest end-of-year System storage since the System filled in 1967; the previous low was 35.2 MAF in 2004. The lowest System storage during the calendar year occurred on December 12 at 34.1 MAF. As per the Master Manual, the July 1 water in storage check resulted in the navigation season being shortened by 44 days from the normal ending date of December 1 at St. Louis, MO.

2. Fort Peck Regulation – January to December 2006

a. General

Fort Peck, the third largest Corps storage reservoir, serves all authorized purposes. Fort Peck's primary functions are: (1) to capture the snowmelt runoff and localized rainfall runoff from the large drainage area above Fort Peck Dam, which are metered out at controlled release rates to meet the authorized purposes while reducing flood damages in the Fort Peck to Garrison reach; (2) to serve as a secondary storage location for water accumulated in the System from reduced System releases due to major downstream flood control regulation, thus helping to alleviate large pool increases in Garrison, Oahe, and Fort Randall; and (3) to provide the extra water needed to meet all authorized purposes that draft storage during low-water years.

Table 3 lists the average monthly inflows and releases in cfs and the end-of-month (EOM) pool elevation in ft msl for Fort Peck for 2005 and 2006 as well as the averages since the System first filled in 1967.

b. Winter Season 2006

The Fort Peck reservoir level began 2006 at elevation 2201.55 ft msl, 32.5 feet below the annual flood control zone and 2.7 feet above the elevation for this same date the previous year.

c. Winter River and Ice Conditions Below Fort Peck

No special release reductions were required to prevent ice-jam flooding. Ice jams were not a threat in 2006 due to the low flows downstream from Fort Peck. December, January, and February discharges were below average. Ice-cover formation on the Missouri River began on December 14-16, 2005 when the Missouri River stage rose over 5.7 feet in the Wolf Point, MT area. The stage at Wolf Point peaked near 8.3 feet on January 24, 2006, which is over 2.5 feet below flood stage and 1.18 feet higher than last year's peak. The Missouri River at Culbertson, MT rose quickly in early December, and, by December 13, 2005 it peaked for the winter at a stage of 7.74 feet. No reports of ice-affected flooding on the Missouri River below Fort Peck Dam were recorded during the 2006 winter season. The Fort Peck reservoir froze over on February 24, 2006 and was free of ice on April 6, 2006. The February 24, 2006 freeze date is the latest freeze date on record for Fort Peck. However, it should be noted that the reservoir did not freeze over in 1987 or 1992.

d. Spring Open Water Season 2006

The releases averaged 5,400 cfs in March, 6,500 cfs in April, 6,900 cfs in May, and 7,900 cfs in June. Although Garrison was given top priority in 2006 during the forage fish spawn, it was also possible to provide a rising pool at Fort Peck du to sufficient runoff. Therefore releases in May and June were scheduled to provide a rising reservoir level at Fort Peck during the fish spawn while still allowing for a rising pool at Garrison and meeting the minimum flow requirements for downstream irrigation. The reservoir elevation rose slowly and steadily from the end of March (2201.5 ft msl) until the end of June (2206.2 ft msl). The reservoir level at the beginning of the navigation season was 2.9 feet higher than the level at the start of the 2005 navigation season.

e. Summer Open Water Season 2006

Summer release rates, which are generally higher than spring releases due to the increased demand for hydropower, were about 8,000 cfs, well below average. The inflows during the summer months were below average. Therefore, the Fort Peck pool slowly declined from 2206.2 ft msl at the end of June to 2202.6 ft msl at the end of September.

f. Fall Open Water Season 2006

Releases were reduced from approximately 8,000 cfs to 5,500 cfs in mid-September, when irrigation ceased for the season. Releases were maintained near this minimum level during October and November and then increased to the winter release rate in December, when power demands increased.

g. Summary

The highest Fort Peck reservoir level during 2006 occurred on June 25 at 2206.3 ft msl. The lowest reservoir level during 2006, which was only 1.2 feet higher than the record low set in 2005, occurred on December 31 at 2199.4 ft msl. The previous record low before the current 7-year drought was 2208.7 ft msl in April 1991. The average annual inflow of 7,600 cfs during CY 2006 was 75% of normal (1967-2006). The average annual release of 7,300 cfs during CY 2006 was 78% of normal. In 2006, Fort Peck did not rise into the annual flood control and multiple use zone, which extends from 2234.0 to 2250.0 ft msl.

Table 3
Fort Peck – Inflows, Releases, and Elevations

Month	Ave Monthly Inflow (cfs)			Ave Monthly Release (cfs)			EOM Elevation (ft msl)		
	2006	2005	1967-2006	2006	2005	1967-2006	2006	2005	1967-2006
January	6,800	4,900	7,300	8,100	6,000	11,000	2201.0	2198.5*	2229.1
February	5,700	5,200	8,800	7,100	5,400	11,4000	2200.4	2198.3*	2228.4
March	8,500	5,400	12,100	5,400	4,500	8,200	2201.5	2198.6*	2229.5
April	11,400	5,300	10,500	6,500	5,200	7,600	2203.4	2198.6*	2230.2
May	11,100	8,300	15,300	6,900	5,400*	9,200	2204.9	2199.6*	2231.7
June	12,200	14,500	18,800	7,900	5,400*	10,000	2206.2	2203.0*	2234.0
July	5,900	7,900	12,300	8,200	6,600	10,300	2204.9	2203.2	2234.1
August	5,800	5,900	8,000	8,000	7,000	10,200	2203.6	2202.2	2233.0
September	6,000	6,400	7,900	6,800	5,600	9,000	2202.6	2202.0	2232.1
October	6,500	6,700	7,400	5,700	4,200	8,300	2202.5	2202.6	2231.5
November	5,500	6,700	7,200	7,200	4,600	8,700	2201.3	2202.9	2230.8
December	5,500	5,100	6,600	9,500	7,800	9,800	2199.4	2201.6	2229.6

* monthly minimum of record

3. Garrison Regulation – January to December 2006

a. General

Garrison, the largest Corps storage reservoir, is another key component in the regulation of the System. Its primary functions are (1) to capture the snowmelt runoff and localized rainfall runoff from the large drainage area between the Fort Peck and Garrison dams, which are metered out at controlled release rates to meet the authorized purposes, while reducing flood damages in the Garrison to Oahe reach, particularly the urban Bismarck area; (2) to serve as a secondary storage location for water accumulated in the System from reduced System releases due to major downstream flood control regulation, thus helping to alleviate large pool increases in Oahe and Fort Randall; and (3) to provide the extra water needed to meet all authorized purposes that draft storage during low-water years.

Table 4 lists the average monthly inflows and releases in cfs and the EOM pool elevation in ft msl for Garrison for 2005 and 2006 as well as the averages since the System filled in 1967.

b. Winter Season 2006

Releases from Garrison were below normal for a sixth consecutive winter season. Garrison began 2006 at 1812.0 ft msl, two feet higher than the previous year's record low elevation of 1810.0 ft msl. The 1812.0 ft msl elevation is 25.5 feet below the base of the annual flood control and multiple use zone. The reservoir declined throughout the winter season to an elevation of 1810.6 ft msl on February 28. This elevation is nearly 27 feet below the base of the annual flood control and multiple use zone of 1837.5 ft msl.

c. Winter River and Ice Conditions Below Garrison

The Missouri River in the Bismarck, ND area rose over 3 feet on December 6-7, 2005 during river ice cover formation. The ice-cover conditions were cyclic from mid-December through February with periods of open water flows and ice free conditions. These open water flows occurred during those periods of much above normal temperatures in December, January, and February. Garrison releases were adjusted to meet the downstream channel conditions during melt and ice formation periods. The peak ice-affected Missouri River stage at Bismarck was 10.37 feet on December 10, 2005. This was well below the Bismarck flood stage of 16 feet and the Corps' winter freeze-in stage target of 13 feet. Garrison reservoir froze over on December 20, 2005 and was free of ice on April 12, 2006.

d. Spring Open Water Season 2006

Starting in mid-April Garrison releases were made in order to maintain a steady to increasing Garrison pool level to promote the forage fish spawn in the Garrison reservoir. The reservoir level at the beginning of the navigation season (March 31) was 1810.7 ft msl, 2.0 feet higher than the level at the start of the 2005 navigation season. The Garrison pool level rose steadily through April, from 1810.7 to 1812.5 ft msl.

e. Summer Open Water Season 2006

During May and June the Garrison reservoir pool level rose almost 5 feet from 1812.5 (May 1) to its peak of 1817.4 ft msl (June 30). The peak pool was 0.3 feet lower than the 2005 peak. The pool level fell during the months of July and August as inflows decreased and releases were increased to meet downstream needs. A daily peaking pattern was established at Garrison during the nesting season to protect terns and plovers nesting below the project. See Section II.F.3. of this report regarding modifications made to the intake structure to assist with coldwater fishery habitat in the Garrison reservoir.

f. Fall Open Water Season 2006

Releases in October and November were maintained in the 11,000 - 13,000 cfs range, followed by slightly higher December releases to provide hydropower during winter demand increases.

g. Lake Audubon / Snake Creek Embankment

At the end of October 2006, Geotechnical Branch reviewed data from piezometers that were installed in September 2006 below the Snake Creek embankment. Evaluation of this new data indicated a strong likelihood that relief wells below the embankment were not functioning as designed. As a result, Geotechnical Branch identified strong concerns regarding the increasing head differential between Garrison Reservoir and Lake Audubon. The concerns centered on the potential adverse foundation underseepage conditions that could develop under high pool level differences between Lake Audubon and Garrison Reservoir, which could threaten the embankment. Geotechnical Branch recommended that a maximum difference in elevations between Lake Audubon and Garrison Reservoir of 36.5 feet to reduce the potential for adverse conditions developing at the Snake Creek embankment.

Following this recommendation Omaha District Water Control Section held a series of agency and public meetings in North Dakota in November to determine the best course of action. Due to forecasted declining pool elevations through the winter months at Garrison Reservoir, the Corps decided that Lake Audubon needed to be lowered by 2 feet prior to winter freeze up.

Verbal approval to deviate from the approved water control plan was obtained from the RCC office and the drawdown was initiated on November 16. A release of approximately 1000 cfs was made for 16 days and terminated on December 1, lowering the pool elevation from 1845 to 1843 ft msl. This resulted in a pool differential between Lake Audubon and Garrison Reservoir of 34 feet. The drawdown was made to 34 feet because the RCC had forecasted that the Garrison reservoir pool to drop an additional 2 feet between December and March. It was determined that the pool differential would be sufficient to remain below the critical pool differential of 36.5 feet.

g. Summary

Buford-Trenton pumping costs totaled $14,562.19 for 2006. The highest Garrison reservoir level during 2006 occurred on June 30th at 1817.4 ft msl. The lowest reservoir level during 2006, which was 2 feet higher than the record low set in May 2005, occurred on December 28th at 1807.8 ft msl. The previous record low before the current drought was 1815.0 ft msl in May 1991. The average annual inflow of 16,100 cfs during calendar year 2006 was 71% of normal (1967-2006). The average annual release of 16,500 cfs during calendar year 2006 was 76% of normal (1967-2006). In 2006, Garrison did not rise into the annual flood control zone, which extends from 1837.5 to 1850.0 ft msl.

Table 4
Garrison – Inflows, Releases, and Elevations

Month	Ave Monthly Inflow (cfs)			Ave Monthly Release (cfs)			EOM Elevation(ft msl)		
	2006	2005	1967-2006	2006	2005	1967-2006	2006	2005	1967-2006
January	15,500	9,700	15,500	17,800	15,400	23,200	1811.4	1808.4*	1832.6
February	12,300	12,400	19,100	15,500	13,000*	24,400	1810.6	1808.2*	1831.8
March	15,400	13,900	27,500	14,500	12,100	19,700	1810.7	1808.7*	1833.3
April	20,300	10,200*	22,800	13,800	17,400	19,300	1812.5	1806.6*	1833.8
May	24,400	24,600	28,400	15,300	16,500	21,400	1814.7	1808.8*	1835.1
June	31,000	38,400	45,600	19,800	15,000	23,300	1817.4	1814.9*	1839.0
July	13,900	25,200	32,400	20,600	15,200	24,700	1815.5*	1817.2	1840.1
August	10,700	11,200	18,300	22,000	15,500	24,500	1812.1*	1815.8	1838.4
September	11,200	10,200	16,700	18,100	14,100	20,900	1809.5*	1814.1	1837.2
October	12,800	14,000	17,500	12,100	12,600	19,300	1809.6*	1814.0	1836.5
November	13,600	12,900	16,100	13,100	13,400	20,200	1808.9*	1813.5	1835.4
December	12,100	11,000	14,000	15,300	15,400	20,500	1807.8*	1812.0	1833.8

* monthly minimum of record

4. Oahe and Big Bend Regulation – January to December 2006

a. General

Oahe, the second largest Corps storage reservoir, serves all authorized purposes. Oahe's primary functions are (1) to capture snowmelt and localized rainfall runoff from the large drainage area between the Garrison and Oahe dams, which are metered out at controlled release rates to meet the authorized purposes, while reducing flood damages in the Oahe to Big Bend reach, especially in the urban Pierre and Fort Pierre areas; (2) to serve as a primary storage location for water accumulated in the System from reduced System releases due to major downstream flood control regulation, thus helping to alleviate large reservoir level increases in Big Bend, Fort Randall and Gavins Point; and (3) to provide the extra water needed to meet all authorized purposes that draft storage during low-water years, particularly downstream water supply and navigation. In addition, hourly and daily releases from Big Bend and Oahe fluctuate widely to meet varying power loads. Over the long term, their release rates are geared to back up navigation releases from Fort Randall and Gavins Point in addition to providing storage space to permit a smooth transition in the scheduled annual fall drawdown of Fort Randall. Big Bend, with less than 2 MAF of storage, is primarily used for hydropower production, so releases from Oahe are generally passed directly through Big Bend.

Table 5 lists the average monthly inflows and releases in cfs and the EOM pool elevations in ft msl for Oahe for 2005 and 2006 as well as the averages since the System first filled in 1967.

A settlement agreement was approved in an order of dismissal by the United States District Court, District of South Dakota on August 8, 2003, in the case of Lower Brule Sioux Tribe et al. v. Rumsfeld, et al. (Civil No. 02-3014 (D.S.D.)). The agreement provides that the Corps will consult with the Lower Brule Tribe and the Crow Creek Sioux Tribe during any review and revision of the Missouri River Master Water Control Manual. This agreement also provides that the Corps will coordinate the regulation of Big Bend and the water level of Lake Sharpe with the two Tribes to include the following: the Corps will normally strive to maintain an reservoir level at Lake Sharpe between elevation 1419 ft msl and 1421.5 ft msl; when the level of Lake Sharpe drops below elevation 1419 ft msl or exceeds elevation 1421.5 ft msl, the Chief of the Water Management Division will provide notice to such persons as the Tribes shall designate in writing. When it is anticipated that the water level will drop below 1418 ft msl or rise above 1422 ft msl, or, in the event the water level falls below 1418 ft msl or rises above 1422 ft msl, the Commander, Northwestern Division, or his designee, shall immediately contact the Chairpersons of the Tribes or their designees to notify them of the situation and discuss proposed actions to remedy the situation. During 2006, the Big Bend reservoir level varied in the narrow range between elevations 1419.8 to 1421.0 ft msl. As per the settlement agreement no additional coordination was necessary.

Table 6 lists the average monthly inflows and releases in cfs and the EOM pool elevations in ft msl for Big Bend for 2005 and 2006 as well as the averages since the System first filled in 1967.

b. Winter Season 2006

Flooding in the Pierre-Fort Pierre area, especially at street intersections in the Stoeser Addition, has been a recurring problem since 1979. High Oahe releases, coupled with the formation of river ice cover in the LaFrambois Island area, have historically caused water to back up into a storm sewer outlet flooding street intersections. The city of Pierre installed a valve on the Stoeser Addition storm sewer in the fall of 1998 to prevent winter flooding; however, Oahe releases will continue to be constrained at times to prevent flooding at other locations. No flooding problems were experienced in this area during the winter of 2006. There were no ice events during this winter season in the Pierre – Fort Pierre area on the Missouri River. The Oahe Project staff performs inspections during cold weather periods for the length and location of the head of ice cover should it form on the Missouri River. The Oahe reservoir did not freeze over during the winter.

Big Bend was regulated in the winter season to follow power peaking requirements with hourly releases varying widely. The daily average flow varied between 0 and 35,200 cfs. The Big Bend reservoir froze over on December 22, 2005 and was free of ice on March 13, 2006.

c. Spring Open Water Season 2006

Releases from Oahe are generally set lower during weekends than on weekdays. The normal regulation is to maintain Oahe releases above 3,000 cfs during weekend daylight hours beginning in early April. This minimum release is scheduled to enhance downstream fishing and boating use during the recreation season. During the spring of 2006, no minimum release rate criteria were established for Oahe. Due to the ongoing drought conditions and ensuing low reservoir levels, making large releases during shorter periods of the day rather than a constant lower release maximized power-producing revenues.

In 2006 Garrison was given priority during the forage fish spawn in April and May. While Oahe's releases were adjusted to back up System releases for downstream flow support, the Oahe pool level remained fairly level during April and May due to the incremental runoff between Garrison and Oahe. The Oahe pool level on March 31 was 1576.7 ft msl, 2.3 feet higher than the previous year. The pool level rose slightly through April and May, reaching a peak of 1577.8 ft msl on May 17th.

d. Summer Open Water Season 2006

The Oahe reservoir pool levels steadily declined through June, July, and August. The June elevation was 1576.7 ft msl and the August 31 elevation was 1570.3 ft msl. The August end-of-month pool level was nearly 3 feet lower than the previous year and 32 feet below the 1967-2006 average of 1602.3 ft msl. The annual minimum pool elevation of 1570.2 ft msl occurred on August 30. This is a new record low, almost 2 feet lower than the previous low set in 2004.

e. Fall Open Water Season 2006

The Oahe reservoir elevation rose slightly through September and October and then remained relatively stable through November and December. Releases were reduced in September to initiate the annual fall drawdown of the Fort Randall reservoir prior to the close of the navigation season. Low releases were maintained in October and November to facilitate the Fort Randall drawdown. Higher releases were scheduled in December for winter energy production.

f. Summary

The highest Oahe reservoir level during CY 2006 occurred on February 16 at 1577.9 ft msl. The lowest reservoir level during the 2006 calendar year, which was a new record low, occurred on August 30 at 1570.2 ft msl. The previous record low before the current 7-year drought was 1580.7 ft msl in November 1989. The average annual inflow to Oahe of 17,100 cfs was 68% of average (1967-2006). The average annual release from Oahe (16,800 cfs) was 69% of average (1967-2006). In 2006, Oahe did not rise into its annual flood control zone, which extends from 1607.5 to 1617.0 ft msl. Big Bend ended the year at 1420.8 ft msl, within the normal regulating range.

Table 5
Oahe – Inflows, Releases, and Elevations

Month	Ave Monthly Inflow (cfs)			Ave Monthly Release (cfs)			EOM Elevation (ft msl)		
	2006	2005	1967-2006	2006	2005	1967-2006	2006	2005	1967-2006
January	18,600	15,500	23,700	13,700	17,000	21,300	1576.8	1575.2*	1599.5
February	15,800	14,900	27,900	12,400	10,900*	18,500	1577.6	1576.2*	1601.3
March	16,200	13,700*	31,200	18,900	19,200	19,000	1576.7	1574.4*	1603.7
April	15,600	17,800	26,800	13,300	16,900	21,600	1577.4	1574.7*	1604.5
May	15,800	19,600	28,000	16,200	12,900	22,500	1577.0	1576.5*	1605.3
June	19,100	19,900	28,400	21,900	15,400	25,800	1575.8*	1577.6	1605.2
July	19,900	16,100*	27,300	27,200	19,500	29,.900	1573.4*	1576.4	1604.3
August	21,800	15,800	25,800	29,500	23,500	33,000	1570.3*	1573.1	1602.3
September	20,600	15,600	22,400	15,300	14,900	29,500	1571.4*	1572.9	1600.5
October	12,500	13,200	20,600	7,300	7,800	24,300	1572.6*	1573.9	1599.3
November	13,800	14,100	21,500	10,400	7,400	23,200	1573.2*	1575.6	1598.7
December	15,200	14,800	20,800	15,400	14,700	21,300	1572.8*	1575.3	1598.3

* monthly minimum of record

Table 6
Big Bend – Inflows, Releases, and Elevations

Month	Ave Monthly Inflow (cfs)			Ave Monthly Release (cfs)			EOM Elevation (ft msl)		
	2006	2005	1967-2006	2006	2005	1967-2006	2006	2005	1967-2006
January	12,800	16,000	21,100	12,600	15,500	21,000	1420.8	1420.8	1420.5
February	11,500	10,400*	18,600	11,900	10,900*	18,700	1420.3	1420.2	1420.4
March	18,100	17,900	19,700	18,000	17,900	19,600	1420.3	1420.0	1420.3
April	12,700	16,200	22,100	12,100	15,400	21,700	1420.7	1420.6	1420.5
May	15,000	13,000	22,900	15,000	12,800	22,800	1420.4	1420.6	1420.4
June	20,400	14,900	26,100	20,500	15,100	25,800	1419.9	1420.0	1420.3
July	24,600	17,400	29,400	23,700	15,900	28,900	1420.6	1421.1	1420.3
August	27,600	21,500	32,500	27,500	21,700	32,000	1420.0	1420.5	1420.2
September	14,300	13,900	29,300	13,500	13,400	28,800	1420.3	1420.4	1420.3
October	6,800	7,200	24,200	6,200	6,300	23,700	1420.7	1421.0	1420.5
November	9,600	7,100	24,800	9,800	7,200	23,000	1420.3	1420.5	1420.4
December	14,400	13,700	21,200	13,800	13,800	21,000	1420.8	1420.5	1420.5

* monthly minimum of record

5. Fort Randall Regulation – January to December 2006

a. General

Fort Randall, the fourth largest Corps reservoir, serves all authorized purposes. Fort Randall's primary functions are: (1) to capture snow and localized rainfall runoffs in the drainage area between the Big Bend and Fort Randall dams, which are metered out at controlled release rates to meet the authorized purposes while reducing flood damages in the Fort Randall reach, where several areas have homes and cabins in close proximity to the river; (2) to serve as a primary storage location along with the upstream projects for water accumulated in the System when System releases are reduced due to major downstream flood control regulation, thus helping to alleviate large pool increases in the very small Gavins Point Project; (3) to provide a location to store the water necessary to provide increased winter hydropower energy by allowing an annual fall drawdown of the reservoir to occur with a winter reservoir refilling that is unique to Fort Randall; and (4) to provide the extra water needed to meet all authorized purposes, particularly navigation and downstream water supply, that draft storage during low water years.

Table 7 lists the Fort Randall average monthly inflows and releases in cfs and the EOM pool elevation in ft msl for 2005 and 2006 as well as the averages since the System was first filled in 1967.

b. Winter Season 2006

The Fort Randall winter release ranged from 6,700 to 15,800 cfs. The Lake Francis Case pool reached a low of 1337.78 ft msl on December 7, 2005, the lowest for CY 2005. Lake Francis Case froze over on February 18, 2006 and was ice free on March 5, 2006.

c. Spring Open Water Season 2006

The March releases were maintained at reduced levels as Gavins Point releases were also maintained on the 9,000 cfs open water release rate prior to the start of the navigation season. Releases were adjusted as needed to back up System releases from Gavins Point and to maintain the Gavins Point pool in the desired range.

d. Summer Open Water Season 2006

A daily peaking pattern was established at Fort Randall during the nesting season to provide flexibility to regulate over a range of releases while minimizing impact to birds nesting below the project.

e. Fall Open Water Season 2006

Due to the 44-day shortening of the navigation season, the annual fall drawdown of Fort Randall was begun September 2. The 44-day shortened navigation season resulted in earlier than normal reduced flows in October 2006. The System release was lowered to 10,000 cfs by October 13.

f. Summary

The highest Fort Randall reservoir level during CY 2006 occurred on May 1 at 1358.3 ft msl. The lowest reservoir level during CY 2006 occurred on November 7 at 1336.9 ft msl. The average annual inflow to Fort Randall of 17,000 cfs was 67% of average (1967-2006). The average annual release from Fort Randall of 16,600 cfs was 66% of average (1967-2006). In 2006, Fort Randall rose into its annual flood control zone, which extends from 1350.0 to 1365.0 ft msl. However, the normal summer regulating pool level at Fort Randall is 1355.0 ft msl. Normal regulation of Fort Randall includes the lowering of the pool level at the end of the navigation season to 1337.5 ft msl, 17 feet below the top of the flood control zone, to make room for winter generation releases from the upper reservoirs. The CY 2006 navigation season was shortened by 44 days, as per the current Master Manual.

Table 7
Fort Randall – Inflows, Releases, and Elevations

Month	Ave Monthly Inflow (cfs)			Ave Monthly Release (cfs)			EOM Elevation (ft msl)		
	2006	2005	1967-2006	2006	2005	1967-2006	2006	2005	1967-2006
January	15,100	17,200	22,400	8,500*	12,300	15,400	1347.8	1346.3	1347.4
February	12,900	12,500*	20,300	11,700	6,200	13,600	1348.5	1350.9	1352.1
March	20,200	19,300	22,200	11,600	13,300	16,400	1355.0	1355.4	1356.2
April	14,800	18,800	24,400	11,400	16,100	22,100	1357.3	1357.0	1357.6
May	16,100	15,800	25,600	17,300	18,800	25,800	1356.2	1354.6	1357.3
June	22,100	19,900	28,400	23,500	16,500	27,800	1355.1	1356.8	1357.4
July	25,100	17,300	30,300	26,000	20,800	31,300	1354.1	1353.8	1356.4
August	30,200	23,100	33,300	29,500	23,100	34,000	1354.0	1353.6	1355.4
September	14,900	14,500	29,700	26,300	24,200	34,300	1344.5	1345.0	1351.3
October	5,900	6,900	23,600	12,400	10,400*	32,800	1337.5	1341.2	1343.1
November	10,500	7,100	22,800	9,900	9,300	29,500	1337.8	1338.7	1336.4
December	16,700	15,600	22,200	10,600	12,400	17,400	1343.8	1341.9	1341.1

* monthly minimum of record

6. Gavins Point Regulation – January to December 2006

a. General

Gavins Point, the most downstream of the System projects, is primarily used for flow re-regulating to smooth out the release fluctuations of the upper projects to better serve downstream purposes. With a total storage of only 500,000 acre-feet, it provides only a small amount of flood control and is generally maintained in a narrow reservoir elevation band between 1205.0 and 1208.0 ft msl. Due to the limited storage, releases from Gavins Point must be backed up with releases out of the upper reservoirs. Gavins Point is the key location in the initiation of release reductions for downstream flood control. Even though it has only a small amount of storage space for flood control, this volume is usually adequate to perform significant downstream flood control by coordinating Gavins Point release reductions with the upstream projects. Releases greater than the powerplant capacity, near 35,000 cfs, are passed through the spillway.

Table 8 lists the Gavins Point average monthly inflows and releases in cfs and the EOM pool elevation in ft msl for 2005 and 2006 as well as the averages since the System was filled in 1967.

b. Winter Season 2006

The Gavins Point average daily release was below the normal winter release rate for the entire winter season. The average January inflow of 11,000 cfs and the average January release of 11,400 cfs were record minimums.

c. Winter River and Ice Conditions Below Gavins Point

The Gavins Point winter release rate was varied between 11,000 cfs and 12,000 cfs in January and between 10,000 cfs and 15,000 cfs in February. The first 2006 ice reports were made on February 7; the reports indicated 1 to 10 percent floating ice with pans ranging from 0 to 3 feet in the Missouri River at Sioux City, IA reach. Another round of sub-zero temperatures from February 13-21 produced the largest volumes and the greatest extent of floating ice reported for the winter season. The reports showed from 10 to 70 percent floating ice with pads ranging from 3 to 5 feet in the Sioux City to Nebraska City reach of the Missouri River. The floating ice diminished over the next couple days and by February 22 less than 1 percent was reported on the Missouri River between Sioux City, IA and Omaha, NE. This was the last report of floating ice made on the Missouri River below Sioux City, IA. No ice bridging was noted this season.

d. Spring Summer Open Water Season 2006

Flow support for the 2006 navigation season began on the normal dates: March 23 at Sioux City, March 25 at Omaha, March 26 at Nebraska City, March 28 at Kansas City and April 1 at the mouth near St. Louis. The decision was made, for water conservation purposes, not to provide flow for support for commercial navigation at Sioux City and Omaha in April since there was no barge traffic in those reaches. System releases were increased up to 21,000 cfs at the start of the navigation season. System releases were lowered to as low as 13,000 cfs in early April due to high incremental runoff downstream of Gavins Point.

e. Summer Open Water Season 2006

The System releases were increased in early May to 25,000 cfs for the May pulse. Further discussion of the May pulse can be found in Section h. System releases were maintained at about 25,000 cfs throughout May, June, and the first half of July to meet the downstream minimum navigation targets of 25,000 cfs, 31,000 cfs and 35,000 cfs at Omaha, Nebraska City and Kansas City, respectively.

f. Fall Open Water Season 2006

System releases were maintained in the 28,000 - 30,000 cfs range for the second half of July until the end of the navigation season in early October to meet the downstream minimum navigation targets. Releases to support navigation stopped on October 8, 2006, resulting in a 44-day shortening of the navigation season. In 2005 and 2004 the navigation season was shortened by 48 and 47 days, respectively.

g. Summary

The highest Gavins Point reservoir level during CY 2006 occurred on October 11 at 1208.2 ft msl. The lowest reservoir level during CY 2006 occurred on February 20 at 1204.9 ft msl. The average annual inflow to Gavins Point of 18,400 cfs was 66% of average. The average annual release from Gavins Point of 18,200 cfs was 66% of average.

Table 8
Gavins Point – Inflows, Releases, and Elevations

Month	Ave Monthly Inflow (cfs)			Ave Monthly Release (cfs)			EOM Elevation (ft msl)		
	2006	2005	1967-2006	2006	2005	1967-2006	2006	2005	1967-2006
January	11,000*	13,900	17,500	11,400*	13,700	17,400	1207.3	1207.8	1207.6
February	13,200	9,100*	16,800	13,400	9,900*	17,700	1206.9	1206.2	1205.6
March	13,700	15,000	20,400	14,000	14,800	20,300	1206.2	1206.6	1205.5
April	15,200	19,000	26,100	14,300	19,200	25,900	1208.1	1206.0	1205.7
May	18,500	21,300	29,600	19,200	21,200	29,300	1206.1	1205.9	1205.9
June	24,900	22,000	31,000	24,400	21,600	30,700	1206.7	1206.3	1206.2
July	26,100	21,900	33,500	26,500	21,500	33,000	1205.1	1206.7	1206.8
August	30,800	24,000	35,700	29,500	23,400	35,300	1207.5	1207.4	1207.4
September	27,900	25,800	36,400	27,600	25,400	36,100	1207.5	1207.6	1207.7
October	14,800	12,500*	35,100	14,600	12,300*	34,900	1207.6	1207.6	1207.8
November	11,300	11,000	31,800	11,400	11,000	31,800	1207.1	1207.3	1207.6
December	13,100	14,800	19,600	12,600	14,300	19,600	1207.9	1208.2	1207.4

* monthly minimum of record

h. 2006 Gavins Point Spring Pulse

The 2003 Amended Biological Opinion recommended the implementation of a Gavins Point spring pulse for the benefit of the endangered pallid sturgeon by 2006. Working with the USFWS, Tribes, states, and basin stakeholders, the Corps developed technical criteria for the bimodal spring pulses, and in March 2006 the Master Manual was revised to include spring pulse criteria. The criteria called for a bimodal spring pulse with a small initial pulse in March, coinciding with the start of the navigation season, and a larger pulse in early to mid-May, with the start date dependent on water temperature, potential incidental take of the ESA protected terns and plovers, and downstream flow conditions. The criteria for each pulse also included System storage precludes below which the pulse would not be run. These precludes are 36.5 MAF for each of the initial pulses (March and May) and 40.0 MAF for subsequent spring pulses.

On March 1, 2006 the System storage was below the preclude value for the initial March pulse identified in the technical criteria (36.5 MAF), so the March pulse was foregone. However, by May 1 System storage had recovered above 36.5 MAF, sufficient to allow the initial May pulse. A flow-to-target regulation was used to determine releases from Gavins Point from the start of the navigation season to the start of the spring pulse. Based on the May 1 System storage and runoff forecast, the magnitude of the May pulse was set at 9,000 cfs over the existing flow rate at the start of the pulse. The initiation date of the pulse, which the criteria sets at between May 1 and May 19, was delayed until May 13 to allow the water temperature to reach the desired 16°C (61°F). Releases were increased from 16,000 cfs on May 12 to 22,000 cfs on May 13 and reached the peak rate of 25,000 cfs on May 14. Releases were maintained at that rate for 2 days, and then were decreased 1,500 cfs/day each of the first 2 days to meet the 30% reduction over 2 days criteria, and then were stepped down incrementally until they reached the navigation flow support release of 18,500 cfs on May 23. In order to minimize the incidental take of terns and plovers, releases were increased to the planned initial steady release rate (25,000 cfs) twice during the recession limb of the hydrograph, on May 19 and May 22, to prevent nesting on low elevation sandbar habitat below Gavins Point.

Approximately 49,000 acre-feet (AF) of water was required to conduct the May 2006 spring pulse:

450,000 AF	- total System releases made from May 13-22, 2006
-20,000 AF	- releases made to prevent nesting in low elevation areas (T&E)
-345,000 AF	- releases made for water supply and navigation
85,000 AF	- storage used to conduct spring pulse
-36,000 AF	- water conserved by shortening of navigation season by 1 day
49,000 AF	- net storage used to conduct spring pulse

Water previously stored in the Fort Randall and Gavins Point reservoirs was used to conduct the actual pulse. Ultimately the volume of water required for the pulse comes from the upper three reservoirs when System storage is balanced at the end of the water year. Based on the July 1 storage check, which determines the navigation season length, the navigation season was shortened 1 additional day due to the spring pulse. This additional day of navigation service shortening conserved about 36,000 acre-feet of water in the System, or slightly less than half of the water required for the spring pulse. The actual decline in System storage due to the pulse was 49,000 acre-feet, which is equivalent to about 1 inch of elevation in each of the upper three reservoirs.

D. <u>Non-Routine Regulation and Other Items Pertaining to System Regulation</u>

Numerous regulation activities are performed each year that, although at one time may have been considered special, are now considered routine. These include release restrictions from a particular project for a period of time to permit soundings, to facilitate limited construction within or adjacent to the downstream channel, and to pattern releases to facilitate measurements of downstream discharges and water surface profiles. Events that occurred in connection with regulation activities during CY 2006 that may be considered unusual, or recently have come to the attention of the Missouri River Basin Water Management Division (MRBWMD), are discussed in the following paragraphs.

1. Lawsuits

a. Clean Water Act Litigation

In this Clean Water Act (CWA) case, the State of North Dakota had filed suit to enjoin the Corps from releasing water from the Garrison Project on the grounds that lowering the level of the reservoir would violate State-law water-quality standards. The Minnesota District Court had dismissed this complaint holding that the CWA preserves the sovereign immunity on behalf of the Corps when the Corps' authority to maintain navigation is at issue. The 8th Circuit Court of Appeals (Court) affirmed the District Court's dismissal of the State of North Dakota's complaint. Subsequent to that decision, the State of North Dakota submitted a petition for U.S. Supreme Court review. On March 1, 2006 the Supreme Court denied the petition for review.

b. Master Manual/Biological Opinion Litigation

This case involved consolidated appeals by various parties challenging the new Master Manual issued by the Corps for regulation of the Missouri River Mainstem Reservoir System and biological opinions by the Service concerning those regulations. The District Court had granted summary judgment to the Corps and Service. The Court dismissed three claims as moot and affirmed the judgment of the District Court on all remaining claims. Subsequent to that decision, three petitions for review were submitted to the U.S. Supreme Court. On April 24, 2006, the Supreme Court denied the petitions for review.

c. NEPA Litigation

On May 24, 2006, the State of Missouri filed a complaint in the District of Minnesota challenging the adequacy of the Corps' National Environmental Policy Act (NEPA) compliance for the spring rise technical criteria. Oral arguments were held on September 22, 2004. On November 2, 2006 the Court held in favor of the Corps. Judge Paul Magnuson found that the Corps did not violate NEPA by preparing an Environmental Assessment (EA) rather than a supplemental Environmental Impact Statement (EIS), when it implemented the revisions to the Master Manual incorporating the spring rise technical criteria. The Court found the Corps also complied with NEPA in its consideration of a range of alternatives and fully analyzed the environmental impacts of the revision. The State of Missouri has appealed this decision to the Court. A briefing schedule has not yet been issued by the Court.

2. Master Manual Revision

A summary of the process used in the 2006 revision of the Master Manual to include technical criteria for a Gavins Point spring pulse can be found in the "Summary of Actual 2005 Regulation" report. A Record of Decision revising the Master Manual was signed on February 28, 2006.

The Corps is committed to monitoring both the physical and biological impacts of the bimodal spring pulse releases, including the response of the pallid sturgeon to the pulses, further evaluation of interior drainage and groundwater concerns, and potential impacts to cultural resources. Within an overall adaptive management strategy, results of monitoring will be used to develop future modifications to the criteria. If information becomes available through the research, monitoring, and evaluation processes that indicate a change to the spring pulse technical criteria, then the adaptive management process, including any NEPA work required, will be followed to revise the Master Manual.

3. Fort Peck Mini-Test and Intrasystem Unbalancing

As described in the 2005-2006 AOP, the Fort Peck "mini-test" and the unbalancing of the three large upper reservoirs were not implemented due to low System storage. When System storage recovers sufficiently, the Corps anticipates that both these regulation plans will be implemented. The endangered species modified flow "mini-test," which was designed to monitor the effects of higher spring releases and warmer water released from the Fort Peck spillway, requires a reservoir elevation of approximately 2229 ft msl to avoid unstable flows over the spillway. The "mini-test" was not possible in 2006 because reservoir elevations during May and June were approximately 20 feet below the spillway crest elevation of 2225 ft msl.

The Missouri River Natural Resources Committee (MRNRC) previously has provided recommended guidelines (Table VIII, 2005-2006 AOP) for unbalancing the upper three reservoirs to benefit reservoir fishery and the endangered terns and plovers. As a result of the continuing drought conditions and low reservoir elevations, the criteria for unbalancing the reservoirs were not met in 2006.

4. Summary of Drought Impacts

CY 2006 was the seventh consecutive year of drought in the Missouri River basin. After falling below the previous record low in October 2003, System storage continued its downward trend, setting a new record low of 34.1 MAF on December 13, 2006, 0.7 MAF below the previous record low set on January 21, 2005 and 6.7 MAF below the record low of 40.8 MAF set in the previous drought in January 1991. System storage ended 2006 at 34.4 MAF, 1.6 MAF lower than the previous year. Because the bulk of the carryover multiple use storage is in the upper three reservoirs, Fort Peck, Garrison, and Oahe reservoirs have also set new record low pool levels during the current drought: Fort Peck reservoir at elevation 2198.3 ft msl on January 23, 2005; Garrison reservoir at elevation 1805.8 ft msl on May 12, 2005; and, Oahe reservoir elevation at 1570.2 ft msl on August 31, 2006. Impacts of the drought have been felt across the basin. Some of the municipal, rural, industrial, and irrigation water intakes in the reservoirs and along the river reaches have been forced to make modifications to maintain access to the water. Some of the boat ramps have been extended, relocated or closed as the reservoir levels declined. Coldwater habitat in the reservoirs has been dramatically reduced threatening the viability of the coldwater fisheries. Cultural resources, once covered by water, are now exposed and vulnerable to additional erosion and looting. Noxious weeds have become even more problematic as thousands of acres of bare shoreline appear. Hydropower generation in 2006 was the fourth lowest on record since the System first filled in 1967, behind only 1993, 2005 and 2001.

The only authorized purpose that is not adversely impacted by the drought is flood control, which is actually enhanced during drought conditions. The negative impacts of drought will be felt even after runoff returns to normal because of the time that will be required to refill the evacuated storage. Full service project releases to all purposes will not resume until the System storage has recovered to near normal levels, however, as System storage increases, improved service will be provided. On the contrary, if the drought persists, further reductions in service to authorized purposes will occur, and the lower the System storage declines, the more stringent the conservation measures become, even to the point of having no navigation season. Users who rely on the Missouri River need to closely monitor current and forecasted river and reservoir conditions and take necessary steps to ensure they can function through a wide range of river flows and reservoir levels.

E. Reservoir Elevations and Storage

Reservoir elevations and storage contents of the System reservoirs at the end of July 2006 are presented in ***Table 9*** and the same information for CY 2006 is presented as ***Table 10***.

Figures 8A and ***8B*** show the end-of-July pool elevations for Fort Peck, Garrison, and Oahe plus total System end-of-July storage for 2004 through 2006. Individual tables with the historic maximum, average, and minimum pool elevations for each reservoir are also shown on ***Figures 8A*** and ***8B***. During CY 2006 only Fort Peck had a higher July 31 pool level in 2006 than it did in 2005. All three reservoirs experienced their historical minimum record pool levels during 2005 or 2006. On July 31, 2006 Fort Peck Lake was at elevation 2204.9 ft msl, 1.7 feet higher than at the same time in 2005. On July 31, 2006 Lake Sakakawea was at elevation 1815.5 ft msl, 1.7 feet lower than at the same time in 2005. Lake Oahe was at elevation 1573.4 on July 31, 2006, 3.0 feet lower than at the same time in 2005.

Table 9
Reservoir Levels and Storages – July 31, 2006

Project	Reservoir Elevation		Water in Storage – 1,000 AF		
	Elevation (ft msl)	12-Month Change (ft)	Total	Above Min. Level*	12-Month Change
Fort Peck	2204.9	+1.7	9,750	5,539	278
Garrison	1815.5	-1.7	12,172	7,192	-419
Oahe	1573.4	-3.0	10,378	5,005	-580
Big Bend	1420.6	-0.3	1,652	31	-35
Fort Randall	1354.1	+0.3	3,448	1,931	12
Gavins Point	1205.1	-1.6	336	15	-40
			37,736	19,713	-784

*Net usable storage above minimum reservoir levels established for power, recreation, irrigation diversions, and other purposes.

Table 10
Reservoir Levels and Storages – December 31, 2006

Project	Reservoir Elevation		Water in Storage – 1,000 AF		
	Elevation (ft msl)	12-Month Change (ft)	Total	Above Min. Level*	12-Month Change
Fort Peck	2199.4	-2.2	8,907	4,696	-316
Garrison	1807.8	-4.2	10,439	5,459	-929
Oahe	1572.8	-2.5	10,260	4,887	-490
Big Bend	1420.9	+0.4	1,676	55	27
Fort Randall	1343.8	+1.9	2,688	1,171	131
Gavins Point	1207.9	+0.3	408	87	-10
			34,378	16,355	-1,587

*Net usable storage above minimum reservoir levels established for power, recreation, irrigation diversions, and other purposes.

F. <u>Summary of Results</u>

1. Flood Control

Releases during CY 2006 were directed by continuation of the drought conservation measures and were implemented to conserve System water in storage. The storage crest was much less than the base of the annual flood control zone. Although mountain snowpack was near average, the basin was in its seventh year of drought. The expectation was, therefore, for a much-below-normal runoff, and water conservation measures were implemented to conserve the remaining storage according to Master Manual criteria.

The estimated total flood damages prevented by the System during CY 2006 was $446,000. The $446,000 total damages prevented in the Missouri River basin includes $439,000 in the Omaha District and $7,000 in the Kansas City District. The unindexed flood damages prevented by the System since construction now totals $18.3 billion, the bulk of which was prevented between 1993 and 1999 (see ***Figure 6A***). ***Figure 6B*** indicates the flood damages prevented indexed to 2006. Although the System prevents enormous amounts of damage, it is not capable of totally eliminating flooding along the Missouri River. No flood damages were incurred along the Missouri River in the Omaha District in 2006.

Figure 7 shows the actual regulated flows that were experienced at Sioux City, IA; Nebraska City, NE; and St. Joseph, MO and the unregulated flows that would have been experienced if the System and tributary reservoirs had not been in regulation.

2. Irrigation

Federally developed irrigation projects are not being served directly from System reservoirs. Releases from the reservoirs, however, are being utilized by numerous private irrigators as well as Federally financed projects that take water from the river. About 900 private irrigators pump directly from the reservoir or river reaches. Releases from the reservoirs during 2006 generally met the needs of irrigators.

3. Water Supply and Water Quality Control

Problems at municipal and industrial (M&I) intakes located in the river reaches and System reservoirs are related primarily to intake or river access problems rather than inadequate water supply. In emergency situations, short-term adjustments to protect human health and safety would be considered to keep M&I intakes functioning.

Low reservoir levels during the current drought have contributed to both intake access and water quality problems for intakes on Garrison and Oahe reservoirs, including several Tribal intakes. The Standing Rock Sioux Tribe’s intake at Fort Yates, ND failed in November 2003, leaving the community without water for several days. The intake, which under normal circumstances is in Oahe reservoir, is presently in an open river situation due to Oahe reservoir receding as the pool level declined. The Bureau of Reclamation (BOR) has installed a temporary intake and drilled a well to ensure continued water supply for that community. The BOR has also lowered the intake at Wakpala, SD on the Oahe reservoir. The Corps has used its emergency authority to lower the intake at Parshall, ND on Garrison reservoir. Other intakes that have been identified as having problems or potential problems include Mandaree, ND and Twin Buttes, ND on Garrison reservoir, and the Mni Waste’, SD intake on Oahe reservoir. The

Missouri River Mainstem Reservoirs Flood Damages Prevented

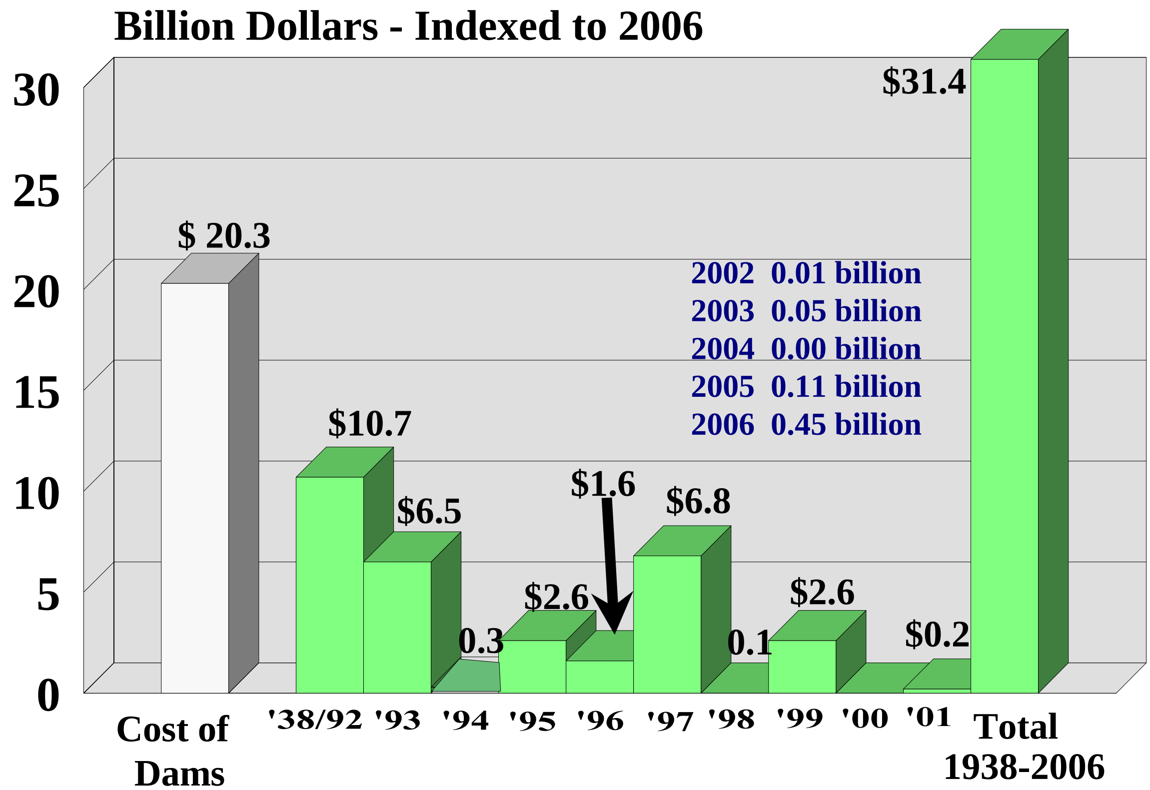


Figure 6A

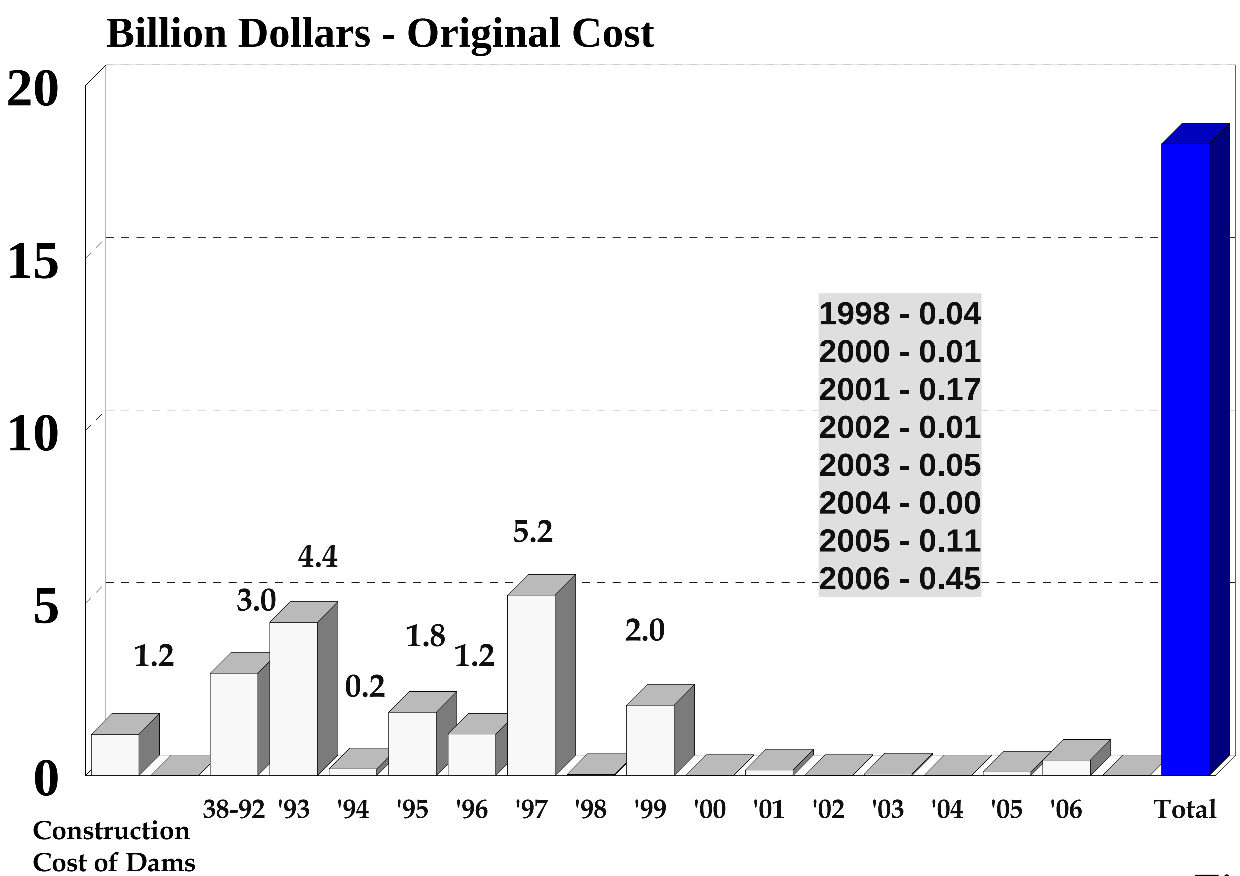
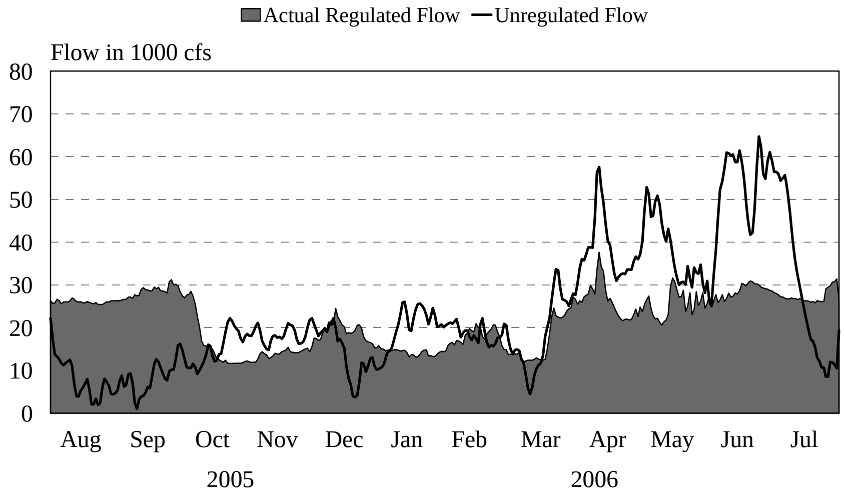


Figure 6B

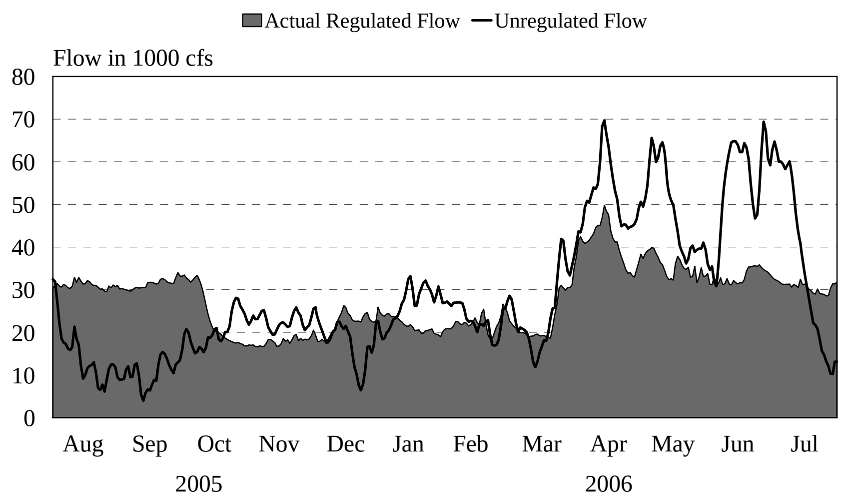
Sioux City

Regulated and Unregulated Flows



Nebraska City

Regulated and Unregulated Flows



St. Joseph

Regulated and Unregulated Flows

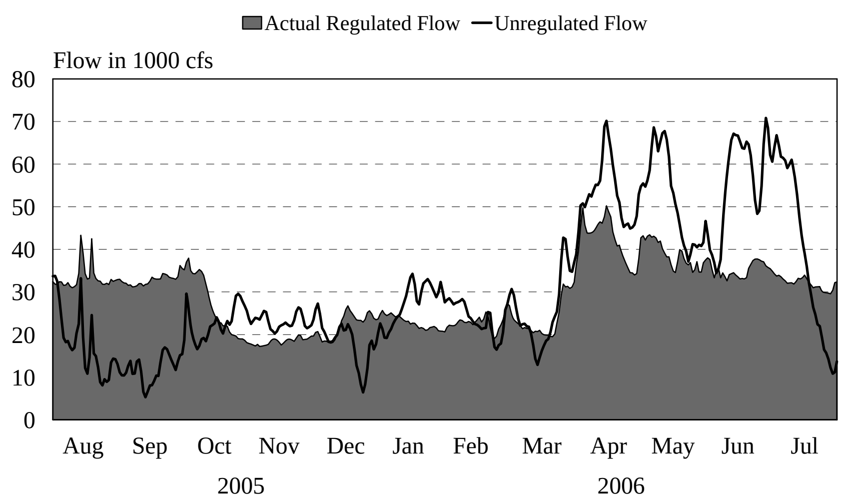


Figure 7

Corps is working with the Cheyenne River Sioux Tribe to relocate the Mni Waste' water intake, which serves over 14,000 residents of and near the Cheyenne River Indian Reservation in Dewey, Ziebach, and Meade Counties in South Dakota. If the drought continues, reservoir pool levels and releases may continue to fall below their previous historic lows creating the potential for additional intake access and water quality problems at both river and reservoir intakes.

Intake owners today are generally better prepared to handle periods of low water due to adjustments made to intakes or regulations procedures. The intake owners have made various adjustments to their operations to account for low water levels. Some of these adjustments involve using warm water to keep ice formation from building up on intake screens, installing new pumps, lowering intakes, installing sediment redirection vanes and ice deflectors, obtaining, or arranging to obtain, alternate sources of water; and cleaning screens more thoroughly and frequently. While these remedial actions were expensive, they have significantly improved the ability of the intakes to operate at lower river stages and reservoir levels.

During 2006, the Omaha District conducted long-term, fixed-station ambient monitoring at the System reservoirs and the lower Missouri River. Water quality conditions of the water discharged through each of the System dams was continuously monitored (i.e., hourly data-logging and monthly sampling). Intensive water quality surveys were conducted at Fort Peck, Oahe, and Fort Randall.

The Omaha District has identified seven priority water quality issues that have relevance to the System projects. These identified priority issues and their relative ranking are:

(1) Determine how regulation of the System dams effects water quality in the impounded reservoir and downstream river. Utilize the CE-QUAL-W2 hydrodynamic and water quality model to facilitate this effort.

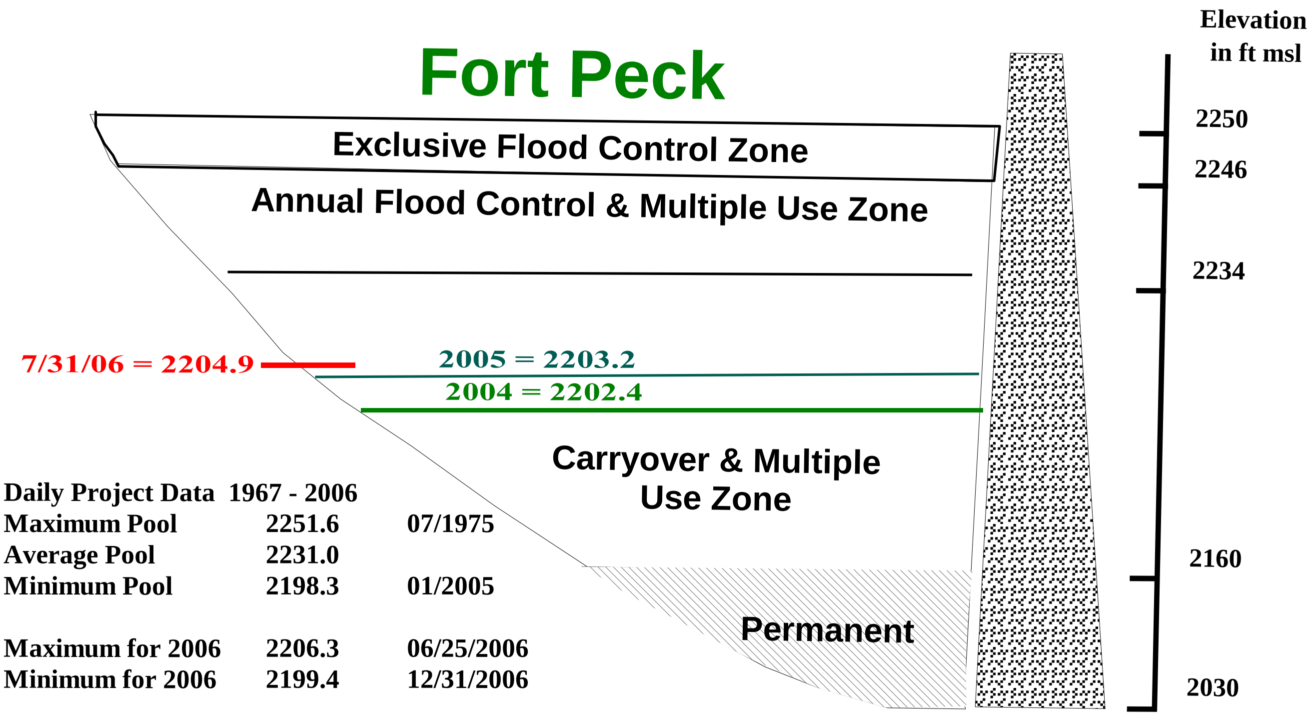
(2) Evaluate how eutrophication is progressing in the System reservoirs, especially regarding the expansion of anoxic conditions in the hypolimnion during summer stratification.

(3) Determine how flow regime, especially the release of water from System projects, affects water quality in the Missouri River.

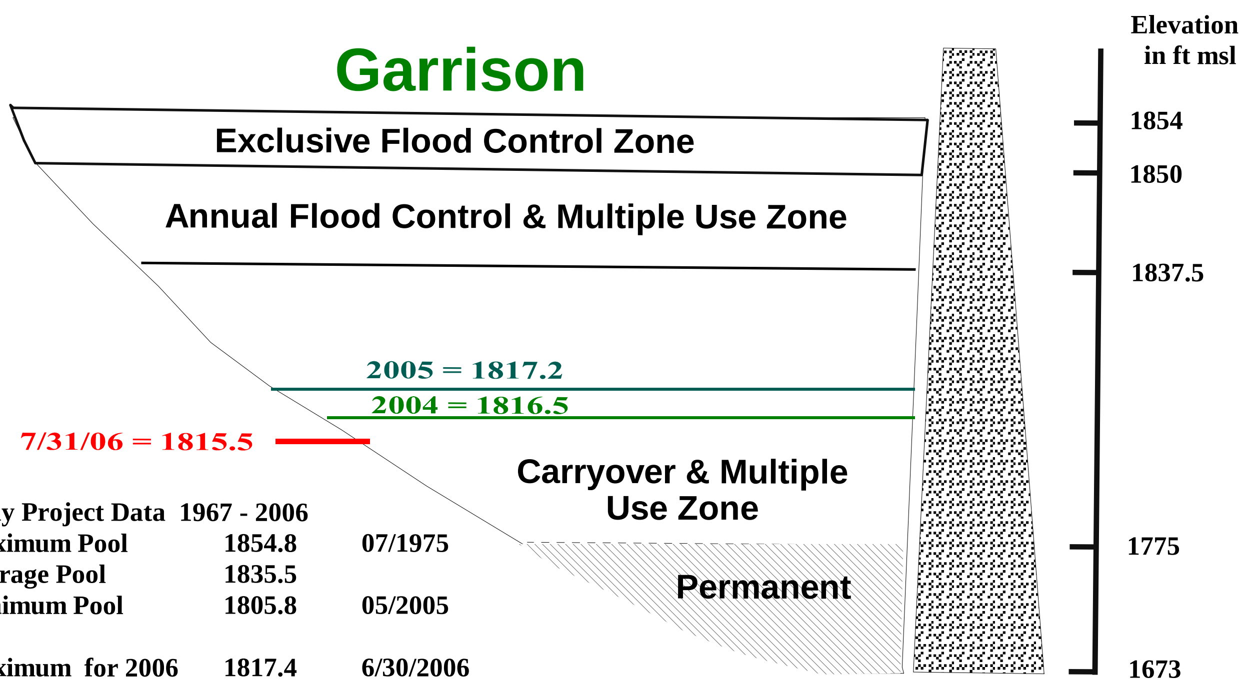
(4) Provide water quality information to support Corps reservoir regulation elements for effective water quality and aquatic habitat management.

(5) Provide water quality information and technical support to the States in the development of their Section 303(d) lists and development and implementation of Total Maximum Daily Loads (TMDL) at District projects, including the System projects.

Missouri River
End-of-July Pool Elevations



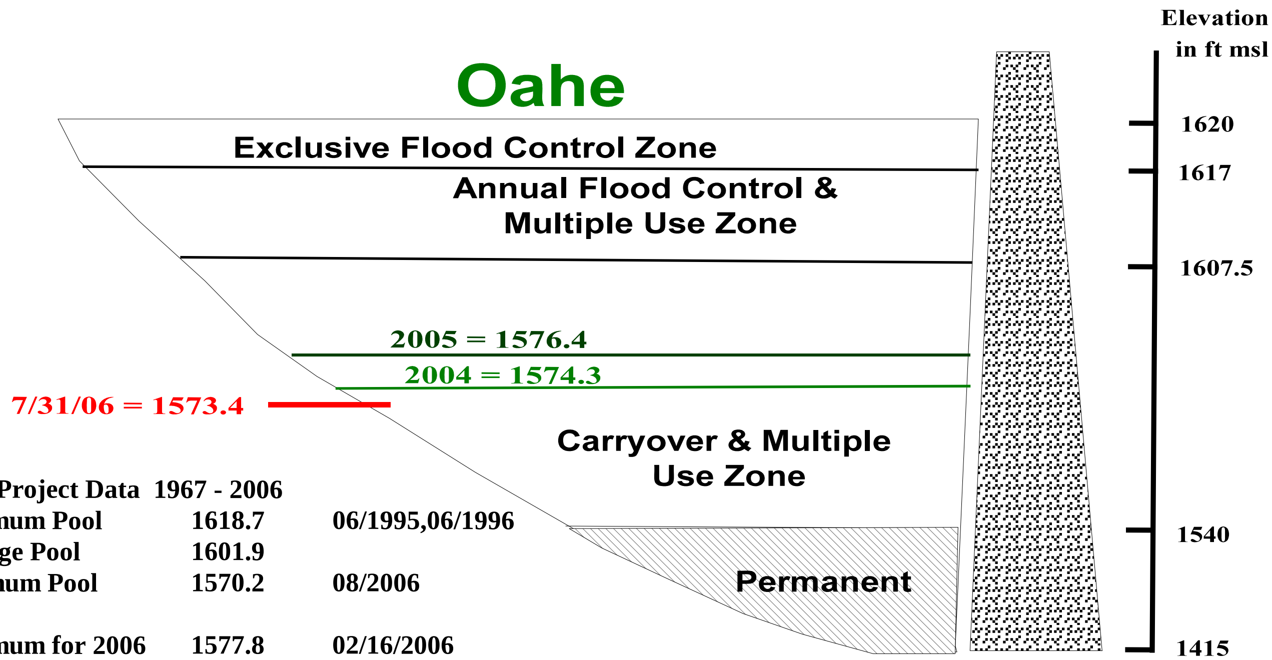
Daily Project Data 1967 - 2006		
Maximum Pool	2251.6	07/1975
Average Pool	2231.0	
Minimum Pool	2198.3	01/2005
Maximum for 2006	2206.3	06/25/2006
Minimum for 2006	2199.4	12/31/2006



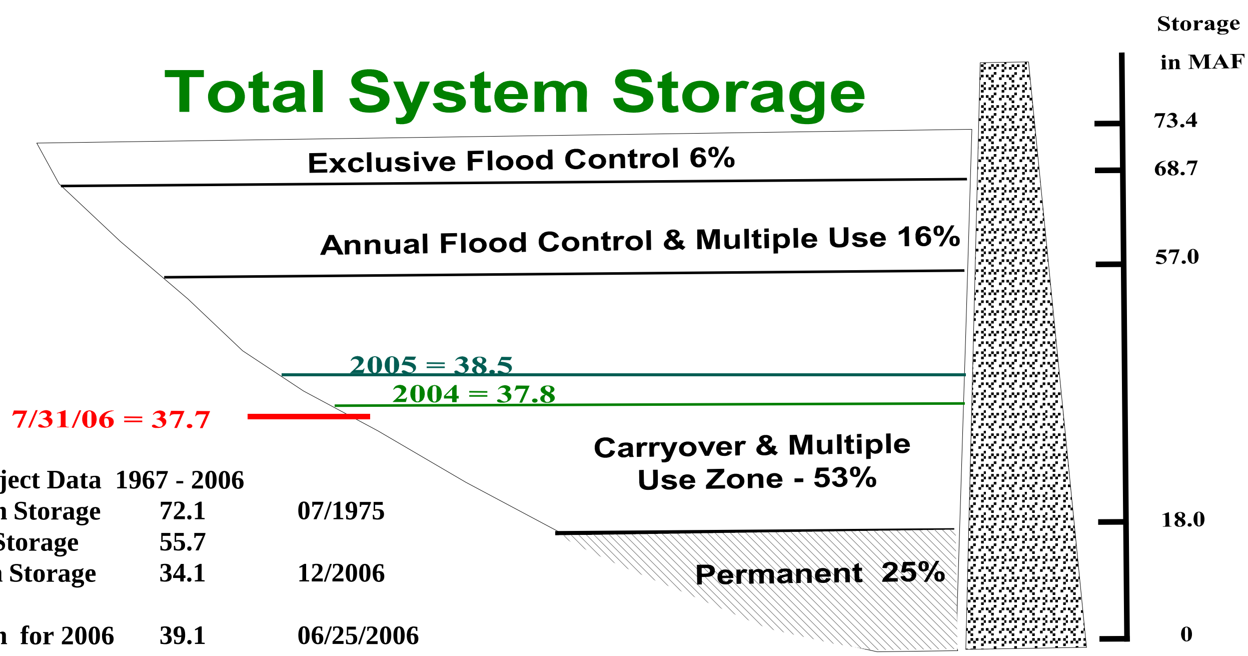
Daily Project Data 1967 - 2006		
Maximum Pool	1854.8	07/1975
Average Pool	1835.5	
Minimum Pool	1805.8	05/2005
Maximum for 2006	1817.4	6/30/2006
Minimum for 2006	1807.8	12/28/2006

Figure 8A

System Reservoirs
and Total System Storage



Daily Project Data 1967 - 2006		
Maximum Pool	1618.7	06/1995,06/1996
Average Pool	1601.9	
Minimum Pool	1570.2	08/2006
Maximum for 2006	1577.8	02/16/2006
Minimum for 2006	1570.2	08/31/2006



Daily Project Data 1967 - 2006		
Maximum Storage	72.1	07/1975
Average Storage	55.7	
Minimum Storage	34.1	12/2006
Maximum for 2006	39.1	06/25/2006
Minimum for 2006	34.1	12/12/2006

Figure 8B

(6) Identify existing and potential water quality problems at District projects, and develop and implement appropriate solutions.

(7) Evaluate water quality conditions and trends at District projects.

Note: Relative ranking of priority in parentheses (1 = highest priority).

Table 11 provides a summary of water quality issues and concerns at each of the System projects, based on Omaha District monitoring and a review of current State water quality reports.

Maintaining coldwater habitat in Garrison reservoir during late summer continues to be a challenge due to the ongoing drought in the western United States. If the drought persists and the reservoir level continues to drop, it will become more probable that coldwater habitat will not be maintained in the Garrison reservoir through the summer months. The pool elevation of the Garrison has reached a point where the reduced hypolimnetic volume of cold water, in concert with the degradation of dissolved oxygen in the deeper water of the reservoir, is limiting the maintenance of coldwater habitat through the end of the summer, the thermal lake stratification period. Water temperature and dissolved oxygen levels are primary water quality factors that determine the suitability of water for coldwater aquatic life.

The State of North Dakota has defined optimal coldwater fish habitat in the Garrison reservoir as being ≤15°C and having dissolved oxygen levels ≥ 5 mg/l. The measured water temperature and dissolved oxygen concentration depth profiles that were obtained through water quality monitoring conducted at the Garrison reservoir during 2003 through 2006 were used to estimate the volume of water in the reservoir that meets the optimal coldwater habitat conditions defined by the State of North Dakota. ***Plate 5*** shows reservoir and optimal coldwater habitat volumes for 2003 to 2006. Optimal coldwater habitat present in the Garrison reservoir during 2005 and 2006 appears to have been similar to that present in 2003 and 2004.

The reduction of coldwater habitat in the reservoir is exacerbated by the releases from the Garrison Dam intake structure. Because the invert elevation of the intake portals to the power tunnels (i.e., penstocks) is 2 feet above the reservoir bottom, water drawn through the penstocks comes largely from the lower depths of the reservoir. Thus, during the summer thermal stratification period, water is largely drawn from the coldwater habitat volume of the reservoir. Three water quality management measures were identified for implementation in an effort to preserve the coldwater habitat in the reservoir. These measures, which were first implemented at Garrison in July 2005 included: 1) modification of the dam's intake trash racks, 2) utilization of head gates to restrict the opening to the dam's power tunnels, and 3) modification of the daily flow cycle and minimum flow releases from the dam. The three implemented water quality management measures were targeted at drawing water into the dam from higher elevations within the reservoir. Implementation of the three water quality management measures was continued in 2006.

Table 11
Water Quality Issues and Concerns

Project	TMDL Considerations*				Fish Consumption Advisories		Other Potential Water Quality Concerns
	On 303(d) List	Impaired Uses	Pollutant/Stressor	TMDL Completed	Advisory in Effect	Identified Contamination	
Fort Peck • Fort Peck Lake	Yes	Drinking Water Supply Primary Contact Recreation	Lead Mercury Noxious Aquatic Plants	No	Yes	Mercury	---
• Missouri River immediately below Fort Peck Dam	Yes	Aquatic Life Support Cold Water Fishery – Trout Warm Water Fishery	Flow Alteration Riparian Degradation Water Temperature	No	No	---	---
Garrison • Lake Sakakawea	Yes	Fish and Other Aquatic Biota Fish Consumption	Low Dissolved Oxygen Water Temperature Methyl-Mercury	No	Yes	Mercury	Hypolimnetic Dissolved Oxygen Levels
• Missouri River immediately below Garrison Dam	No	---	---	---	Yes	Mercury	Dissolved oxygen in Garrison Dam tailwaters (associated with late summer hypolimnetic lake withdrawals)
Oahe • Lake Oahe	No	---	---	---	No	---	---
Big Bend • Lake Sharpe	No	---	---	Yes	No	---	TMDL completed for sediment. A nonpoint source management project is being implemented in the Bad River watershed.
Fort Randall • Lake Francis Case	No	---	---	---	No	---	---
• Missouri River immediately below Fort Randall Dam	No	---	---	---	No	---	---
Gavins Point • Lewis and Clark Lake	No	---	---	---	No	---	Sedimentation Emergent Aquatic Vegetation
• Missouri River immediately below Gavins Point Dam	Yes	Recreation Aquatic Life Public Drinking Water Supply	Pathogens Dieldrin PCBs Chlorodibromomethane	No	Yes	Dieldrin PCBs	Summer ambient water temperature (NPDES limitations regarding cooling water discharges)

* Information taken from published state Total Maximum Daily Load (TMDL) 303(d) reports and listings.

Based on water quality monitoring of the water discharged through Garrison Dam, it appears that up to 1,021,150 acre-feet of water meeting optimal coldwater habitat criteria may have been prevented from being discharged through Garrison and retained in the reservoir due to the implementation of the water quality management measures in 2006. This compares to the 379,390 acre-feet of optimal coldwater habitat that was potentially saved in 2005. Similar to 2005, implementation of the water quality management measures in 2006 warmed the water that was discharged through Garrison Dam during the summer by 2 to 4°C. Although the water quality management measures were implemented to preserve coldwater habitat in the reservoir, they also had the probable benefit of allowing water quality standards criterion established by the State of North Dakota for dissolved oxygen to be met in the Missouri River immediately below Garrison Dam during late summer minimum flow releases.

4. Navigation

The first towboat to enter the Missouri River from the Mississippi River in 2006 was the MV OMAHA, owned by Excell Marine. The towboat entered on April 1, 2006 with four loads of fertilizer for Brunswick River Terminal, MO at River Mile (RM) 256. By April 3, five tows were operating on the Missouri River. The first towboats to arrive in the Omaha, NE area were a dual vessel tow MV CLAUDE R and MV PIASA, of McDonough Marine Service for a temporary moorage at RM 624. The tow arrived on April 15, 2006 delivering one barge containing steam generators, a pressurizer, and a reactor vessel head destined for the Omaha Public Power District (OPPD) Fort Calhoun Nuclear Power Station just downstream of Blair, NE at RM 645. There were no tows that delivered to Sioux City, IA during 2006. The most upstream tow was the MV OMAHA, arriving at Blair, NE on April 20, 2006 with four barges that were loaded with alfalfa pellets at Consolidated Blenders and bound for Alabama.

With the drought continuing through 2006, the navigation industry was again impacted by minimum service flow support. Compared to the last 2 years, there was increased agricultural commodity movements above Kansas City this year. Consolidated Blenders of Blair, NE loaded several barges of alfalfa pellets for shipment to Alabama. During 2006, 3 specialized tow movements of power plant equipment occurred. There were 2 tow deliveries of powerplant equipment to the Fort Calhoun Nuclear Power Station at Blair, NE and one tow delivery to the Nebraska Public Power District Brownville Nuclear Power Station. These shipments represented equipment valued at $85 million.

The Waterborne Commerce Statistics Center (WCSC) data for 2005 shows total Missouri River tonnage at 7.94 million tons. This includes 7.54 million tons for sand and gravel, 111,125 tons for waterways materials, and 284,641 tons for long-haul commercial tonnage. The higher than normal waterway materials tonnage was due to the habitat construction work for the Corps' Missouri River Recovery Program. The largest total tonnage year was 2001 at 9.73 million tons. The largest long-haul commercial tonnage year, excluding sand, gravel, and waterway material, occurred in 1977 at 3.3 million tons. Tonnages of commodities shipped during 2002 through 2005 are shown in ***Table 12***.

Figure 9A shows the value of the commodities since 1960, using 2006 present-worth computations. ***Figure 9B*** shows tonnage value of long-haul commercial commodities since 1960. The commercial tonnage figure for 2006 is an estimate and will change once final WCSC tabulations are available late in 2007 or early 2008. Missouri River long-haul commercial tonnage in 2006 is currently estimated to total about 192,000 tons, based on towboat activity from the Corps' daily boat reports.

Navigation season target flows for past years are given in ***Table 13***. ***Table 14*** shows the scheduled lengths of past navigation seasons with total tonnage and ton-miles for each year. The 2006 navigation season was shortened 44 days in accordance with the Master Manual.

Figure 10 presents discharge data at Sioux City, IA; Nebraska City, NE; and Kansas City, MO for the August 2005 through December 2006 period. The three graphs demonstrate that actual flows at these locations are influenced considerably by System releases. Tributaries between Gavins Point and Kansas City did not provide much inflow during the navigation season. Supplemental Missouri River navigation support was provided from releases from the Milford, Tuttle Creek and Perry projects. Between Sioux City and Nebraska City, however, tributary flows provided additional flow, especially in the months of May and June. Refer to Section II.C. of this report for further discussion on System releases during the 2006 navigation season.

5. Power-Eastern Division, Pick-Sloan Missouri Basin Program (P-S MBP)

The energy generated in 2006 was transmitted over a Federal transmission system that traverses 7,745 circuit miles. This past year, service was provided to 360 customers. Customers in a 6-state area receiving direct service include 194 municipalities, 2 Federal agencies, 33 state agencies, 28 BOR projects, 5 irrigation districts, 36 rural electric cooperatives, 7 public utility districts, 30 private utilities, 27 Native American Services, and 1 inter-project sale. Additional benefits were provided by the interconnections to the Southwestern and Bonneville Power Administrations and other areas of the Western Area Power Administration (Western). Statistics from the Omaha Public Power District (OPPD) show that the average customer uses approximately 11,000 kilowatt hours (kWh) of energy annually. Based upon the total System generation of 6,269,499,000 kWh, the energy generated in CY 2006 by this portion of the Federal power system could have supplied all of the yearly needs of 570,000 residential OPPD customers.

In addition to the clean, renewable energy transmitted to the Midwest area, the hydropower system provides an added measure of stability to the regional power system with the ability to meet full load in 5 seconds or less. Large coal-fired and nuclear units are reinforced by idle hydropower units, typically in 30 seconds. Outside utilities can have access to the hydropower capability within several minutes of a known problem.

Table 12
Missouri River Tonnage by Commodities (In Thousands of Tons)

Commodity Classification Group	2002	2003	2004	2005
Farm Products	352	105	**41**	**9**
Corn	126	70	32	9
Wheat	28	15	5	0
Soybeans	167	19	1.5	0
Misc Farm Product	31	1	2.5	0
Nonmetallic Minerals	7145	7381	**7606**	**7540**
Sand/Gravel	7129	7375	7606	7540
Misc Nonmetallic	16	6	0	0
Food and Kindred	36	23	**0**	**1.4**
Pulp and Paper	0	0	**0**	**0**
Chemicals	246	118	**48**	**6.6**
Fertilizer	241	114	41	3.8
Other Chemicals	5	4	7	0
Petroleum (including coke)	173	213	**216**	**180**
Stone/Clay/Glass	189	203	**221**	**88**
Primary Metals	13	2	**0**	**0.1**
Waterway Materials	112	5	**60**	**111**
Other	0	0	**0**	**0**
Total Commercial	8266	8050	**8192**	**7936**
Total Long Haul Commercial	1009	670	**526**	**285**

The excellent reliability of the hydropower system is indicated by having to maintain a 10% reserve, while thermal power must maintain a 15% reserve. Although the Federal hydropower system that serves the Missouri River region accounts for only 9% of the region's energy, it is large enough to fill gaps and provide a positive benefit to the integrated system.

CY 2006 generation was 65 percent of average since the System first filled in 1967. Energy generation was below normal due to reduced heads, below normal runoff, and below-normal releases at all powerplants. Western purchased about 4.0 billion kWh between January 1, 2006 and December 31, 2006, at a cost of $206.4 million to supplement System hydropower production.

System generation with individual project distribution for each calendar year since 1954 is shown on ***Figure 11***. The gross generation from the Federal system (peak capacity and energy sales) for 2005 is shown in ***Table 15***. The tabulations in ***Table 16*** and ***Table 17*** summarize the total gross generation and power regulation for the Eastern Division, P-S MBP, marketing area system for the past operating year. Actual settlement

Missouri River

Total Navigation Tonnage Value - 2006 Present Worth

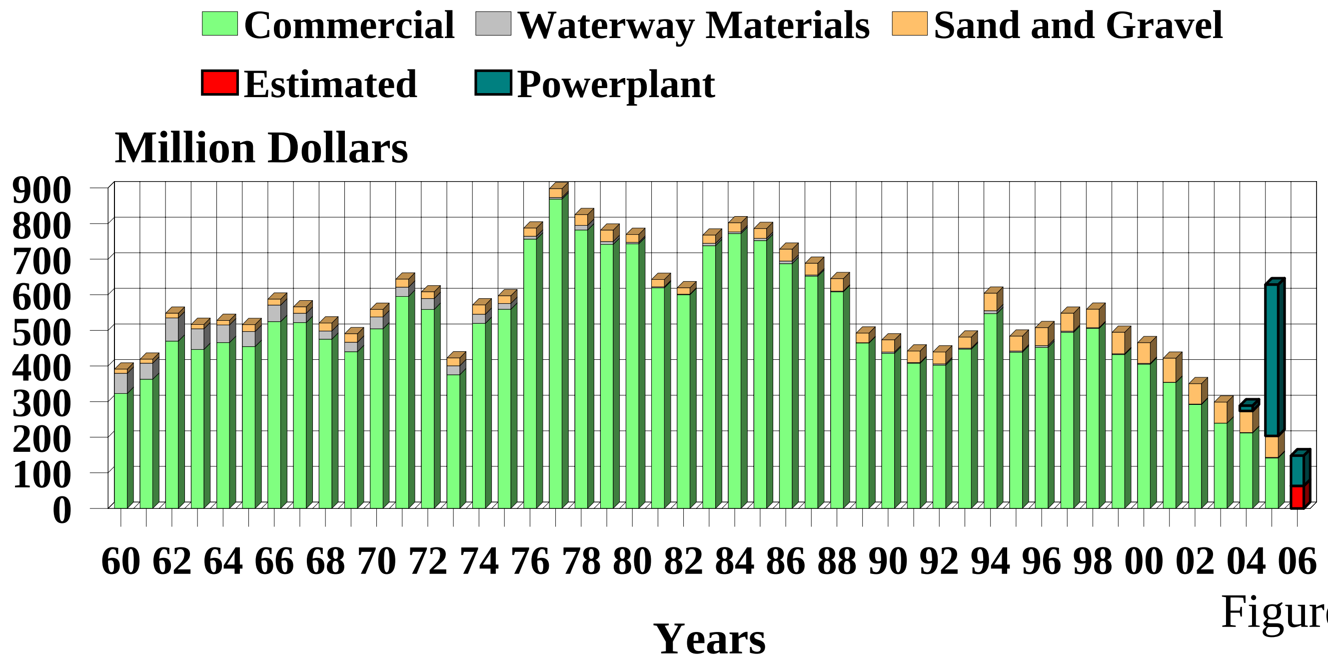
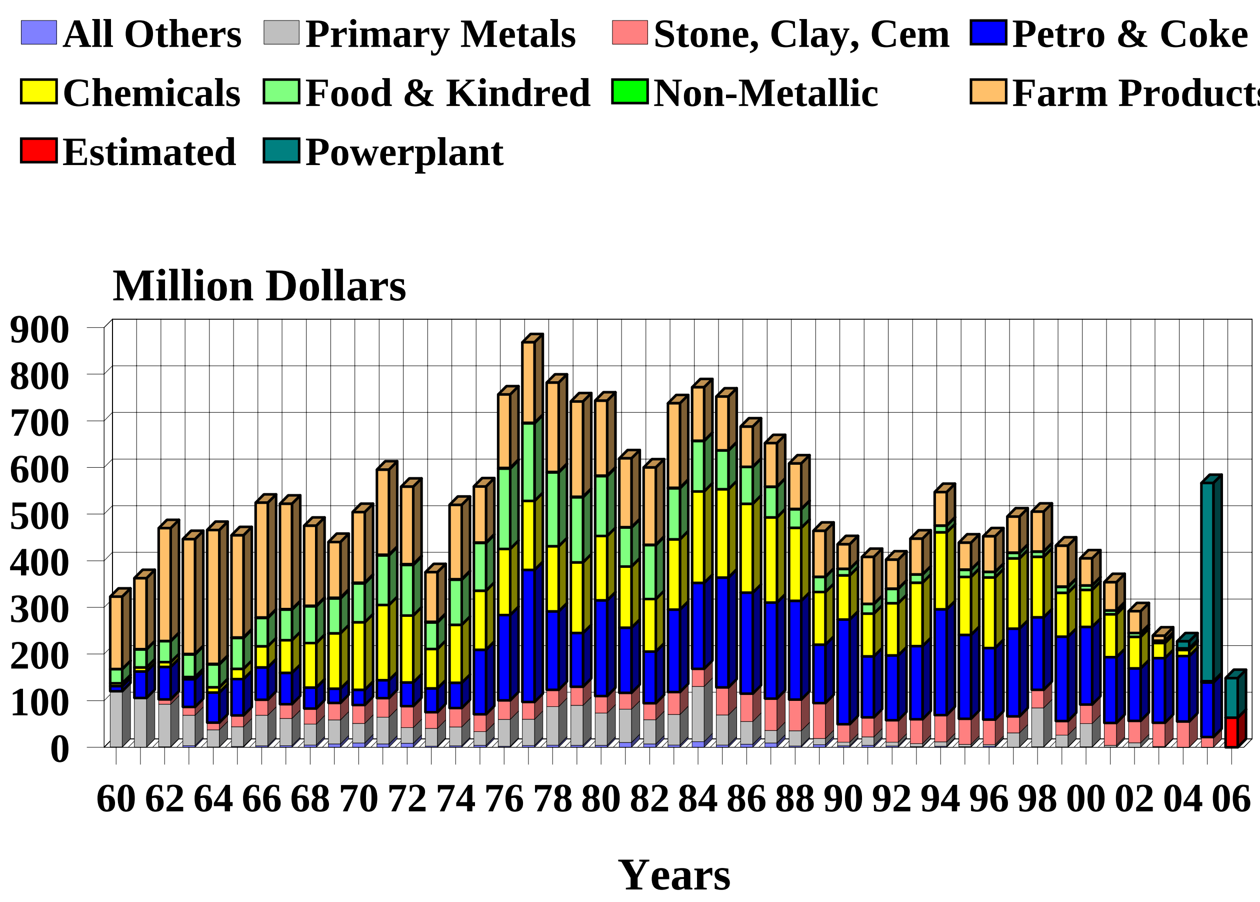


Figure 9A

Commercial Navigation Tonnage Value - 2006 Present Worth



Commercial Value Excludes Sand, Gravel and Waterway Materials

Figure 9B

Table 13
Navigation Season Target Flows
in 1,000 cfs

Year	Months	Sioux City	Omaha	Nebraska City	Kansas City
1967	Apr-Jun	28	28	34	38
	Jul-Nov	31	31	37	41
1968	Apr-Nov	31	31	37	41
1969	Apr-Jun(1)	35.0-40.0	35.0-40.0	41.0-46.0	45.0-50.0
	Jul(1)	36	36	42	46
	Aug-Sep(1)	50.0-55.0	50.0-55.0	55.0-60.0	55.0-60.0
	Oct-Nov(1)	40.0-45.0	40.0-45.0	45.0-50.0	50.0-55.0
1970	Apr-May	31	31	37	41
	May-Sep(1)	36	36	42	46
	Oct-Nov(1)	40	40	46	50
1971	Apr-May(1)	36	36	42	46
	May-Nov(1)	45.0-50.0	45.0-50.0	50.0-55.0	55.0-60.0
1972	Apr-Nov(1)	40.0-50.0	40.0-50.0	45.0-55.0	50.0-60.0
1973-74	Apr-Nov	31	31	37	41
1975	Apr	31	31	37	41
	May-Nov(1)	35.0-60.0	35.0-60.0	41.0-66.0	45.0-70.0
1976	Apr-Jul(1)	34.0-38.0	34.0-38.0	40.0-44.0	44.0-48.0
	Aug-Dec(1)	31.0-34.0	31.0-34.0	37.0-40.0	41.0-44.0
1977	Apr-Nov	31	31	37	41
1978	Apr	31	31	37	41
	May-Jul(1)	35.0-46.0	35.0-46.0	41.0-52.0	45.0-56.0
	Aug-Nov(1)	46.0-51.0	46.0-51.0	52.0-57.0	56.0-61.0
1979	Apr-Jul(1)	36.0-42.0	36.0-42.0	42.0-48.0	46.0-52.0
	Aug-Nov(1)	31.0-36.0	31.0-36.0	37.0-42.0	41.0-46.0
1980	Apr-Nov	31	31	37	41
1981	Apr-Nov(2)	31	31	37	41
1982	Apr-Sep	31	31	37	41
	Oct	31.0-36.0	31.0-36.0	37.0-42.0	41.0-46.0
	Nov-Dec(1)	36.0-46.0	36.0-46.0	42.0-52.0	46.0-56.0
1983	Apr-Jun	31	31	37	41
	Jul	31.0-36.0	31.0-36.0	37.0-42.0	41.0-46.0
	Aug-Nov(1)	36	36	42	46
1984	Apr-Jun	31	31	37	41
	Jul-Dec(1)	31.0-44.0	31.0-44.0	37.0-50.0	41.0-54.0
1985	Apr-Dec	31	31	37	41
1986	Apr(1)	36.0-41.0	36.0-41.0	42.0-47.0	46.0-51.0
	May-Dec(1)	41.0-46.0	41.0-46.0	47.0-52.0	51.0-56.0
1987	Apr-Nov	31	31	37	41
1988	Apr-Nov(2)	31	31	37	41
1989	Apr-Aug(3)	28	28	34	38
	Sep-Oct(3)	28	28	34	35
1990-93	Apr-Oct(4)	25	25	31	35
1994	Apr-Dec	31	31	37	41
1995	Apr-May	31	31	37	41
	Jun-Dec(1)	46.0-56.0	46.0-56.0	52.0-62.0	56.0-66.0
1996	Apr(1)	41	41	47	51
	May(1)	41.0-51.0	41.0-51.0	47.0-57.0	51.0-61.0
	Jun-Dec(1)	56	56	62	66
1997	Apr-Dec(5)	*	*	*	*
1998	Apr-Dec(5)	31	31	37	41
1999	Apr-Dec(1)	31.0-43.0	31.0-43.0	37.0-49.0	41.0-53.0
2000	Apr-Jun	31	31	37	41
	Jul-Dec(3)	29.5	29.5	35.5	39.5
2001	Apr-Dec(3)	28	28	34	38
2002	Apr-Jun(3)	27	27	33	37
	Jul-Dec(3)	25	25	31	35
2003	Apr-Nov(4)	25	25	31	35
2004-06	Apr-Oct(6)	25	25	31	35

(1) Downstream flow targets above full-service navigation level as a flood control storage evacuation measure.
(2) Full service flows provided for shortened season.
(3) Navigation targets below full service as a water conservation measure.
(4) Navigation targets at minimum service as a water conservation measure.
(5) Releases determined by flood control storage evacuation critiera and not adjusted to meet specific navigation targets.
(6) Minimum service targets at Sioux City and Omaha not met in April and a few days in September due to no commerical navigation in those reaches.

Table 14
Missouri River Navigation
Tonnage and Season Length

Year	Scheduled Length of Season (Months)	Commercial (Tons) (1)	Total Traffic (Tons) (2)	Total Traffic (1000 Ton-Miles) (2)
1967 (3)	8	2,562,657	6,659,219	1,179,235
1968	8 (4)	2,254,489	6,724,562	1,047,935
1969	8 (4)	2,123,152	7,001,107	1,053,856
1970	8 (5)	2,462,935	7,519,251	1,190,232
1971	8 (4)	2,791,929	7,483,708	1,329,899
1972	8 (4)	2,665,579	7,182,841	1,280,385
1973	8	1,817,471	6,370,838	844,406
1974	8	2,576,018	7,673,084	1,227,525
1975	8 (4)	2,317,321	6,208,426	1,105,811
1976	8 (4)	3,111,376	6,552,949	1,535,912
1977	8	3,335,780	6,734,850	1,596,284
1978	8 (4)	3,202,822	7,929,184	1,528,614
1979	8 (4)	3,145,902	7,684,738	1,518,549
1980	8	2,909,279	5,914,775	1,335,309
1981	7 1/4 (6)	2,466,619	5,251,952	1,130,787
1982	8 (4)	2,513,166	4,880,527	1,131,249
1983	8 (4)	2,925,384	6,301,465	1,300,000
1984	8 (4)	2,878,720	6,386,205	1,338,939
1985	8 (4) (7)	2,606,461	6,471,418	1,201,854
1986	8 (4) (7)	2,343,899	6,990,778	1,044,299
1987	8	2,405,212	6,735,968	1,057,526
1988	7 1/2	2,156,387	6,680,878	949,356
1989	6 3/4	1,906,508	5,352,282	796,799
1990	6 3/4	1,329,000	5,841,000	552,509
1991	6 3/4	1,563,000	5,729,000	537,498
1992	6 3/4	1,403,000	5,783,000	593,790
1993	8 (8)	1,570,000	5,631,000	615,541
1994	8	1,800,000	8,501,000	774,491
1995	8 (4)	1,439,000	6,884,000	604,171
1996	8 (4)	1,547,000	8,165,000	680,872
1997	8 (4)	1,651,000	8,172,000	725,268
1998	8 (4)	1,735,000	8,379,000	777,727
1999	8 (4)	1,576,000	9,252,000	699,744
2000	8	1,344,000	8,733,000	628,575
2001	8	1,288,000	9,732,000	566,150
2002	8 (9)	1,009,000	8,266,000	409,980
2003	8 (10)	667,000	8,050,000	256,788
2004	6 1/2 (11)	525,498	8,192,219	181,995
2005	6 1/2 (11)	284,641 (12)	7,935,747 (12)	100,000 (12)
2006	6 1/2 (11)	data not available	data not available	data not available

(1) Includes commercial tonnage except for sand and gravel or waterway materials. Tonnage compiled by Waterborne Commerce Statistics Center (WCSC).
(2) Includes commodities; sand, gravel, and crushed rock; and waterway improvement materials. Tonnage by WCSC.
(3) Mainstem Reservoir System first reached normal operating storage level in 1967.
(4) 10-day extension of season provided.
(5) 10-day extension and 10-day early opening provided.
(6) Full service flows for shortened season in preference to reduced service.
(7) 10-day extension provided for 1985 season in trade for 10-day delayed support of 1986 season.
(8) Lower Missouri River closed: 57 days in 1993, 20 days in 1995, and 18 days in 1999.
(9) To protect endangered shore birds below Gavins Point Dam, the Corps did not support navigation from July 3 to August 14, 2002. Average days towing industry off the river was 23 days.
(10) 6-day shortening of season to follow CWCP. From Aug 11 to Sep 1 Corps did not support navigation flows to comply with lawsuit to follow 2000 Biological Opinion. Navigation industry left the river during this period.
(11) 47-day shortening, 2004; 48-day shortening, 2005; 44-day shortening, 2006.
(12) Preliminary Data from WCSC. Final data expected spring of 2007.

Missouri River Flows at Sioux City, Nebraska City and Kansas City

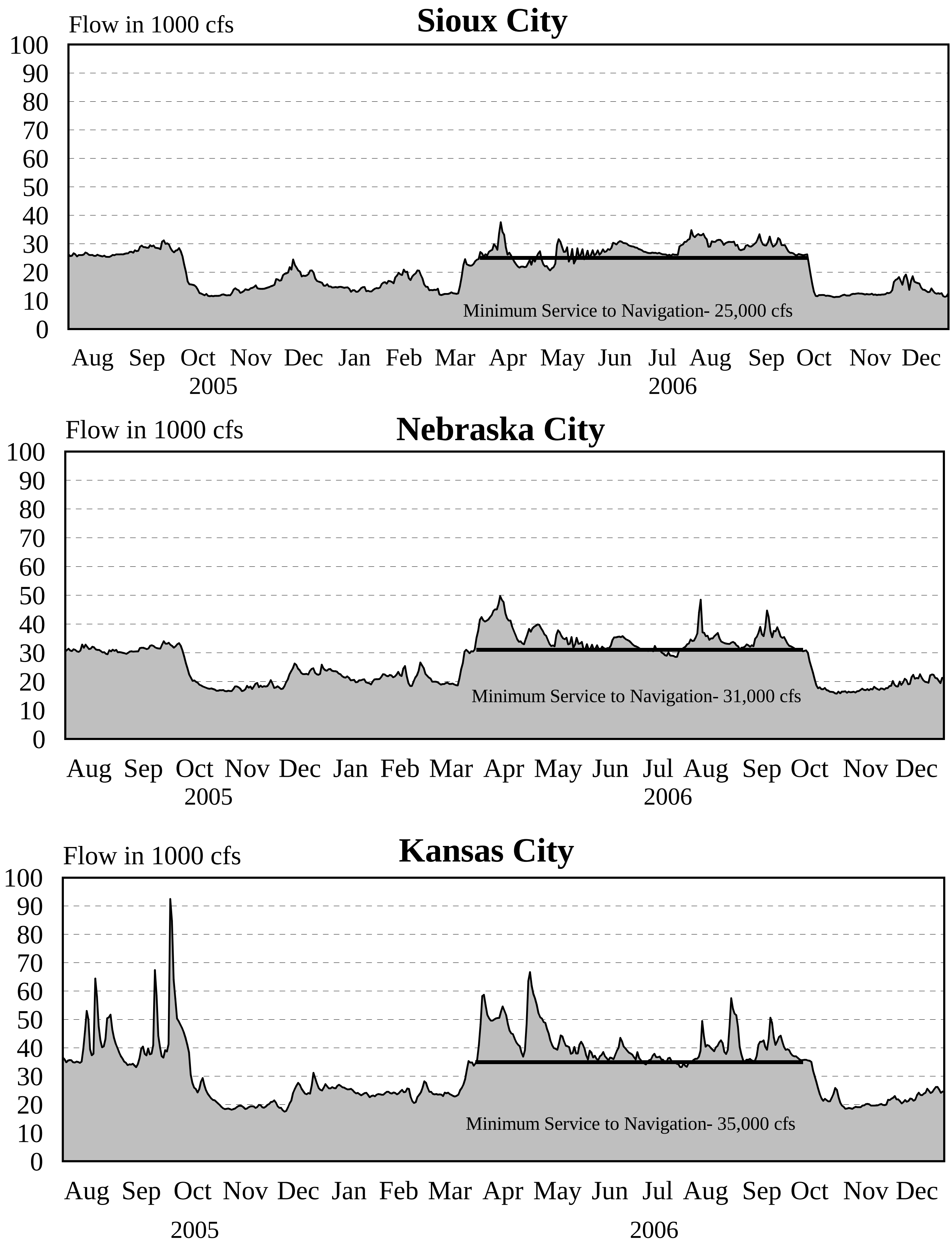


Figure 10

Missouri River Mainstem Power Generation 1954 - 2006

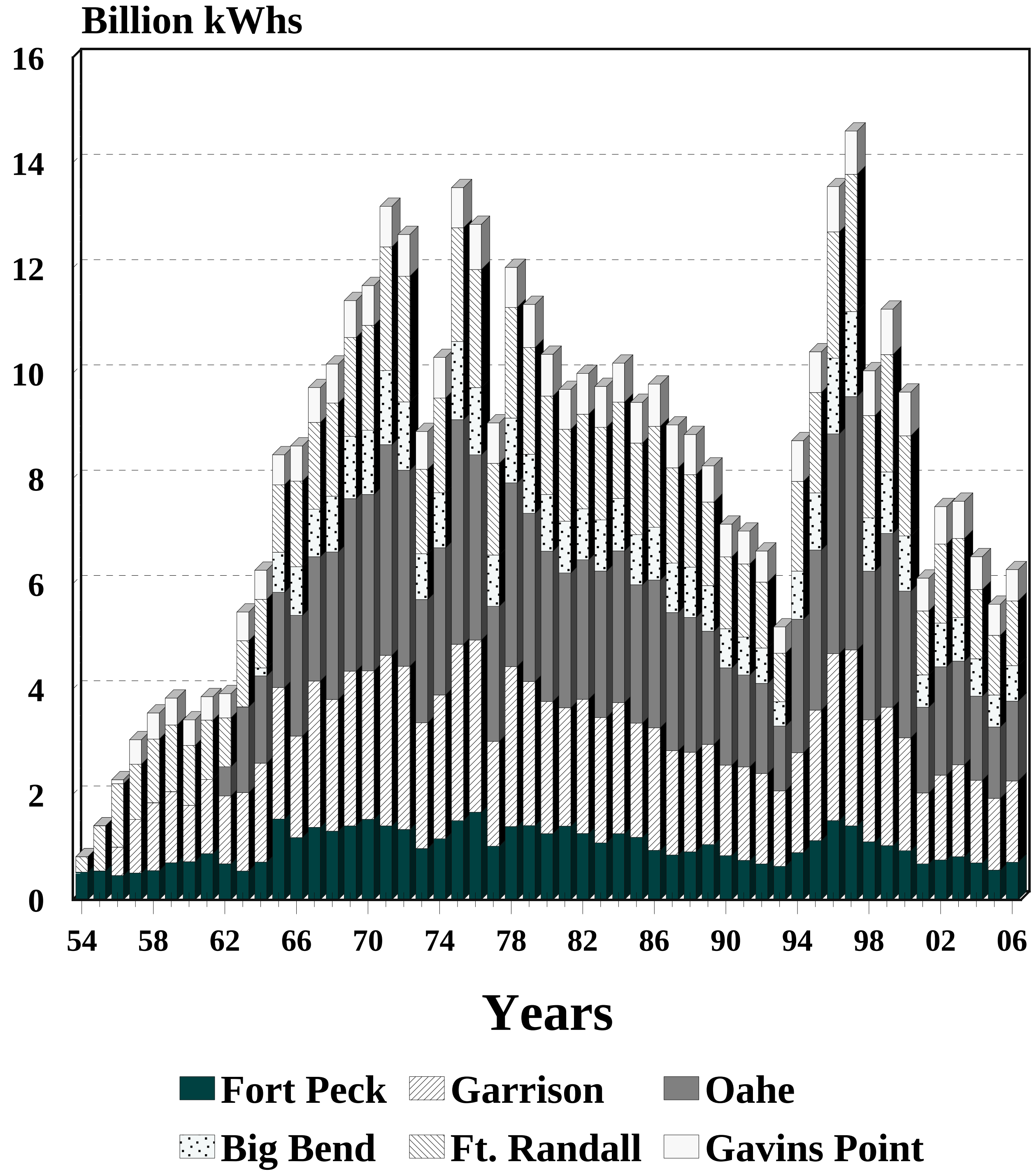


Figure 11

figures at the end of the billing periods differ somewhat from the calendar month figures shown.

Table 15
Gross Federal Power System Generation – January 2006 through December 2006

	Energy Generation 1,000 kWh	Peak Hour kWh	Generation Date
Corps Power Plants – Mainstem			
Fort Peck	712,940	142,000	12/25/2006
Garrison	1,543,103	381,000	08/28/2006
Oahe	1,516,297	527,000	07/12/2006
Big Bend	675,923	470,000	06/29/2006
Fort Randall	1,227,585	352,000	05/16/2006
Gavins Point	593,651	110,000	08/05/2006
Corps Subtotal	6,269,499	1,759,000	08/29/2006
USBR Powerplants			
Canyon Ferry	474,776	54,000	4/2006
Yellowtail*	374,331	111,000	2/2006
USBR Subtotal	849,107		
Federal System Total	7,118,606		

* Includes only half of total Yellowtail generation, which is marketed by the Eastern Division, P-S MBP.

6. Fish Management

Rainbow smelt are the primary forage species in both Garrison and Oahe. Successful rainbow smelt reproduction is dependent on many factors including stable reservoir levels during the smelt spawning period, generally in April and early May. Most eggs are laid in water less than 1-foot deep and are subject to desiccation through wave action and slight drops in water level. In the Fort Peck reservoir, a forage fish spawn normally occurs between April 15 and May 30. As per the 2005-2006 AOP, if runoff was not sufficient to keep all pool levels rising during the fish spawn in 2006, the Corps would, to the extent reasonably possible, set releases to result in a steady-to-rising pool level in Lake Sakakawea during April and May. Reservoir levels rose in the spring of 2006 in Fort Peck, Garrison, and Oahe reservoirs. However, despite the rising pool levels in Lake Sakakawea and favorable weather conditions, smelt spawning success appeared to be poor. The lack of success was attributed to the lack of suitable spawning substrate. In Oahe the number of adult smelt spawning was average but larval smelt surveys revealed peak larval densities to be half of that observed in 2005. It was the first decline in larval smelt densities detected by the South Dakota Game, Fish and Parks since 2001.

Table 16

Historical Generation and Load Data - Peaks
Eastern Division, Pick-Sloan Missouri River Program*
Data at plant - 1,000 kW
January 1, 2006 through December 31, 2006

Period	Corps of Engineers Peak Hour Generation (Gross)	(plus)	USBR Hourly Generation (Gross)	(equals)	Federal Peak Hour Generation (Gross)	(plus)	Interchange and Purchases Received**	(equals)	Total System Load**
January	1,252		39		1291		-74		1217
February	1,433		43		1476		-100		1376
March	1,383		37		1420		-368		1052
April	1,099		52		1151		-53		1098
May	1,528		37		1565		-246		1319
June	1,718		36		1754		-235		1519
July	1,756		34		1790		227		2017
August	1,759		30		1789		-189		1600
September	1,473		31		1504		-323		1181
October	973		35		1008		152		1160
November	1,155		35		1190		554		1744
December	1,510		35		1545		140		1685

* This tabulation summarizes the total gross generation and power operations for the Eastern Division marketing area system shown on Table 15.
** During hour of Federal peak hour generation.

Table 17

Historical Generation and Load Data - Total
Eastern Division, Pick-Sloan Missouri Basin Program*
Data at plant - 1,000 kWh
January 1, 2006 through December 31, 2006

Period	Corps of Engineers Generation (Gross)	(plus)	USBR Generation (Gross)	(equals)	Federal Generation (Gross)	(plus)	Scheduled Interchange and Purchases Received	(equals)	Total System Load
January	450,063		57,190		507,253		470,000		977,253
February	391,649		50,643		442,292		458,000		900,292
March	489,192		54,466		543,658		440,000		983,658
April	413,738		58,089		471,827		352,000		823,827
May	528,985		59,892		588,877		235,000		823,877
June	669,620		53,320		722,940		229,000		951,940
July	768,407		47,929		816,336		200,000		1,016,336
August	829,509		42,217		871,726		277,000		1,148,726
September	578,094		36,032		614,126		357,000		971,126
October	334,288		37,311		371,599		449,000		820,599
November	358,451		36,434		394,885		552,000		946,885
December	463,186		39,868		503,054		486,000		989,054

*Powerplants from Table 15

The ongoing drought has continued to cause a decline in coldwater habitat in the Garrison reservoir. The Corps has installed plywood barriers on the trash racks on the intake structures of powerplant units 2 and 3. In addition hydropower peaking patterns were adjusted to try to limit the volume of cold water released. As shown on ***Plate 5***, the measures preserved coldwater habitat through the summer, but the volume of optimal habitat was very low for a few weeks in the late summer.

7. Threatened and Endangered Species

This was the 21st year of reservoir regulation since the plover and tern were Federally listed as threatened and endangered species, respectively. This was the first year of operating for the pallid sturgeon per the revised Master Manual. A spring pulse was released from Gavins Point Dam in May to attempt to create conditions needed to initiate pallid sturgeon spawning. Refer to Section II.C.6.h. of this report for a summary of the 2006 Gavins Point Spring Pulse. Refer to the Omaha District website ***https://www.nwo.usace.army.mil/html/pm-c/PMCBiOp.htm*** for recovery information and results.

The terns and plovers nest on sparsely vegetated sandbars, islands, and shoreline of the Missouri River and System reservoirs. Stream gages have been installed on the Missouri River to monitor stream flows during the nesting season. These gages provide a check, as well as a stage history, throughout the season to help relate the effects of regulation and natural events at intervals along the river. The gaging data must be supplemented with observations of nesting activities and conditions to provide the information that is needed for regulation. A dynamic flow routing model has been developed to accurately predict river stages along the river for different combinations of daily and hourly power-peaking.

Beginning in 1999, the Omaha District created a computerized Threatened and Endangered Species Data Management System. Report data, which is updated daily, includes nest records, census and productivity data, site descriptions, field journals, and messages. This database provided vital information again during the 2006 nesting season and proved to be a valuable tool in aiding release decisions benefiting the terns and plovers.

Although following the listing the Corps prevented inundation of nests, where possible, and created habitat, fledging continued to be lower than predicted by the USFWS 1990 Biological Opinion until 1998, when fledge ratios exceeded the goal for both species. Predation, habitat degradation, severe weather, nest inundation, record runoff, and other factors contributed to the previously disappointing low fledging. The record fledging that occurred for both species in 1998 and the subsequent above-average and new record fledge ratios achieved since then can be attributed to the large amount of habitat created by the high flows of 1997 and the declining reservoir levels during the current drought. The creation of additional habitat has also allowed greater flexibility in the release levels at the lower two System projects.

During CY 2006, the majority of plovers were again found on the Garrison reservoir, below Gavins Point and on the Oahe reservoir. The number of adults of both species was lower than the record numbers experienced in 2005. Fledge ratios were also lower, falling to 0.78 chicks per pair of plovers and 0.80 chicks per pair of interior least terns. The majority of least terns were found on the Missouri River reaches below the Gavins Point and Garrison dams. Fifty-six piping plover eggs were inundated at the Garrison reservoir as a result of rising pools during the nesting season. Another 36 were flooded below Gavins Point.

The population distribution and productivity for terns and plovers for 1986 through 2006 are shown on ***Tables 18*** and ***19***. Productivity estimates for these birds on the Missouri River does not include least terns and piping plovers raised in captivity. The captive rearing facility was not utilized in 2006. Adult birds in this table are considered breeders even though they may not have had nesting success. The term "fledglings/pair" refers to the number of young birds produced per breeding pair. This ratio is an estimate, as the fate of every single fledgling is impossible to obtain.

8. Recreation and Resource Management

The System reservoirs provide outstanding opportunities for boating, fishing, swimming, camping, and other outdoor recreation pursuits. Tourism related to the reservoirs is a major economic factor in all of the states adjoining the System. However, during extended drought periods, such as the Missouri River basin is currently experiencing, recreation may be adversely affected. The pool levels at the upper three large reservoirs, Fort Peck, Garrison, and Oahe, have been the most affected by the drought. Due to their relatively small size, the lower three reservoirs are regulated in a similar manner year-to-year and are not significantly impacted by the drought. The low pool levels at the upper three reservoirs make some boat ramps unusable, expose large areas of beach and sometimes make areas of the reservoirs unreachable. Thus, the low pools adversely affect recreation activities such as boating, fishing, swimming, and camping.

During CY 2006 the Corps spent approximately $198,000 extending and relocating boat ramps to maintain public access where such work was feasible. Considerable effort has been required by all parties involved to maintain recreation access to the reservoirs as the drought progresses. However, in some locations it is impossible to extend or relocate boat ramps due to the local topography. Of the 11 reservoir access areas located on the Fort Peck reservoir, 9 ramps were usable for approximately 2 months beginning in the spring, and then 8 remained in operation for all or most of the remainder of the 2006 recreation season. At Garrison, 22 of the total 35 reservoir access areas were available for the majority of the recreation season. At Oahe, 8 of 13 access areas were available on the North Dakota portion of the reservoir although all 8 of these were in river conditions; and 13 of 27 were available on the South Dakota portion in 2006. Access areas at the upper three reservoirs include Corps-owned as well as Tribal, state, and privately-owned facilities. In 2002, many of the Federal recreation areas and boat ramps in South Dakota

Table 18
Missouri River System
Interior Least Tern Survey Data

	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Fort Peck Lake																					
Adults	-	4	3	4	6	10	0	7	9	2	0	0	4	0	0	0	0	2	0	0	2
Fledglings/Pair	-	-	0	3.00	-	0.40	{}	0	0.44	0	0	0	0	0	0	0	0	0	0	0	3
Fort Peck to Lake Sakakawea																					
Adults	-	-	18	48	92	66	110	31	58	95	128	162	25	40	13	39	34	38	48	34	36
Fledglings/Pair	-	-	0.33	0	0.17+	0.55+	0.25+	0.45+	1.41+	0.99+	0.33	0.53	.1.52	1.70	0.15	0.97	0.59	0.63	0.50	2.18	1.17
Lake Sakakawea																					
Adults	-	-	7	15	6*	8	29+	17	35	7	27	2	23	9	10	34	21	25	16	26	48
Fledglings/Pair	-	-	0	0	-	-	0.83+	0.12+	0	0	0.15	0	1.04	0.67	0.20	0.76	0.86	0.56	0.88	0.31	0.71
Garrison to Lake Oahe																					
Adults	171	175	142	121	174	195	198	145	217	284	105	41	141	105	105	125	126	144	142	157	139
Fledglings/Pair	-	-	0.93	0.43	0.44+	0.58	0.48	0.28	0.54	0.91	0.08	0.39	1.52	1.50	1.03	1.26	1.83	1.28	1.13	0.73	0.81
Lake Oahe																					
Adults	16*	21*	82	97	100	143	124	125	160	84	74	101	110	57	85	94	106	70	73	131	128
Fledglings/Pair	0.75	1.62	0	0	-	-	0.42	0	0.06	0	0.24	0.16	1.29	0.88	1.01	1.34	1.32	1.20	1.26	0.87	1.14
Ft. Randall to Niobrara																					
Adults	25	60	0	4	26	32	13	38	43	10	2	0	64	124	72	71	84	50	71	76	55
Fledglings/Pair	0.48	0.43	0	0	0.31+	0.63	0.46	0	0	0	0	0	0.94	1.03	1.26	0.14	0.71	0.92	0.37	0.47	0.69
Lake Lewis and Clark																					
Adults	0	0	45	29	63	55	29	76	44	16	28	60	120	76	44	58	46	46	13	4	0
Fledglings/Pair	-	-	0.13	0.62	0.35+	0	1.59	0.97	0	0	0	1.57	2.33	0.21	0.38	1.17	1.04	0.39	0.00	0.00	0.00
Gavins Point to Ponca																					
Adults	181	232	252	210	167	193	187	272	211	93	82	115	148	161	149	232	314	366	359	476	383
Fledglings/Pair	0.26	0.46	0.49	0.55	0.46+	0.26	0.21	0.83	0.48	0.49	0.27	0.90	2.27	2.41	1.72	1.09	1.32	0.75	1.04	1.34	0.63
Total Adults	393	492	549	528	634	702	690	711	777	591	446	481	635	572	551	653	731	741	722	904	802**
Fledglings/Pair	0.26	0.46	0.59	0.54	0.38	0.41	0.42	0.50	0.41	0.67	0.21	0.66	1.73	1.42	1.22	1.04	1.27	0.87	0.95	1.09	.80**

5-Year Running Average Interior Least Tern Fledge Ratio Goal = 0.94

- Data not collected
* Partial Survey Results
{} No Birds Found
\+ Subsamplng of Selected Nesting Areas
** includes adults and fledglings from Lake Francis Case

The data does not include least terns and piping plovers raised in captivity. The data represents only wild fledged birds.
From 1990 to 2003 the 10-Year Least Tern Fledge Ratio was 0.70 (1990 and 2000 Biological Opinions).
From 2004 to current 5-Year running average goal is 0.94 (2003 Amended Biological Opinion)
Data in this table may differ from previous reports. As information becomes available, this table is updated.

Table 19
Missouri River System
Piping Plover Survey Data

	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Fort Peck Lake																					
Adults	16	10	20	12	22	25	26	30	4	5	0	0	4	2	0	4	2	17	9	26	20
Fledglings/Pair	-	-	1.70	1.50	3.18	1.20	1.00	0.60	1.50	1.20	0	0	0	2.00	0	1	2	0.35	2.22	1.08	1.2
Fort Peck to Lake Sakakawea																					
Adults	-	-	5	11	17	13	0	4	9	20	24	23	4	5	4	3	2	6	0	2	5
Fledglings/Pair	-	-	0	0.18	0	0	{}	0+	0	3.50	1.00	0.87	1.00	0	0	1.33	0	2.67	0	4	0.4
Lake Sakakawea																					
Adults	-	-	143	57	132	150	108	8	45	24	70	3	119	83	277	424	469	528	738	746	430
Fledglings/Pair	-	-	0	0	-	-	1.50	8.5+	1.24	0	0.57	0.67	1.24	1.25	1.61	1.25	1.65	1.06	1.5	0.89	0.61
Garrison to Lake Oahe																					
Adults	139	160	113	84	71	124	77	127	119	261	45	6	74	139	99	149	119	149	164	220	175
Fledglings/Pair	-	-	0.97	0.26	1.04+	1.13+	1.06+	0.54+	0.87	0.87	0.09	0	1.84	0.88	1.41	1.53	2.03	1.66	1.16	0.8	0.77
Lake Oahe																					
Adults	4*	4*	55	140	88	87	143	66+	85	30	21	31	98	46	141	184	203	301	372	364	331
Fledglings/Pair	-	2.50*	0	0	-	-	0.97+	0.33	0.09	0.93	0.29	1.29	1.06	0.30	1.45	1.41	2.16	1.84	1.41	1.21	0.99
Ft. Randall to Niobrara																					
Adults	11	16	0	0	12	25	8	12	17	0	3	0	33	51	62	38	35	37	42	42	37
Fledglings/Pair	0.18	0.13	0	0	0.67*	0.48	0.75	0	0	0	0	0	1.27	1.02	0.87	0.74	1.03	1.46	0.71	0.81	0.38
Lake Lewis and Clark																					
Adults	0	0	31	18	30	33	6	32	12	4	6	32	84	67	28	34	44	14	0	24	4
Fledglings/Pair	-	-	0.06	0.56	0.67+	0	0	0.06	0.33	0	0	1.25	2.45	0.30	0.5	0.71	1.68	1.57	0	0.17	0.5
Gavins Point to Ponca																					
Adults	172	177	212	122	148	166	112	109	62	63	22	22	49	141	186	218	260	286	262	340	309
Fledglings/Pair	0.05	1.13	0.62	0.21	0.39+	0.35	0.34	1.06	0.61	0.16	0	0	2.20	1.60	2.17	1.85	2.29	1.9	1.87	1.97	0.78
Total Adults	342	367	579	444	521	623	480	388	353	407	191	117	465	534	797	1054	1134	1338	1587	1764	1311
Fledglings/Pair	0.06	1.08	0.73	0.32	0.76	0.62	0.94	0.76	0.61	0.84	0.39	0.87	1.61	1.01	1.58	1.41	1.91	1.5	1.49	1.15	0.78

10-Year Running Average Piping Plover Fledge Ratio Goal = 1.22

- Data not collected
* Partial Survey Results
{} No Birds Found
\+ Subsamplng of Selected Nesting Areas

The data does not include least terns and piping plovers raised in captivity. The data represents only wild fledged birds.
From 1990 to 2000 the 15-Year Piping Plover Fledge Ratio Goal was 1.44 (1990 Biological Opinion).
From 2001 to 2003 the goal was 1.13 (2000 Biological Opinion)
From 2004 to current the 10-year running average goal is 1.22 (2003 Amended Biological Opinion)
Data in this table may differ from previous reports. As information becomes available, this table is updated.

were turned over in fee title to the state of South Dakota and the Bureau of Indian Affairs through the Title VI process. Since the land transfer, both the Federal treasury and the Corps have provided money to the South Dakota Game Fish and Parks, Cheyenne River Sioux Tribe, and Lower Brule Sioux Tribe for operations and stewardship of the Title VI lands they received. Congress is also capitalizing a trust fund to cover these costs in the future.

During 2006, public use at these reservoirs totaled 41,687,500 visitor hours, an 8% increase from 2005. Visitor attendance figures at the System projects from 2003 through 2006 are shown in ***Table 20***. Overall, visitation in 2006 was up 8 percent over 2005. Garrison, Oahe and Big Bend experienced over 10 percent increases during 2006; Fort Randall experienced the large decrease at 6 percent. ***Figure 12*** displays recreation related visitor hours at each of the six mainstem projects for the years 1954 through 2006. Although the drought has had an impact on visitation during the past 5 years, much of the reduction shown in Figure 12 is attributed to the data collection changes associated with the South Dakota Title VI land transfer mentioned previously. Since the land transfer occurred, the Corps has not collected visitation data consistent with previous years at the recreation sites in South Dakota. The 2006 visitation in South Dakota presented in ***Table 20*** and ***Figure 12*** reflects water-related use on the reservoirs but not the visitation at the campgrounds that were turned over to the State of South Dakota.

The reporting method was changed from recreation days to visitor hours in 1987, and the reporting period was changed from calendar year to fiscal year in 1989 for all Corps projects. All Corps projects, including the System projects, are now reporting visitation using the Visitation Estimation Reporting System (VERS).

Table 20
Visitation at System Reservoirs in Visitor Hours

Mainstem Project	2003	2004	2005	2006	Percent Change 2005-2006
Fort Peck	5,128,000	5,252,800	5,445,900	5,374,200	-1
Garrison	14,626,600	13,894,500	12,698,600	14,016,900	+10
Oahe	7,933,300	7,140,000	7,700,600	9,009,700	+17
Big Bend	5,701,600	3,433,500	2,980,900	3,325,000	+12
Fort Randall	1,265,500	1,275,400	1,103,600	1,033,400	-6
Gavins Point	8,744,400	8,907,900	8,800,200	8,928,300	+1
System Total	**43,399,400**	**39,904,100**	**38,729,800**	**41,687,500**	**+8**

Beginning in January 2003 and running through 2006, the nation commemorated the 200th anniversary of the Lewis and Clark Expedition. An increase in visitation was observed at points of interest along the entire route taken by the Captains and the expedition members. Because the Corps has management responsibilities on more of the route than any other entity (90%) and because of its Army heritage of exploring and mapping the western United States, the Corps played a key leadership role in the observance of the Lewis and Clark Expedition Bicentennial. The Corps worked with other Federal, Tribal, state, and local governments; the National Council for the Lewis and Clark Bicentennial (Council), and the Lewis and Clark Trail Heritage Foundation to ensure that adequate facilities and information were available to accommodate the increased visitation, to ensure a safe visitor experience, to protect the natural and cultural resources, and to plan and coordinate commemorative activities.

In 2000, the Council decided to highlight some of the more nationally significant festivals and events commemorating the journey of Lewis and Clark and the members of the Expedition. The Council designated these significant events as "Signature Events". Signature Events were commemorations that were of nationwide historical significance, had the potential for high visitation, and were multicultural in nature. The year 2004 saw the beginning of the Lewis and Clark Bicentennial Commemorations in the Missouri River basin. There were seven Lewis and Clark Signature Events held in 2004, each with a different theme and focus. These events continued in 2005, with two additional Signature Events. CY 2006 marked the end of the Lewis and Clark Bicentennial. There were four Signature Events scheduled – three of which were held in the Missouri Basin.

These events were all very well attended, with visitation occurring from all over the United States, Canada, and Europe. Visitation to these multi-day events ranged between 20,000 and 50,000 per event. The Corps participated in these events by offering a variety of venues. The Corps' National Lewis and Clark team provided school programs, recreated a Lewis and Clark camp complete with period-uniformed re-enactors, set up and manned several different displays, and arranged performances and lectures by numerous individuals.

9. Cultural Resources.

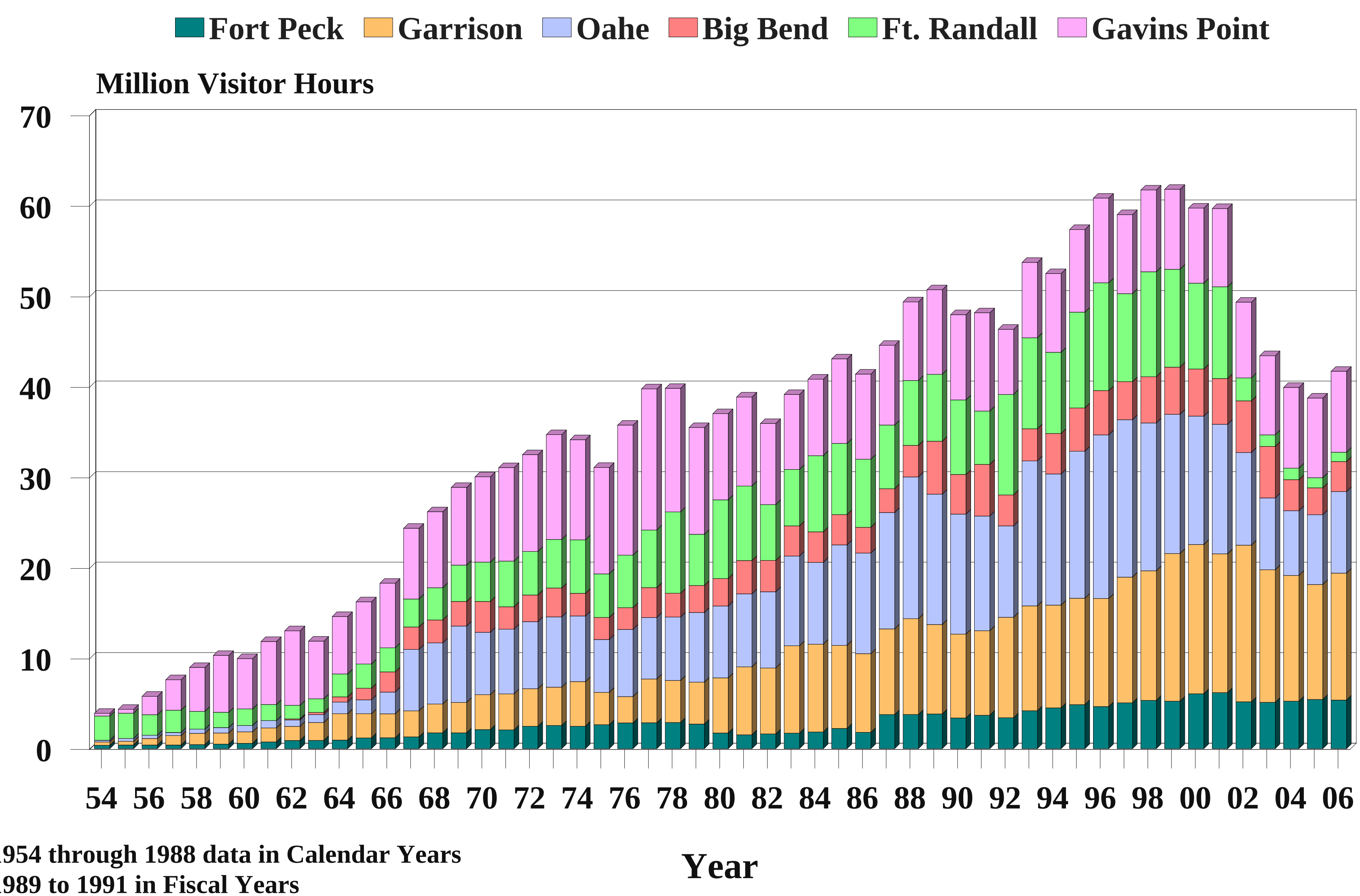
As acknowledged in the 2004 Programmatic Agreement for the Operation and Management of the Missouri River Main Stem System (PA), wave action and the fluctuation of reservoirs levels results in erosion along the banks of the reservoirs. With the recent drought conditions, additional cultural resource sites have become exposed as the pool levels have declined. The Corps will continue to work with the Tribes utilizing 36 CFR Part 800 and the PA to address the exposure of these sites. The objective of a programmatic agreement is to deal "…with the potential adverse effects of complex projects or multiple undertakings…" The objective of the PA was to collaboratively develop a preservation program that would avoid, minimize, and/or mitigate the adverse effects of the System regulation.

The planned preservation program is outlined by multiple stipulations in the PA. One of the stipulations, or program components, is the 5-year plan. This plan outlines how the Corps will accomplish its responsibilities under the PA and National Historic Preservation Act. The "Draft Five Year Plan, dated February 2005" (see website ***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 the Corps' lands within the System.

Under the terms of Stipulation 18 of the 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 AOPs under 36 CFR Part 800, the PA, and Executive Order 13175. The planning process for consultation on the Draft and Final 2006-2007 AOPs consisted of a series of informational meetings and government to government consultation with Tribes requesting such meetings. During the summer and fall of 2006 three informational meetings were held on August 15-16, 2006 in Pierre, South Dakota, September 12, 2006 in Rapid City, South Dakota, and November 9, 2006 in Pierre, South Dakota for the Draft and Final 2006-2007 AOP's.

System Project Visits

1954 to 2006



1954 through 1988 data in Calendar Years
1989 to 1991 in Fiscal Years
1992 to present in VERS System
2002 to present reflect changed accounting due to Title VI land transfer to State of South Dakota

Figure 12

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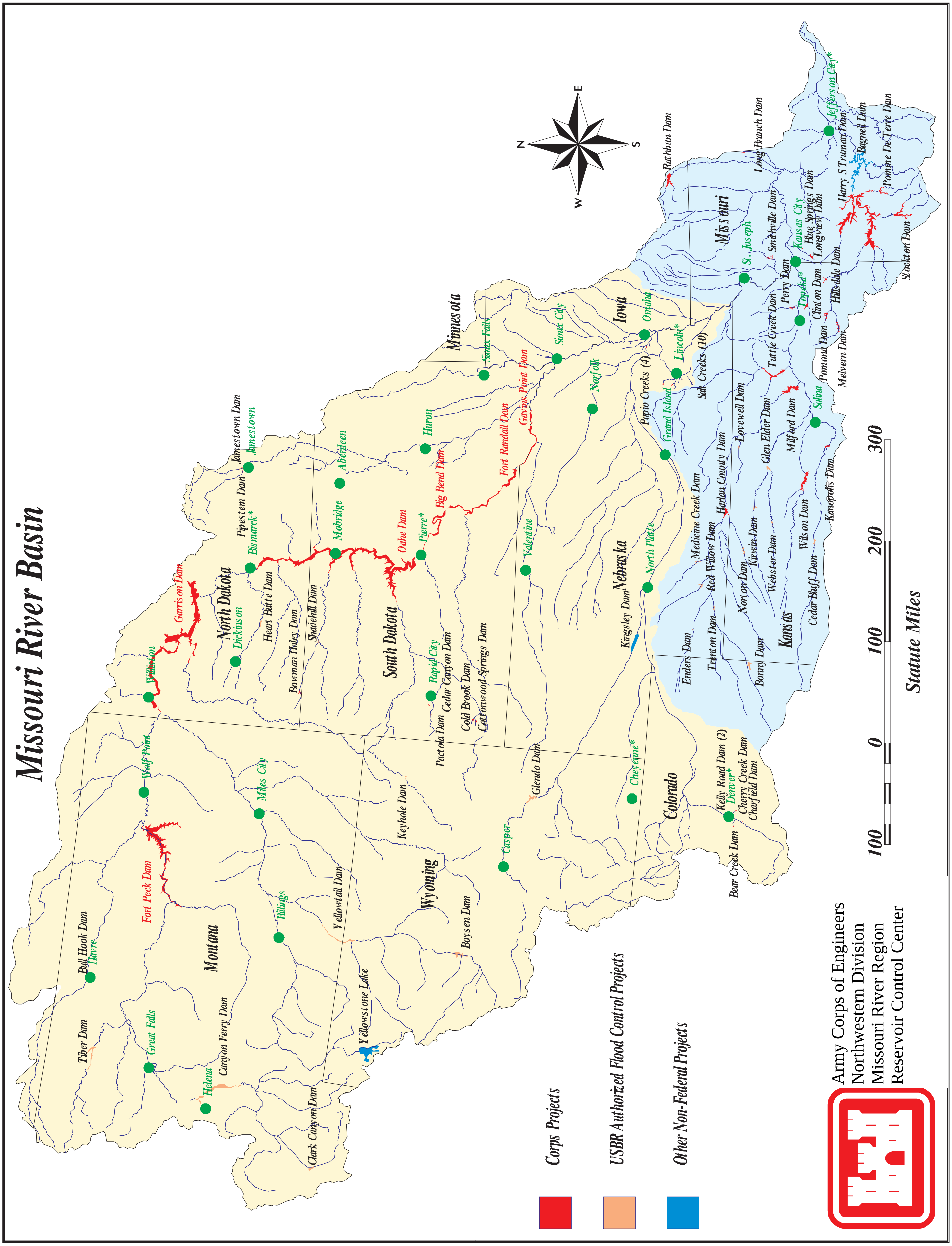

Missouri River Basin
Corps Projects
USBR Authorized Flood Control Projects
Other Non-Federal Projects
Statute Miles
100 0 100 200 300
Army Corps of Engineers
Northwestern Division
Missouri River Region
Reservoir Control Center
N
S
E
W
Montana
Wyoming
North Dakota
South Dakota
Nebraska
Kansas
Colorado
Iowa
Minnesota
Missouri
Tiber Dam
Bull Hook Dam
Havre
Great Falls
Helena
Canyon Ferry Dam
Clark Canyon Dam
Fort Peck Dam
Wolf Point
Williston
Garrison Dam
Billings
Yellowtail Dam
Yellowstone Lake
Miles City
Boysen Dam
Keyhole Dam
Casper
Glendo Dam
Cheyenne*
Denver*
Bear Creek Dam
Kelly Road Dam (2)
Cherry Creek Dam
Chatfield Dam
Dickinson
Heart Butte Dam
Bowman Haley Dam
Shadehill Dam
Bismarck*
Pipestem Dam
Jamestown Dam
Jamestown
Mobridge
Aberdeen
Oahe Dam
Pierre*
Big Bend Dam
Huron
Fort Randall Dam
Gavins Point Dam
Sioux Falls
Sioux City
Rapid City
Cedar Canyon Dam
Cold Brook Dam
Cottonwood Springs Dam
Pactola Dam
Valentine
Norfolk
North Platte
Kingsley Dam
Grand Island
Papio Creeks (4)
Omaha
Lincoln*
Salt Creeks (10)
Enders Dam
Trenton Dam
Medicine Creek Dam
Red Willow Dam
Harlan County Dam
Lovewell Dam
Norton Dam
Kirwin Dam
Webster Dam
Bonny Dam
Glen Elder Dam
Cedar Bluff Dam
Wilson Dam
Kanopolis Dam
Milford Dam
Salina
Tuttle Creek Dam
Perry Dam
Topeka*
Clinton Dam
Pomona Dam
Melvern Dam
Hillsdale Dam
St. Joseph
Smithville Dam
Kansas City
Blue Springs Dam
Longview Dam
Harry S Truman Dam
Stockton Dam
Pomme De Terre Dam
Bagnell Dam
Jefferson City*
Long Branch Dam
Rathbun Dam

Plate 1

Item No.	Summary of Engineering Data -- Missouri River Mainstem System 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
	Dam and Embankment			
10	Top of dam, elevation in feet msl	2280.5	1875	1660
11	Length of dam in feet	21,026 (excluding spillway	11,300 (including spillway	9,300 (excluding spillway
12	Damming height in feet (5)	220	180	200
13	Maximum height in feet (5)	250.5	210	245
14	Max. base width, total & w/o berms in feet	3500, 2700	3400, 2050	3500, 1500
15	Abutment formations (under dam & embankment)	Bearpaw shale and glacial fill	Fort Union clay shale	Pierre shale
16	Type of fill	Hydraulic & rolled earth fill	Rolled earth filled	Rolled earth fill & shale berms
17	Fill quantity, cubic yards	125,628,000	66,500,000	55,000,000 & 37,000,000
18	Volume of concrete, cubic yards	1,200,000	1,500,000	1,045,000
19	Date of closure	24 June 1937	15 April 1953	3 August 1958
	Spillway Data			
20	Location	Right bank - remote	Left bank - adjacent	Right bank - remote
21	Crest elevation in feet msl	2225	1825	1596.5
22	Width (including piers) in feet	820 gated	1336 gated	456 gated
23	No., size and type of gates	16 - 40' x 25' vertical lift gates	28 - 40' x 29' Tainter	8 - 50' x 23.5' Tainter
24	Design discharge capacity, cfs	275,000 at elev 2253.3	827,000 at elev 1858.5	304,000 at elev 1644.4
25	Discharge capacity at maximum operating pool in cfs	230,000	660,000	80,000
	Reservoir Data (6)			
26	Max. operating pool elev. & area	2250 msl 246,000 acres	1854 msl 380,000 acres	1620 msl 374,000 acres
27	Max. normal op. pool elev. & area	2246 msl 240,000 acres	1850 msl 364,000 acres	1617 msl 360,000 acres
28	Base flood control elev & area	2234 msl 212,000 acres	1837.5 msl 307,000 acres	1607.5 msl 312,000 acres
29	Min. operating pool elev. & area	2160 msl 90,000 acres	1775 msl 128,000 acres	1540 msl 117,000 acres
	Storage allocation & capacity			
30	Exclusive flood control	2250-2246 975,000 a.f.	1854-1850 1,489,000 a.f.	1620-1617 1,102,000 a.f.
31	Flood control & multiple use	2246-2234 2,717,000 a.f.	1850-1837.5 4,222,000 a.f.	1617-1607.5 3,201,000 a.f.
32	Carryover multiple use	2234-2160 10,785,000 a.f.	1837.5-1775 13,130,000 a.f.	1607.5-1540 13,461,000 a.f.
33	Permanent	2160-2030 4,211,000 a.f.	1775-1673 4,980,000 a.f.	1540-1415 5,373,000 a.f.
34	Gross	2250-2030 18,688,000 a.f.	1854-1673 23,821,000 a.f.	1620-1415 23,137,000 a.f.
35	Reservoir filling initiate	November 1937	December 1953	August 1958
36	Initially reached min. operating poo	27 May 1942	7 August 1955	3 April 1962
37	Estimated annual sediment inflow	18,100 a.f. 1030 yrs.	25,900 a.f. 920 yrs.	19,800 a.f. 1170 yrs.
	Outlet Works Data			
38	Location	Right bank	Right Bank	Right Bank
39	Number and size of conduits	2 - 24' 8" diameter (nos. 3 & 4)	1 - 26' dia. and 2 - 22' dia.	6 - 19.75' dia. upstream, 18.25' dia. downstream
40	Length of conduits in feet (8)	No. 3 - 6,615, No. 4 - 7,240	1529	3496 to 3659
41	No., size, and type of service gates	1 - 28' dia. cylindrical gate 6 ports, 7.6' x 8.5' high (net opening) in each control shaft	1 - 18' x 24.5' Tainter gate per conduit for fine regulation	1 - 13' x 22' per conduit, vertical lift, 4 cable suspension and 2 hydraulic suspension (fine regulation)
42	Entrance invert elevation (msl	2095	1672	1425
43	Avg. discharge capacity per conduit & total	Elev. 2250 22,500 cfs - 45,000 cfs	Elev. 1854 30,400 cfs - 98,000 cfs	Elev. 1620 18,500 cfs - 111,000 cfs
44	Present tailwater elevation (ft msl	2032-2036 5,000 - 35,000 cfs	1670-1680 15,000- 60,000 cfs	1423-1428 20,000-55,000 cfs
	Power Facilities and Data			
45	Avg. gross head available in feet (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	1,087	2,318	2,717
55	Initial generation, first and last uni	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

Plate 2A

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.
21 miles upstream Chamberlain, SD	Near Lake Andes, SD	Near Yankton, SD		1
Mile 987.4	Mile 880.0	Mile 811.1		2
249,330 (1) 5,840	263,480 (1) 14,150	279,480 (1) 16,000		3
80, ending near Pierre, SD	107, ending at Big Bend Dam	25, ending near Niobrara, NE	755 miles	4
200 (elevation 1420)	540 (elevation 1350)	90 (elevation 1204.5)	5,940 miles	5
28,900	30,000 1,100	32,000 2,000		6
440,000 (April 1952)	447,000 (April 1952)	480,000 (April 1952)		7
1959	1946	1952		8
1964	1953	1955		9
1440	1395	1234		10
10,570 (including spillway	10,700 (including spillway	8,700 (including spillway	71,596	11
78	140	45	863 feet	12
95	165	74		13
1200, 700	4300, 1250	850, 450		14
Pierre shale & Niobrara chalk	Niobrara chalk	Niobrara chalk & Carlile shale		15
Rolled earth, shale, chalk fill	Rolled earth fill & chalk berms	Rolled earth & chalk fill		16
17,000,000	28,000,000 & 22,000,000	7,000,000	358,128,000 cu. yds	17
540,000	961,000	308,000	5,554,000 cu. yds.	18
24 July 1963	20 July 1952	31 July 1955		19
Left bank - adjacent	Left bank - adjacent	Right bank - adjacent		20
1385	1346	1180		21
376 gated	1000 gated	664 gated		22
8 - 40' x 38' Tainter	21 - 40' x 29' Tainter	14 - 40' x 30' Tainter		23
390,000 at elev 1433.6	620,000 at elev 1379.3	584,000 at elev 1221.4		24
270,000	508,000	345,000		25
1423 msl 61,000 acres	1375 msl 102,000 acres	1210 msl 31,000 acres	1,194,000 acres	26
1422 msl 60,000 acres	1365 msl 95,000 acres	1208 msl 28,000 acres	1,147,000 acres	27
1420 msl 57,000 acres	1350 msl 77,000 acres	1204.5 msl 24,000 acres	989,000 acres	28
1415 msl 51,000 acres	1320 msl 38,000 acres	1204.5 msl 24,000 acres	450,000 acres	29
1423-1422 60,000 a.f.	1375-1365 985,000 a.f.	1210-1208 59,000 a.f.	4,670,000 a.f.	30
1422-1420 117,000 a.f.	1365-1350 1,309,000 a.f.	1208-1204.5 90,000 a.f.	11,656,000 a.f.	31
	1350-1320 1,607,000 a.f.		38,983,000 a.f.	32
1420-1345 1,621,000 a.f.	1320-1240 1,517,000 a.f.	1204.5-1160 321,000 a.f.	18,023,000 a.f.	33
1423-1345 1,798,000 a.f.	1375-1240 5,418,000 a.f.	1210-1160 470,000 a.f.	73,332,000 a.f.	34
November 1963	January 1953	August 1955		35
25 March 1964	24 November 1953	22 December 1955		36
4,300 a.f. 430 yrs.	18,300 a.f. 250 yrs.	2,600 a.f. 180 yrs.	92,500 a.f.	37
	Left Bank			38
None (7)	4 - 22' diameter	None (7)		39
	1013			40
	2 - 11' x 23' per conduit, vertical lift, cable suspension			41
1385 (11)	1229	1180 (11)		42
	Elev 1375 32,000 cfs - 128,000 cfs			43
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
1,001	1,778	740	9,642 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

Remarks

(1) Includes 4,280 square miles of non-contributing areas.
(2) Includes 1,350 square miles of non-contributing areas.
(3) With pool at base of flood control.
(4) Storage first available for regulation of flows
(5) Damming height is height from low water to maximum operating pool. Maximum height is from average streambed to top of dam.
(6) Based on latest available storage data.
(7) River regulation is attained by flows over low-crested spillway and through turbines.
(8) Length from upstream face of outlet or to spiral case.
(9) Based on 8th year (1961) of drought drawdown (From study 8-83-1985).
(10) Affected by level of Lake Francis case. Applicable to pool at elevation 1350.
(11) Spillway crest
(12) 1967-2006 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

Corps of Engineers, U.S. Army
Compiled by
Northwestern Division
Missouri River Region
January 2007

Plains Snow Depth (inches) - March 20, 2006

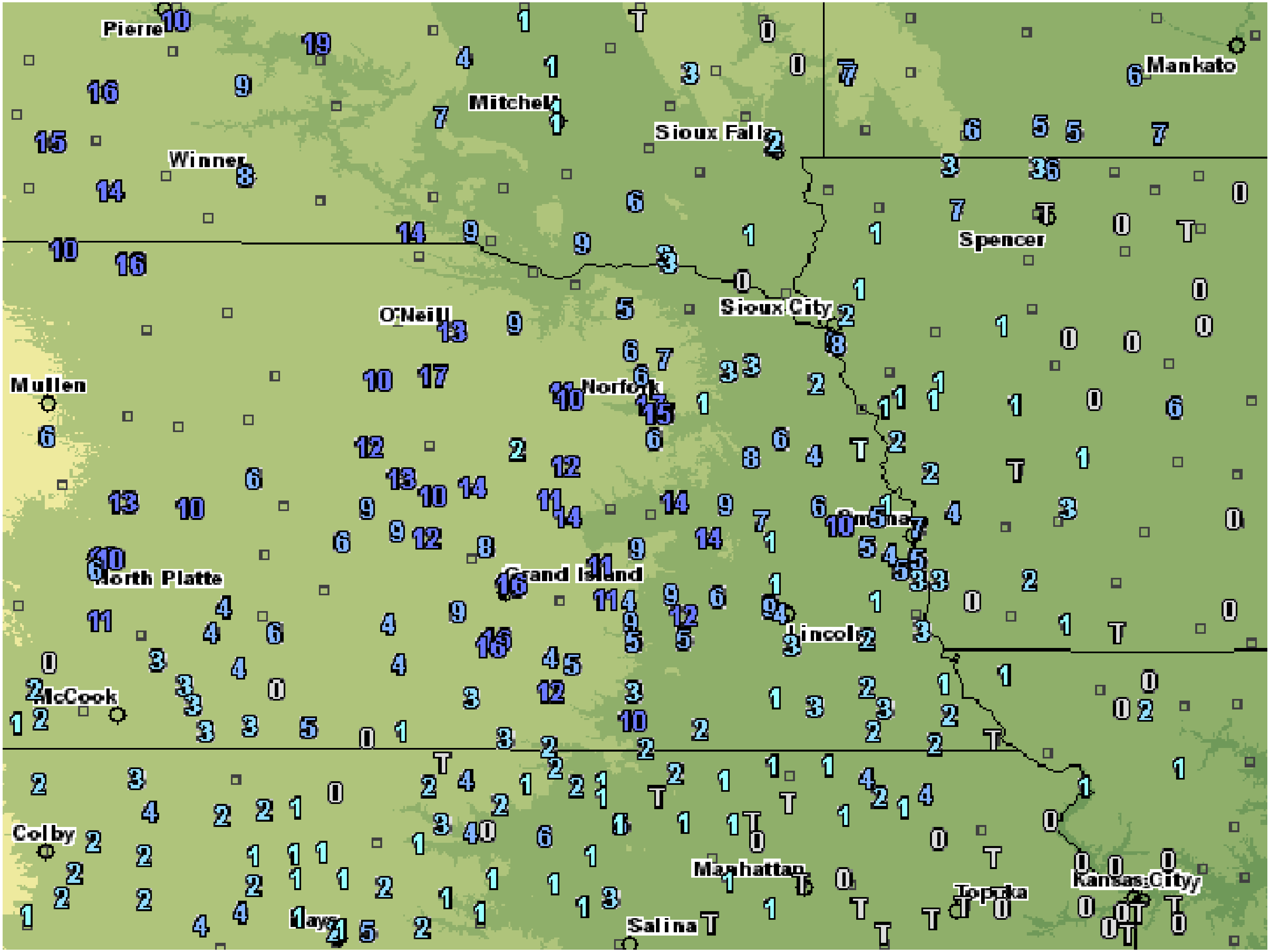


Plate 3

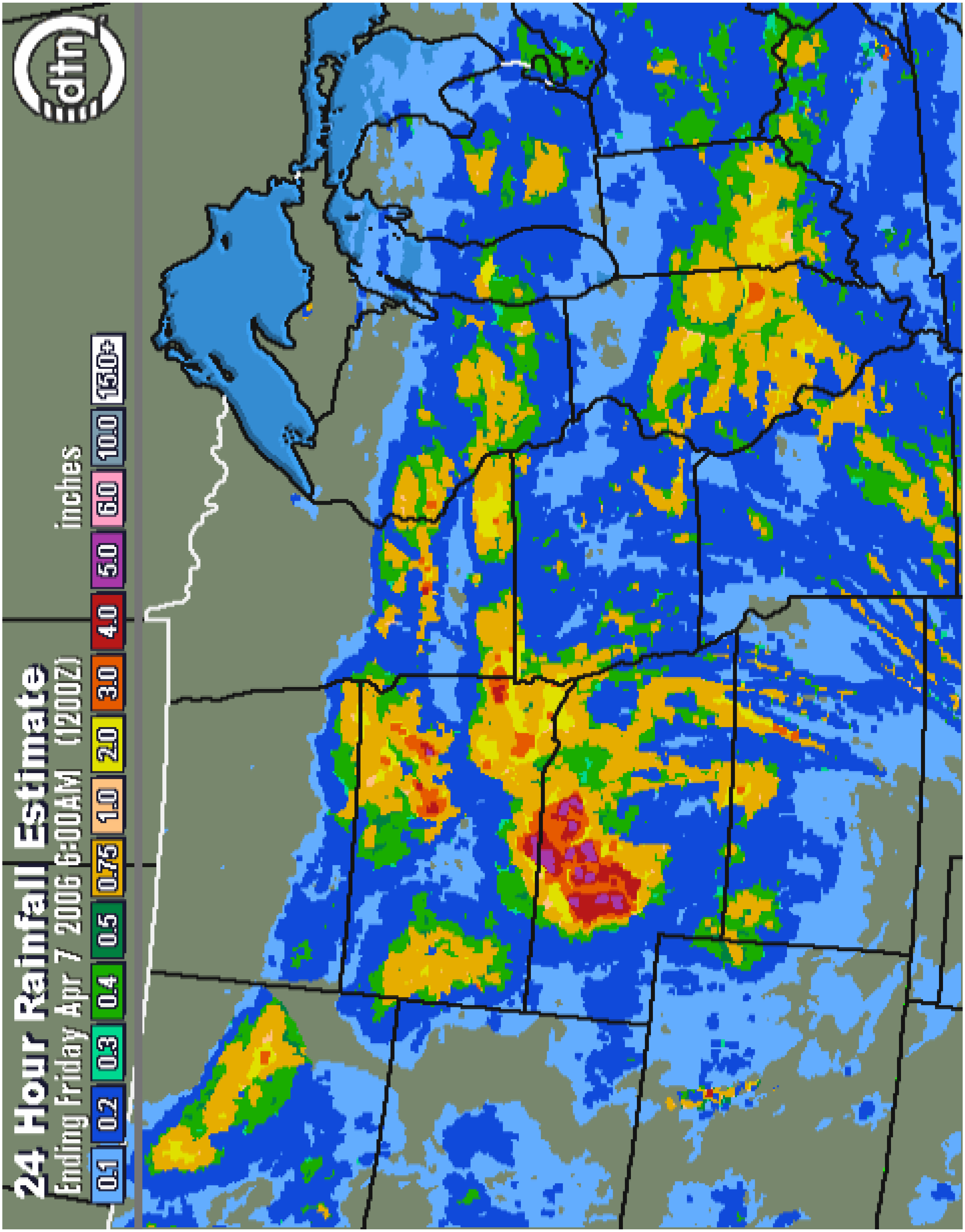
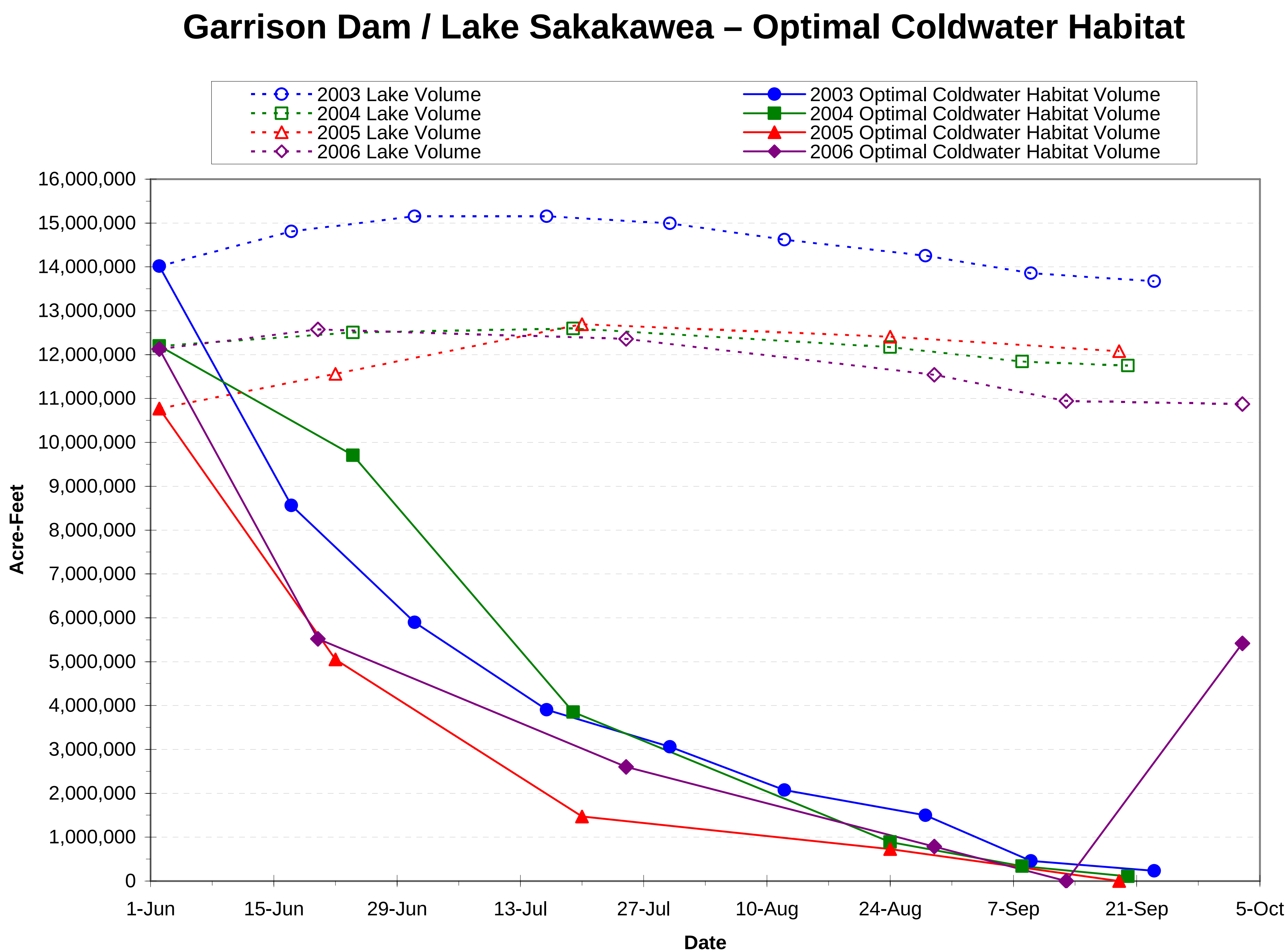

24 Hour Rainfall Estimate
Ending Friday Apr 7 2006 6:00AM (1200Z)
inches
0.1
0.2
0.3
0.4
0.5
0.75
1.0
2.0
3.0
4.0
5.0
6.0
10.0
15.0+
dtn

Plate 5



Garrison Dam / Lake Sakakawea – Optimal Coldwater Habitat
2003 Lake Volume
2004 Lake Volume
2005 Lake Volume
2006 Lake Volume
2003 Optimal Coldwater Habitat Volume
2004 Optimal Coldwater Habitat Volume
2005 Optimal Coldwater Habitat Volume
2006 Optimal Coldwater Habitat Volume
Acre-Feet
16,000,000
15,000,000
14,000,000
13,000,000
12,000,000
11,000,000
10,000,000
9,000,000
8,000,000
7,000,000
6,000,000
5,000,000
4,000,000
3,000,000
2,000,000
1,000,000
0
1-Jun
15-Jun
29-Jun
13-Jul
27-Jul
10-Aug
24-Aug
7-Sep
21-Sep
5-Oct
Date