INTRODUCTION

Annual reports on actual operations and operating plans for reservoir regulation activities were initiated in 1953. The Montana Area Office (MTAO), Wyoming Area Office (WYAO), Dakotas Area Office (DKAO) and the Regional Office are all responsible for preparing reports on actual operations and operating plans for reservoirs within the Upper Missouri River Basin above Sioux City, Iowa. This report briefly summarizes weather and streamflow conditions in the Upper Missouri River Basin during water year 2010, which are principal factors governing the pattern of reservoir operations. This report also describes operations during water year 2010 for reservoirs constructed by the Bureau of Reclamation (Reclamation) for providing flood control and water supplies for power generation, irrigation, municipal and industrial uses, and to enhance recreation, fish, and wildlife benefits.

This report includes operating plans to show estimated ranges of operation for water year 2011, with a graphical presentation on a monthly basis. The operating plans for the reservoirs are presented only to show possible operations under a wide range of inflows, most of which cannot be reliably forecasted at the time operating plans are prepared; therefore, plans are at best only probabilities. The plans are updated monthly as the season progresses as more reliable estimates of inflow become available.

A report section devoted to Energy Generation is included at the end of this report. The energy generation and water used for power at Reclamation and Corps of Engineers (Corps) plants are discussed, and the energy generated in 2010 is compared graphically with that of previous years. Energy produced at the Reclamation and Corps mainstem plants is marketed by the Department of Energy. Table CET6, entitled "Total Reservoir Storage Contents at the End of Water Years 2009 and 2010," compares the water storage available at the beginning of water year 2011 to that available at the beginning of water year 2010. Table CET7 is a summary of the end of month storage contents for each reservoir during water year 2010. The MTAO also assists in the preparation of plans for operation of the Corps reservoir on the mainstem of the Missouri River by furnishing depletion estimates based upon the operating plans presented in this report.

All references to a year in this report will mean the water year extending from October 1 through September 30, unless specifically stated otherwise.

SUMMARY OF HYDROLOGIC CONDITIONS

AND FLOOD CONTROL OPERATIONS DURING 2010

Antecedent Conditions:

The conditions that existed after the 2009 water year indicated that normal precipitation had returned to Montana. With cool temperatures and near average precipitation, the outlook for the upcoming year looked to provide favorable runoff conditions. Ending the water year, the Marias and St. Mary Basins in northwest Montana were still showing some signs of drought as the Mountain precipitation for the year finished out at around 75 percent of average. Valley precipitation for the water year finished out between 82 and 109 percent of average for all the basins east of the continental divide in Montana.

According to the Natural Resources Conservation Service (NRCS), the snowpack on April 1, 2009, ranged from 73 percent of average in the St. Mary Basin to 118 percent of average in the Milk River above Fresno. Snowpack continued to improve throughout April and by May 1 the snowpack ranged from 80 percent of average in the St. Mary drainage to 122 percent of average in the Beaverhead above Clark Canyon.

Water year 2009 ended with varying storage levels. Gibson Reservoir was at 20 percent of average while Lake Sherburne was 163 percent of average, and the big surprise for the year was that Clark Canyon Reservoir which had been at extremely low levels for the past eight years finished the year at 112 percent of average storage levels. The Reclamation reservoir with the least amount of carryover storage was Gibson Reservoir at 6 percent of full capacity.

October through December:

Precipitation for the 2010 water year started out much better than in recent years. Mountain precipitation throughout the basins in October ranged from 133 percent of average to 185 percent of average, while precipitation in the valleys in October ranged from 125 to 242 percent of average. By December, the accumulated precipitation declined due to a lack of weather patterns moving through November and December. By the end of December, the accumulated mountain precipitation ranged from 68 percent of average in the mountains above Lima Reservoir to 88 percent of average in the mountains above Tiber Reservoir. Valley precipitation ranged from 60 percent of average in the Madison Valley drainage to 221 percent of average in the Beaverhead Valley drainage. Precipitation data can be found in Tables MTT1A and MTT1B.

January through March:

During January through March time frame, things continued to look grim throughout the basins east of the continental divide with the exception of the Gallatin River Basin where valley precipitation remained near normal. During this timeframe, snowpack accumulated slowly, and very little snow cover could be found in the low lying areas. Reports were coming in that snowmobilers and skiers were having a hard time finding locations that favored winter sports, which correlated well with the precipitation data being collected.

TABLE MTT1A
PRECIPITATION IN INCHES AND PERCENT OF AVERAGE
2010 VALLEY PRECIPITATION

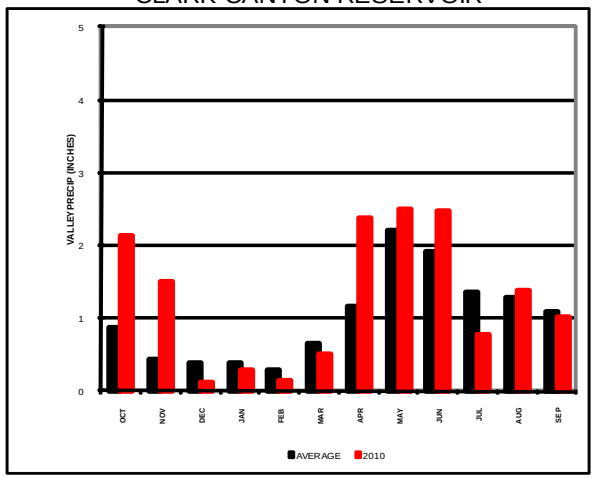
BASIN	OCT		NOV		DEC		JAN		FEB		MAR		APR		MAY		JUN		JUL		AUG		SEP	
	IN.	%	IN.	%	IN.	%	IN.	%	IN.	%	IN.	%	IN.	%	IN.	%	IN.	%	IN.	%	IN.	%	IN.	%
Beaverhead																								
Monthly Precip Average	0.89		0.43		0.39		0.39		0.28		0.65		1.16		2.20		1.92		1.37		1.28		1.09	
Monthly Precip and % of Average	2.15	242	1.51	354	0.12	29	0.29	73	0.15	52	0.52	80	2.39	206	2.51	114	2.47	129	0.78	57	1.40	109	1.01	93
Year-to-Date Precip and % of Averag	2.15	242	3.65	279	3.77	221	4.05	194	4.20	177	4.71	156	7.10	170	9.61	151	12.07	146	12.85	133	14.25	130	15.26	127
Jefferson																								
Monthly Precip Average	0.80		0.58		0.47		0.48		0.35		0.71		1.13		2.14		2.12		1.47		1.36		1.13	
Monthly Precip and % of Average	1.69	212	1.02	177	0.16	33	0.52	107	0.17	48	0.59	84	1.94	172	2.61	122	2.95	139	1.05	71	2.03	149	1.13	100
Year-to-Date Precip and % of Averag	1.69	212	2.71	197	2.86	155	3.38	145	3.54	132	4.14	122	6.08	135	8.69	131	11.64	133	12.69	124	14.72	127	15.84	124
Madison																								
Monthly Precip Average	1.49		1.77		2.04		1.87		1.55		1.88		1.70		2.78		2.71		1.81		1.61		1.67	
Monthly Precip and % of Average	1.87	125	0.65	37	0.65	32	1.30	69	0.51	33	0.76	40	2.37	139	3.08	111	4.76	176	0.86	47	2.86	178	1.23	74
Year-to-Date Precip and % of Averag	1.87	125	2.51	77	3.16	60	4.46	62	4.97	57	5.73	54	8.10	66	11.18	74	15.94	90	16.80	86	19.66	93	20.89	91
Gallatin																								
Monthly Precip Average	1.61		1.10		0.79		0.84		0.70		1.40		2.06		3.22		2.85		1.44		1.48		1.79	
Monthly Precip and % of Average	2.29	142	2.22	202	0.64	81	1.01	120	0.61	87	1.56	111	2.27	110	3.69	115	4.85	170	0.42	29	2.72	184	2.20	123
Year-to-Date Precip and % of Averag	2.29	142	4.51	166	5.15	147	6.16	142	6.77	134	8.33	129	10.60	125	14.29	122	19.14	131	19.56	122	22.28	127	24.48	127
Missouri Above Toston																								
Monthly Precip Average	1.06		1.01		1.02		0.97		0.78		1.16		1.38		2.44		2.37		1.57		1.46		1.37	
Monthly Precip and % of Average	1.74	164	0.93	92	0.36	36	0.79	82	0.33	42	0.72	63	2.00	145	2.85	117	3.88	164	0.93	59	2.30	158	1.23	90
Year-to-Date Precip and % of Averag	1.74	164	2.68	129	3.04	98	3.83	94	4.16	86	4.88	82	6.88	93	9.74	99	13.61	112	14.54	106	16.84	111	18.07	109
Sun-Teton																								
Monthly Precip Average	1.17		1.29		1.22		1.33		1.03		1.12		1.41		2.63		2.55		1.54		1.67		1.43	
Monthly Precip and % of Average	1.97	169	0.71	55	1.03	84	0.98	85	0.31	30	0.65	58	1.69	120	2.96	112	3.06	120	0.98	64	1.70	102	1.98	139
Year-to-Date Precip and % of Averag	1.97	169	2.68	109	3.71	101	4.69	94	5.00	83	5.65	79	7.33	86	10.29	92	13.36	97	14.33	94	16.03	95	18.01	98
Marias																								
Monthly Precip Average	0.57		0.43		0.38		0.39		0.28		0.59		0.93		2.11		2.43		1.41		1.56		1.13	
Monthly Precip and % of Average	0.91	159	0.01	2	0.60	159	0.67	174	0.14	51	0.09	15	2.04	218	3.10	147	3.24	133	1.50	107	2.07	133	1.20	107
Year-to-Date Precip and % of Averag	0.91	159	0.92	92	1.52	110	2.19	124	2.34	114	2.43	92	4.46	125	7.57	133	10.80	133	12.31	129	14.38	130	15.58	128
Milk																								
Monthly Precip Average	0.60		0.43		0.42		0.41		0.30		0.52		0.86		2.01		2.23		1.58		1.18		1.20	
Monthly Precip and % of Average	0.78	128	0.00	0	0.51	121	0.32	79	0.18	60	0.16	31	1.40	163	2.88	144	2.38	107	1.86	118	2.35	198	2.23	186
Year-to-Date Precip and % of Averag	0.78	128	0.78	75	1.29	89	1.61	86	1.80	83	1.96	73	3.36	95	6.24	112	8.62	111	10.48	112	12.83	122	15.06	128
St. Mary																								
Monthly Precip Average	1.47		1.98		1.94		1.86		1.36		1.49		1.52		2.82		2.97		1.86		2.00		1.75	
Monthly Precip and % of Average	2.63	179	0.82	41	1.53	79	0.82	44	0.19	14	0.97	65	2.23	147	3.26	116	4.97	168	2.06	111	2.48	124	2.43	139
Year-to-Date Precip and % of Averag	2.63	179	3.44	100	4.97	92	5.79	80	5.97	69	6.94	69	9.17	79	12.43	86	17.40	100	19.46	101	21.93	103	24.36	106
Bighorn Above Yellowtail																								
Monthly Precip Average	0.82		0.47		0.33		0.34		0.29		0.61		1.17		1.95		1.35		0.97		0.73		1.05	
Monthly Precip and % of Average	1.50	183	0.04	8	0.25	75	0.27	80	0.28	96	0.45	73	1.27	109	3.05	157	1.44	107	0.62	64	1.02	139	0.18	17
Year-to-Date Precip and % of Averag	1.50	183	1.53	119	1.78	110	2.05	105	2.34	104	2.78	97	4.06	101	7.11	119	8.55	117	9.18	110	10.19	113	10.37	103

A composite of the following National Weather Service stations was used to determine monthly valley precipitation and percent of average for the drainage basins:

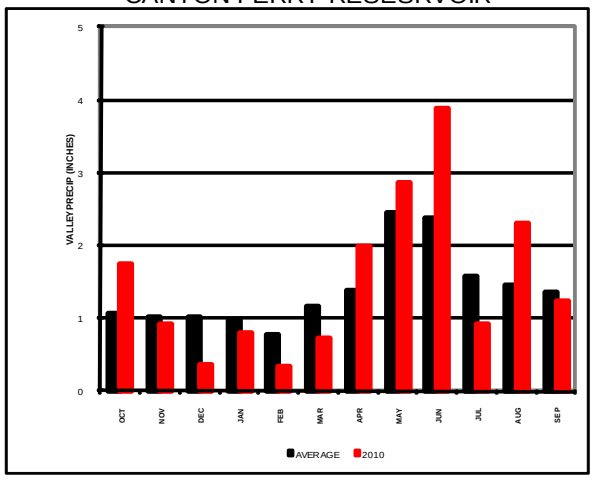
Beaverhead.....Lima and Dillon
Jefferson.....Lima, Dillon, Virginia City, and Boulder
Madison.....Hebgen, West Yellowstone, and Norris Madison
Gallatin.....Bozeman
Missouri Above Toston.....Townsend, Lima, Dillon, Virginia City, Boulder, Hebgen, West Yellowstone, Norris Madison, and Bozeman
Sun-Teton.....Summit, Choteau, Fairfield, Augusta, and Gibson
Marias.....Cut Bank, Conrad, Valier, Gold Butte, and Chester
Milk.....Havre, Chinook, Harlem, Malta, and Rudyard
St. Mary.....Babb and East Glacier
Bighorn Above Yellowtail....Buffalo Bill, Sunshine, Boysen Dam, Dubois, Gas Hills, Lander, Riverton, Basin, Lovell, Thermopolis, and Worland

TABLE MTT1A-1
PRECIPITATION IN INCHES AND PERCENT OF AVERAGE
2010 VALLEY PRECIPITATION

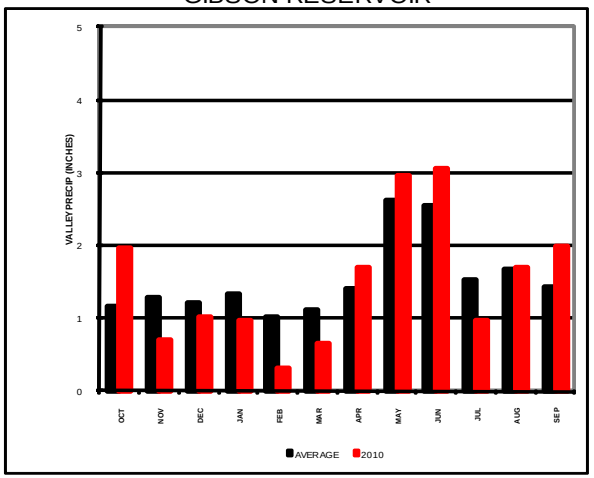
CLARK CANYON RESERVOIR



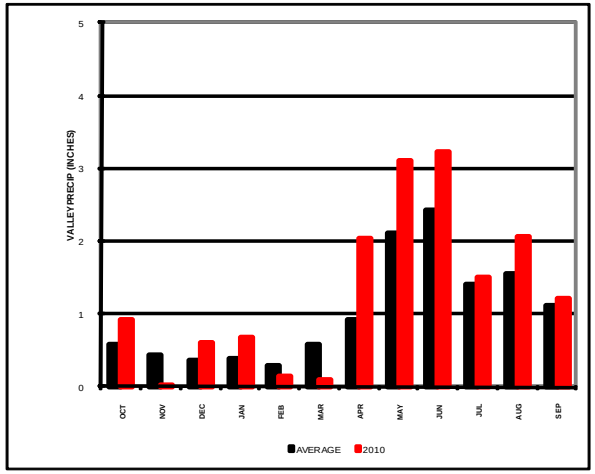
CANYON FERRY RESESRVOIR



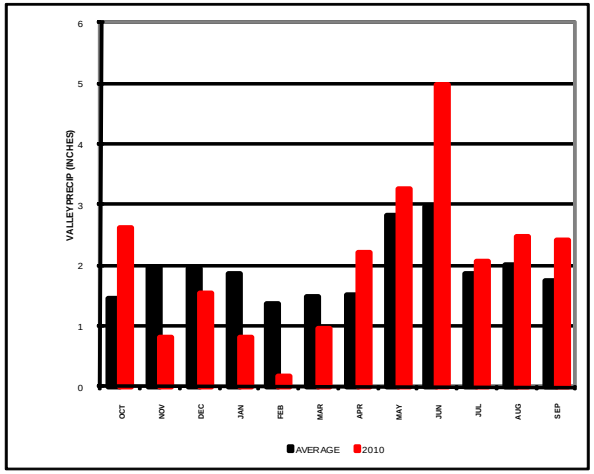
GIBSON RESERVOIR



LAKE ELWELL



LAKE SHERBURNE



BIGHORN LAKE

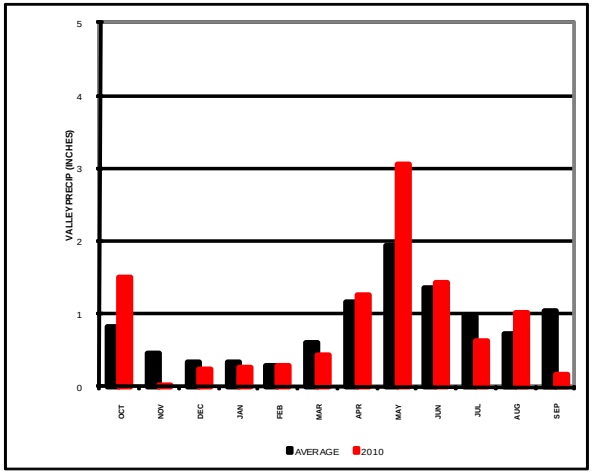


TABLE MTT1B
PRECIPITATION IN INCHES AND PERCENT OF AVERAGE
2010 MOUNTAIN PRECIPITATION

BASIN	OCT		NOV		DEC		JAN		FEB		MAR		APR		MAY		JUN		JUL		AUG		SEP	
	IN.	%	IN.	%	IN.	%	IN.	%	IN.	%	IN.	%	IN.	%	IN.	%	IN.	%	IN.	%	IN.	%	IN.	%
Lima Reservoir																								
Monthly Precip Average	8.70		12.60		14.20		14.20		13.10		15.70		13.00		16.00		14.20		8.70		8.40		9.40	
Monthly Precip and % of Average	15.00	172	3.60	29	5.50	39	14.20	100	4.80	37	5.10	32	15.10	116	13.60	85	18.10	127	2.70	31	6.00	71	4.60	49
Year-to-Date Precip and % of Avera	15.00	172	18.60	87	24.10	68	38.30	77	43.10	69	43.10	61	63.30	69	76.90	72	95.00	78	97.70	75	103.70	75	108.30	73
Clark Canyon Reservoir																								
Monthly Precip Average	13.50		20.20		21.40		20.30		17.10		22.00		21.30		27.00		21.20		12.40		11.70		12.90	
Monthly Precip and % of Average	25.00	185	8.60	43	7.50	35	17.40	86	6.70	39	10.30	47	21.40	100	30.30	112	30.40	143	3.90	31	10.40	89	9.80	76
Year-to-Date Precip and % of Avera	25.00	185	33.60	100	41.10	75	58.50	78	65.20	70	75.50	66	96.90	71	127.20	78	157.60	86	161.50	82	171.90	83	181.70	82
Jefferson Drainage																								
Monthly Precip Average	31.40		45.80		48.90		47.50		39.30		47.60		48.80		58.20		45.90		28.00		26.60		29.00	
Monthly Precip and % of Average	54.10	172	20.90	46	21.50	44	34.00	72	17.00	43	27.60	58	50.10	103	72.50	125	73.90	161	13.87	50	34.80	131	25.20	87
Year-to-Date Precip and % of Avera	54.10	172	75.00	97	96.50	77	130.50	75	147.50	69	175.10	67	225.20	73	297.70	81	371.60	90	385.47	87	420.27	90	445.47	90
Madison Drainage																								
Monthly Precip Average	21.30		33.10		35.30		35.90		30.90		36.40		30.20		32.90		26.00		15.90		14.90		17.90	
Monthly Precip and % of Average	34.60	162	15.70	47	16.40	46	16.40	66	12.00	39	17.80	49	39.40	130	39.50	120	46.50	179	5.90	37	20.20	136	10.20	57
Year-to-Date Precip and % of Avera	34.60	162	50.30	92	66.70	74	66.70	72	102.50	65	120.30	62	159.70	72	199.20	78	245.70	87	251.60	84	271.80	87	282.00	85
Gallatin Drainage																								
Monthly Precip Average	9.40		11.20		11.30		11.40		9.90		14.90		14.40		15.90		13.10		7.20		6.70		8.20	
Monthly Precip and % of Average	13.30	141	5.70	51	6.50	58	6.90	61	5.90	60	8.20	55	15.70	109	16.50	104	16.00	122	5.50	76	9.60	143	7.90	96
Year-to-Date Precip and % of Avera	13.30	141	19.00	92	25.50	80	32.40	75	46.50	72	46.50	68	62.20	75	78.70	80	94.70	85	100.20	84	109.80	88	117.70	88
Canyon Ferry Reservoir																								
Monthly Precip Average	51.80		75.90		80.70		80.40		67.80		82.40		77.60		89.30		70.60		42.20		40.20		45.80	
Monthly Precip and % of Average	85.40	165	35.50	47	37.40	46	54.00	67	28.90	43	43.30	53	87.20	112	105.70	118	112.90	160	20.77	49	53.20	132	36.90	81
Year-to-Date Precip and % of Avera	85.40	165	120.90	76	158.30	76	212.30	74	241.20	68	284.50	65	371.70	72	477.40	79	590.30	87	611.07	85	664.27	88	701.17	87
Gibson Reservoir																								
Monthly Precip Average	9.70		13.60		13.90		13.40		11.00		11.40		11.00		14.80		15.00		7.70		9.10		8.70	
Monthly Precip and % of Average	14.20	146	5.40	40	10.00	72	4.40	33	1.60	15	5.10	45	11.90	108	18.90	128	14.00	93	4.40	57	11.00	121	9.00	103
Year-to-Date Precip and % of Avera	14.20	146	19.60	80	29.60	80	34.00	67	35.60	58	40.70	56	52.60	63	71.50	72	85.50	75	89.90	74	100.90	77	109.90	79
Lake Elwell Reservoir																								
Monthly Precip Average	14.70		22.30		23.70		25.20		19.50		19.80		17.30		20.70		19.80		10.50		12.80		12.80	
Monthly Precip and % of Average	22.50	153	12.50	56	18.30	77	8.40	33	4.10	21	8.60	43	20.50	118	25.00	121	18.60	94	6.40	61	14.80	116	13.00	102
Year-to-Date Precip and % of Avera	22.50	153	35.00	88	53.30	88	61.70	72	65.80	62	74.40	59	94.90	67	119.90	73	138.50	76	144.90	75	159.70	77	172.70	79
Sherburne Reservoir																								
Monthly Precip Average	9.80		16.50		16.20		15.70		12.10		11.20		9.60		10.00		10.30		6.00		5.10		6.80	
Monthly Precip and % of Average	13.00	133	12.30	75	11.80	73	11.80	48	3.00	25	8.30	74	10.60	110	11.20	112	11.30	110	5.50	92	4.60	90	11.50	169
Year-to-Date Precip and % of Avera	13.00	133	25.30	96	37.10	87	44.70	77	47.70	68	56.00	69	66.60	73	77.80	77	89.10	80	94.60	81	99.20	81	110.70	86
Bighorn Lake																								
Monthly Precip Average	42.30		48.80		43.20		42.20		34.80		50.10		63.00		69.70		55.60		37.70		26.10		42.20	
Monthly Precip and % of Average	56.70	134	16.80	34	22.70	53	23.10	55	21.90	63	36.40	73	59.50	94	106.40	153	76.80	138	17.90	47	24.40	93	24.90	59
Year-to-Date Precip and % of Avera	56.70	134	73.50	81	96.20	72	119.30	68	141.20	67	177.60	68	237.10	73	343.50	87	420.30	93	438.20	90	462.60	90	487.50	88

A composite of the following Natural Resources Conservation Service SNOTEL sites was used to determine monthly mountain precipitation and percent of average for the drainage basins:

Lima Reservoir.....Crab Creek, Island Park, Tepee Creek, Divide, and Lakeview Ridge

Clark Canyon Reservoir.....Beagle Springs, Darkhorse Lake, Lemhi Ridge, Tepee Creek, Divide, Bloody Dick, and Lakeview Ridge

Jefferson Drainage.....Beagle Springs, Clover Meadow, Darkhorse Lake, Mule Creek, Lemhi Ridge, Rocker Peak, Tepee Creek, Clavert Creek, Saddle Mountain, Lower Twin, Divide, Bloody Dick, Lakeview Short Creek, Frohner Meadow, and Moose Creek

Madison Drainage.....Carrot Basin, Clover Meadow, Tepee Creek, Black Bear, Lower Twin, Beaver Creek, Madison Plateau, and Whiskey Creek

Gallatin Drainage.....Carrot Basin, Shower Falls, and Lick Creek

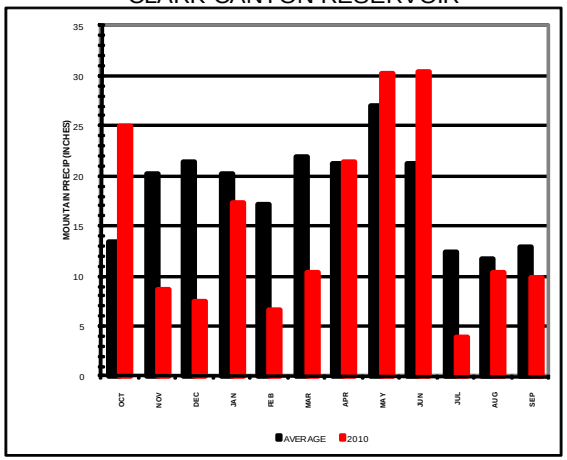
Canyon Ferry Reservoir.....Beagle Springs, Darkhorse Lake, Carrot Basin, Clover Meadow, Shower Falls, Mule Creek, Rocker Peak, Black Bear, Saddle Mountain, Lower Twin, Beaver Creek, Madison Plateau, Short Creek, Lick Creek, Whiskey Creek, Frohner Meadow, Calvert Creek, Moose Creek, Lemhi Ridge, Tepee Creek, Divide, Bloody Dick, and Lakeview Ridge

Gibson Reservoir.....Mount Lockhart, Wood Creek, Dupuyer Creek, and Waldron

Lake Elwell Reservoir.....Mount Lockhart, Badger Pass, Pike Creek, Dupuyer Creek, and Waldron

TABLE MTT1B-1
PRECIPITATION IN INCHES AND PERCENT OF AVERAGE
2010 MOUNTAIN PRECIPITATION

CLARK CANYON RESERVOIR



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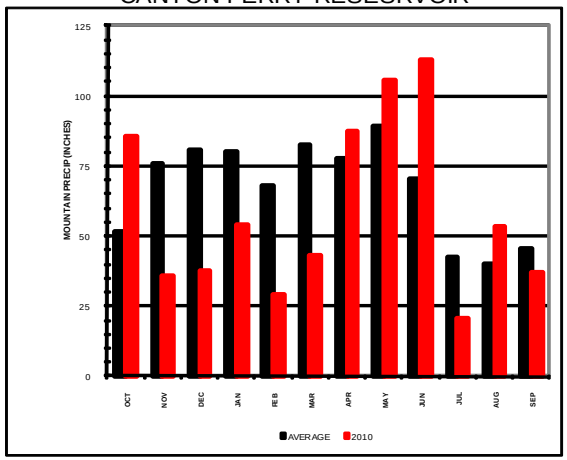

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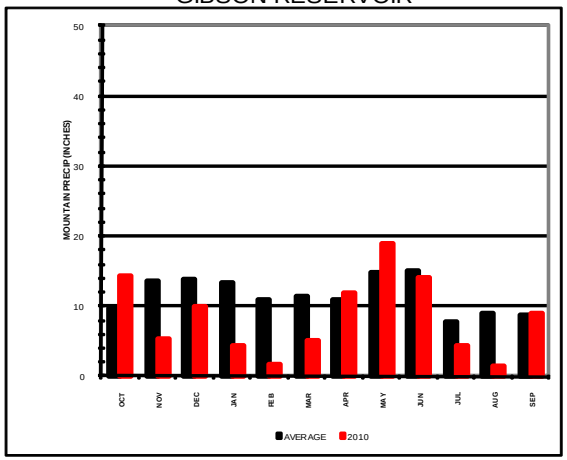
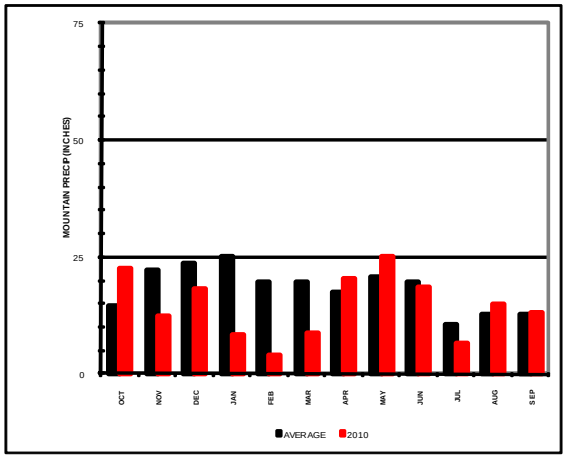
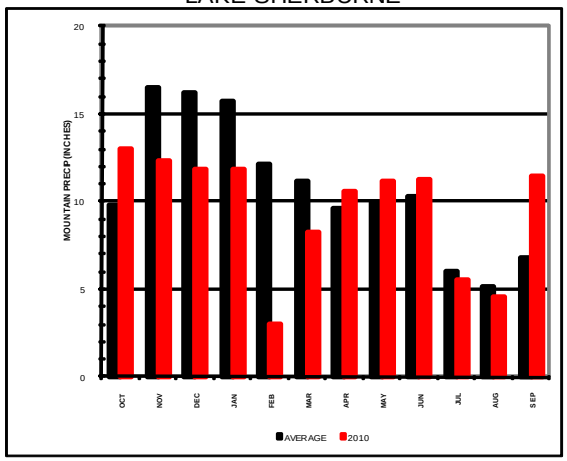


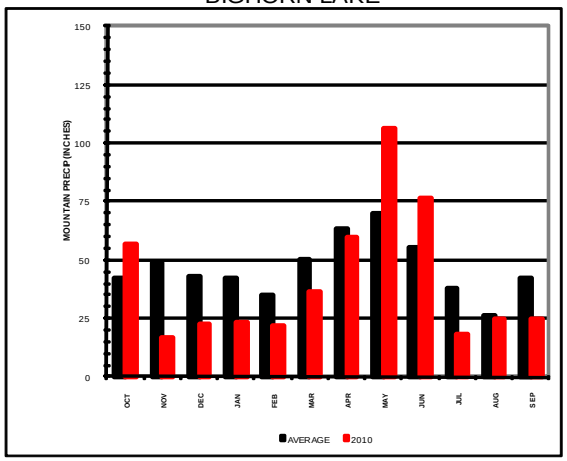
LAKE ELWELL



LAKE SHERBURNE



BIGHORN LAKE

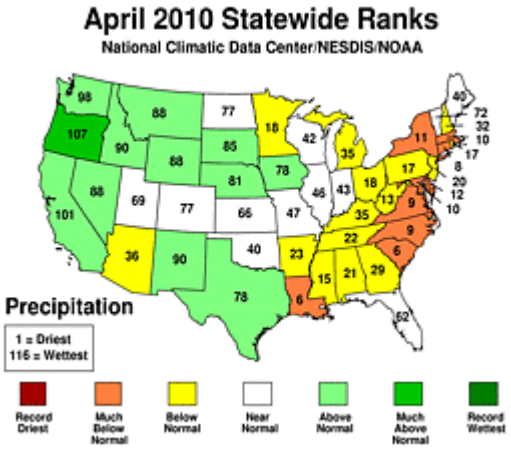


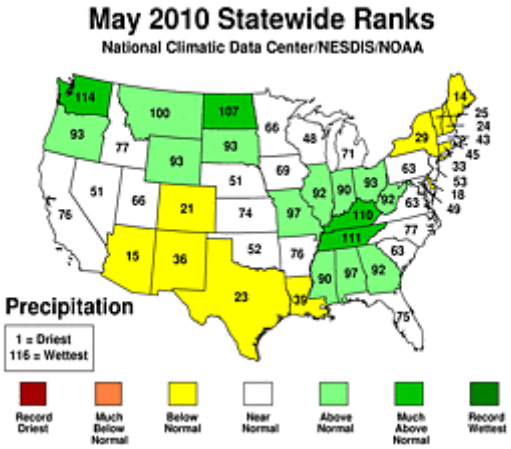
By the end of March, cumulative valley precipitation varied from 31 percent of average in the Milk River Basin to 129 percent of average in the Gallatin River Basin. Mountain precipitation ranged from 56 percent of average in the Sun River Basin to 68 percent of average in the Gallatin River Basin.

Throughout February and March with the low snowpack accumulations, releases from some of the reservoirs were reduced to conserve storage based on the new runoff forecasts that were being calculated.

April through June:

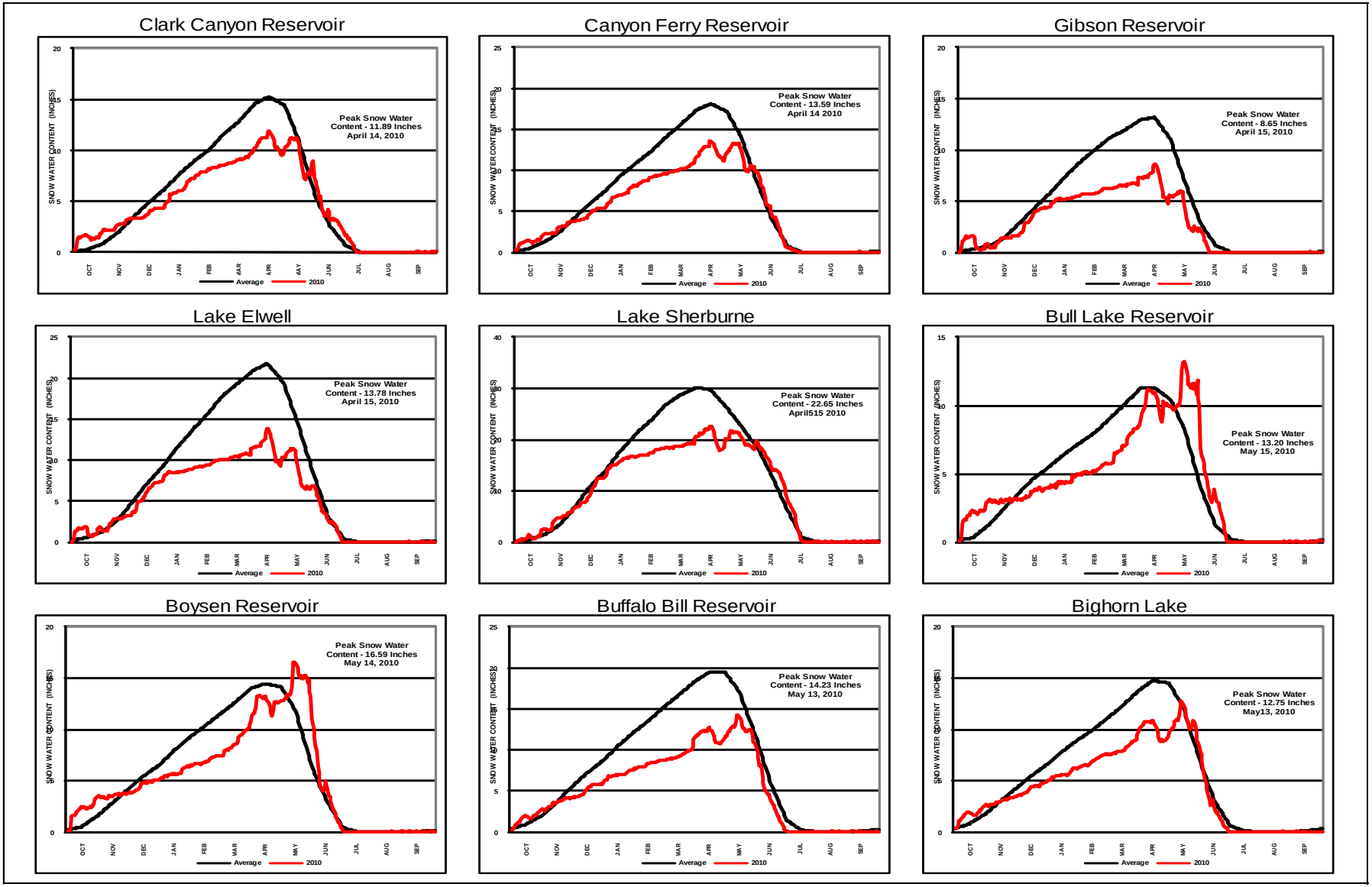
Although the previous 5 months were lean, in mid-April, things turned around dramatically and the precipitation moving in from the coasts once again brought large amounts of precipitation to the basins. In the Bearpaw Mountains near Havre, the snowpack, the second half of April was nearly double of what had accumulated throughout the rest of the winter. C umulative precipitation for the year jumped between 10-25 percent of average throughout the basins during this time period. At the end of June, valley precipitation had increased to 90 percent of average in the Madison Basin to 146 pe rcent of average in the Beaverhead Basin, and mountain precipitation ranged from 75 percent of average above Gibson Reservoir to 93 percent of average in the Bighorn Basin above Yellowtail.





Normally, the higher elevation snowpack reaches peak accumulations around the middle of April and begins to melt out. However, because of the cooler temperatures experienced in April-May, and the large storm that moved through the region in May, after the first peak occurred about April 15 in many of the basins, a second peak which was higher than the first in a few cases, generally occurred around May 15. The peak snowpack for Reclamation reservoirs occurred between April 14 and May 15. T he peak generally occurs around April 15 for mountain locations, Figure MTG1.

Figure MTG1
WATER YEAR 2010
S N O W W A T E R C O N T E N T



July through September:

During July through September, precipitation was widely scattered across much of Montana and northern Wyoming. August temperatures were significantly less than average while the August precipitation was generally near to above average. Weather conditions changed considerably during September as the warmer temperatures moved in and the precipitation declined. The mountain precipitation varied from only 49 percent of average in the basin above Lima to 96 percent of average in the Gallatin River Basin. The valley precipitation varied from 31 percent of average in the St. Mary River Basin to 81 percent of average in the Beaverhead River Basin. During July, temperatures were below average, allowing for reduced irrigation demands and better carryover storage for next season.

Generally speaking, most of Montana experienced very dry conditions, with the exception of the Beaverhead River Basin. Overall, precipitation across Montana during September was at or near a record low.

Reservoir Storage, Releases and Inflows:

At the beginning of 2010, storages in all of the Reclamation reservoirs were at above average with the exception of Gibson and Pishkun Reservoirs in the Sun River Basin, which were at 46 and 68 percent of average, respectively.

On October 1, reservoir storage in the Upper Missouri River Basin totaled 2,741,900 acre-feet, and was 102 percent of average. Storage for the Milk River Project totaled 129,900 acre-feet and was 120 percent of normal. Storage in Bighorn Lake totaled 1,063,800 acre-feet and was 106 percent of normal. Due to the low snowpack development throughout the winter months, and the predictions for the upcoming spring inflows, storage in many reservoirs were allowed to increase through the fall and winter, in hopes of being able to fill to full pool levels by May or June of 2010. By the end of March, storage levels ranged from 58 percent of normal at Gibson Reservoir to 123 percent of normal at Lake Sherburne.

Due to the spring precipitation received during late April and May, the inflows improved in many basins located in north-central and southwest Montana to above average levels. As a result, storage conditions improved dramatically in May. With cool temperatures in April and May the snowmelt runoff came off later than the normal timeframe than during the drought years. In the Bighorn River Basin in Wyoming a variety of weather patterns created flooding problems in the upper Wind River Basin near Lander and produced a higher runoff volume than what would have been expected given the snowpack that existed on April 1. With the high runoff volumes produced by these rains, releases from all reservoirs on the Bighorn system were increased gradually to unusually high levels to control the runoff. The peak flow out of Bighorn Lake was just over 10,361 cfs on June 17. The reservoir level was allowed to increase until reaching a peak elevation of 3645.59 feet on July 4.

All Reclamation reservoirs in Montana filled to near full capacity; Lake Elwell was the only reservoir that did not fill to the top of the conservation pool. Four Reclamation reservoirs located in Montana had to utilize part of their exclusive flood pools to reduce the potential for downstream flooding. These were Clark Canyon Reservoir on the Beaverhead River near Dillon; Canyon Ferry Reservoir located on the Missouri River near Helena; Bighorn Lake located on the Bighorn River near Fort Smith; and Fresno Reservoir on the Milk River near Havre.

During June and July, storage was above average at many of Reclamation's Projects, except Gibson Reservoir, and Lake Elwell. By the end of August, the reservoirs on the Sun River Project were the only reservoirs with storage below normal levels; all other reservoirs varied between 99 and 234 percent of average. Maintaining conservative releases between 2,500-2,900 cfs during August and September, storage in Bighorn Lake ended water year 2010 at 94 percent of average.

Water year 2010 ended with varying storage levels. Gibson Reservoir was at 58 percent of average while Lake Sherburne was 369 percent of average. The Reclamation reservoir with the least amount of carryover storage was Gibson Reservoir at 17 percent of full capacity. Clark Canyon Reservoir near Dillon was able to have another successful year, finishing the year at 115 percent of average.

Spillway releases were made at Gibson Reservoir, Fresno Reservoir, Canyon Ferry Reservoir, and Bighorn Lake to control the large flows from the spring runoff. This was a result of the delayed snowmelt and storm events bringing favorable amounts of precipitation.

The runoff pattern allowed most Reclamation facilities to maintain flows at or above the desired fishery flows through the remainder of the water year. In early October, releases from Gibson Dam were set for the winter at approximately 85 cfs which is below the desired fishery flow. Entering water year 2011, releases from all Reclamation facilities in Montana except Gibson Reservoir were maintained near or above the recommended fishery flow.

There was approximately $23,678,600 in flood damages prevented during water year 2010 by Reclamation facilities in Montana east of the Continental Divide. The total flood damage prevented by these facilities since 1950 is approximately $453,791,200.

Water Supply and Runoff:

The water supply forecasts prepared on January 1, indicated April-July runoff volumes ranged from 46 to 80 percent of average among Reclamation reservoirs east of the Continental Divide, as shown in Table MTT3. Based upon these forecasts, it appeared the drought may be continuing for most of Montana and northwest Wyoming. All basins, except the Milk River Basin, showed little improvements in the snowpack levels during January and February, and by March 1, the forecasts ranged from 53 to 79 percent of average with the Milk River Basin jumping to 142 percent of average.

TABLE MTT2
2010 MOUNTAIN SNOW WATER CONTENT
AS A PERCENT OF NORMAL

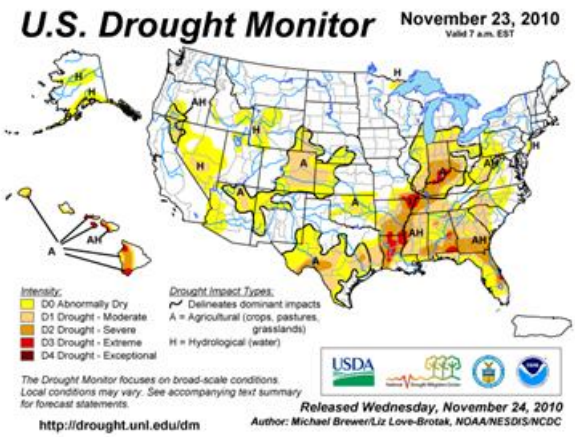
DRAINAGE BASIN	JAN 1	FEB 1	MAR 1	APR 1	MAY 1
Beaverhead	72	76	69	68	67
Jefferson	80	80	72	70	67
Madison	71	71	64	63	65
Gallatin	77	78	79	73	75
Missouri Headwaters above Toston	76	76	71	69	67
Sun	80	66	53	44	45
Marias	78	63	54	50	48
Milk River	46	128	142	71	161
St. Mary	95	78	70	60	65
Wind	75	64	58	67	81
Shoshone	69	63	57	61	57
Bighorn (Boysen-Bighorn)	72	67	71	73	65

TABLE MTT3
2010 WATER SUPPLY FORECASTS

RESERVOIR	JAN 1 1/		FEB 1 1/		MAR 1 1/		APR 1 2/		MAY 1 3/		JUN 1 4/		ACTUAL APRIL-JULY 5/		% OF APRIL FORE-CAST REC'D
	1,000 AC-FT	% OF AVG	1,000 AC-FT	% OF AVG	1,000 AC-FT	% OF AVG	1,000 AC-FT	% OF AVG	1,000 AC-FT	% OF AVG	1,000 AC-FT	% OF AVG	1,000 AC-FT	% OF AVG	
Clark Canyon	59.0	52	53.0	47	42.0	37	37.0	33	39.0	43	30.0	47	94.4	84	255
Canyon Ferry	1,297.0	64	1,333.0	66	1,188.0	59	1,117.0	55	914.0	54	844.0	76	2,127.9	105	191
Gibson	348.0	73	332.0	70	290.0	61	259.0	54	240.0	55	197.0	74	278.0	58	107
Tiber	317.0	65	332.0	68	266.0	55	200.0	41	206.0	49	144.0	57	267.6	55	134
Sherburne	93.0	89	88.0	85	83.0	80	79.0	76	71.0	75	58.0	92	92.8	89	117
Fresno	61.0	73	65.0	78	51.0	61	32.0	53	27.0	65	17.0	87	110.3	102	216
Yellowtail	758.0	68	634.0	57	591.0	53	625.0	56	779.0	82	801.0	114	1,504.4	135	241

1/ Runoff Forecast for April-July; Fresno Reservoir is March-July.
2/ Runoff Forecast for April-July.
3/ Runoff Forecast for May-July.
4/ Runoff Forecast for June-July.
5/ Actual Runoff for April-July; Fresno Reservoir is March-July.

The April 1 snowpack ranged from 44 percent of average in the Missouri Headwaters above Toston to 73 percent of average in the Bighorn River Basin, as shown in Table MTT2. The resulting April-July forecasted runoff volumes ranged from 33 percent of average into Clark Canyon Reservoir to 76 percent of average into Sherburne Reservoir. In the end, due to spring precipitation and improved April snowfall, the actual April-July runoff volumes for water year 2010 ranged from 55 percent of average into Tiber Reservoir to 161 percent of average into Fresno Reservoir, as shown in Table MTT3. All water users experienced full water supplies during water year 2010.



During water year 2010 the peak release at Clark Canyon was approximately 353 cfs less than peak inflow. Peak release was 870 cfs on July 25, while the inflow peaked at 1,223 cfs on June 18, which was above average. Canyon Ferry's peak inflow was 24,002 cfs on June 20, while the peak release was 18,340 cfs on June 20. In the Sun River Basin, Gibson Reservoir inflow peaked at 2,990 cfs on May 19, while the release peaked at 2,548 cfs on June 17. The peak inflow for Pishkun and Willow Creek Reservoirs were 1,403 cfs on July 17 and 116 cfs on June 16, respectively. Inflow to Lake Elwell peaked at 4,069 cfs on June 19 and releases peaked at 612 cfs on November 3. In the Milk River Basin, Lake Sherburne peak inflow was 1,080 on June 21 and releases peaked at 680 cfs on August 27. The peak inflow for Fresno Reservoir was 6,179 cfs on June 21 while the release peaked at 3,041 cfs on June 22. Peak inflow at Nelson Reservoir was 419 cfs on June 17 while the release peaked at 290 on August 11. In the Bighorn River Basin, Bighorn Lake peak inflow was 16,232 cfs on June 17 and the peak release was 9,993 cfs on June 24. Inflows to Reclamation facilities in Montana east of the Continental Divide ranged from 58 percent of average at Lake Elwell to 129 percent of average at Fresno Reservoir for 2010.

FLOOD BENEFITS

The Corps evaluated the reservoir regulation data pertaining to Reclamation reservoirs within the jurisdiction of the Montana Area Office (MTAO) and indicated that six reservoirs provided flood relief during water year 2010. They were: Clark Canyon Reservoir on the Beaverhead River near Dillon; Canyon Ferry Reservoir on the Missouri River near Helena; Lake Elwell on the Marias River near Chester; Fresno Reservoir on the Milk River near Havre; Gibson Reservoir on the Sun River near Augusta; and Bighorn Lake on the Bighorn River near Fort Smith. Canyon Ferry Reservoir and Bighorn Lake played the most important role in preventing flood damages during the 2010 runoff season. The most notable examples of peak flows regulated by Reclamation reservoirs during the spring runoff are as follows:

Reservoir	Peak Inflow (cfs)	River Discharge (cfs)	Date
Clark Canyon	1,223	382	06/18/10
Canyon Ferry	24,002	18,340	06/20/10
Lake Elwell	4,069	531	06/19/10
Fresno Reservoir	6,179	2,184	06/21/10
Bighorn Lake	16,232	9,978	06/17/10

The Corps estimated these four Reclamation reservoirs in Montana reduced flood damages by $23,678,600 in 2010. Some of these benefits were derived by reducing local damages and other benefits were derived by storing water which would have contributed to flooding downstream on the main stem of the Missouri River below Fort Peck Reservoir. The flood damages prevented is as listed in Table MTT4. For additional information on the operations of the reservoirs within the jurisdiction of the MTAO, refer to the individual "Summary of Operations for 2010" for each reservoir in this report. Figure MTG2 shows the annual flood damages prevented by MTAO reservoirs since 1950.

TABLE MTT4

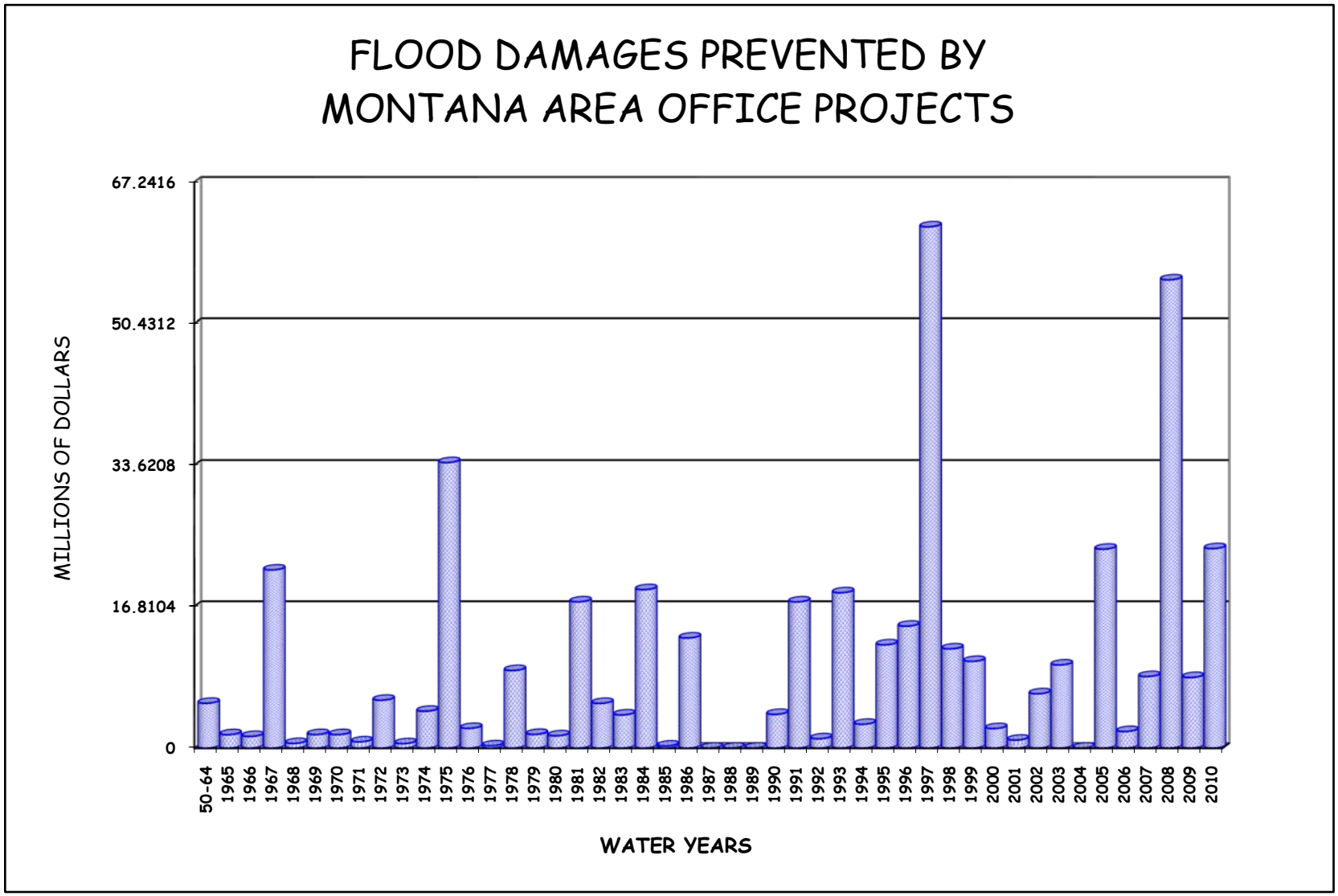
FLOOD DAMAGES PREVENTED (THOUSANDS OF DOLLARS)

Reservoir	Local	Main Stem	2010 Total	Prev. Accum.	1950-2010 Accum. Total
Clark Canyon	$ 323.3	$ 0.0	$ 323.3	$ 14,108.1	$ 14,431.4
Canyon Ferry	1,239.6	8,434.6	9,674.2	185,927.4	195,601.6
Gibson[1]	2.6	0.0	2.6	3,063.5	3,066.1
Lake Elwell	0.0	3,344.2	3,344.2	75,261.5	78,605.7
Lake Sherburne[2]	0.0	0.0	0.0	7,964.5	7,946.5
Fresno	1,118.7	0.0	1,118.7	13,126.8	14,245.5
Bighorn Lake	0.0	9,215.6	9,215.6	130,678.8	139,894.4
Total	$2,684.2	$ 20,994.4	$ 23,678.6	$430,112.6	$453,791.2

[1] No space allocated to flood control, but some flood protection provided by operation for other purposes.

2 Now includes historical flood damages prevented by Lake Sherburne since 1950 based on estimates provided by the Corps of Engineers.

FIGURE MTG2


FLOOD DAMAGES PREVENTED BY
MONTANA AREA OFFICE PROJECTS
MILLIONS OF DOLLARS
67.2416
50.4312
33.6208
16.8104
0
50-64
1965
1966
1967
1968
1969
1970
1971
1972
1973
1974
1975
1976
1977
1978
1979
1980
1981
1982
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2003
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2006
2007
2008
2009
2010
WATER YEARS

UNIT OPERATIONAL SUMMARIES FOR WATER YEAR 2010

Clark Canyon Reservoir

Clark Canyon Reservoir, a Pick-Sloan Missouri River Basin Program (P-S MBP) project is located on the Beaverhead River approximately 20 miles upstream from Dillon, Montana. It has a total capacity of 257,152 acre-feet (255,643 acre-feet active). The reservoir is the storage facility for the East Bench Unit providing a full water supply for irrigation of 21,800 acres and a supplemental supply for about 28,000 acres. Flood control, recreation, and fish and wildlife are among the other functions served by the reservoir.

In 2000, Reclamation surveyed Clark Canyon Reservoir to develop a topographic map and compute a present storage-elevation relationship (area-capacity tables). The data was used to calculate reservoir capacity lost due to sediment accumulation since dam closure in August of 1964. The 2000 survey determined that Clark Canyon Reservoir has a storage capacity of 174,367 acre-feet and a surface area of 5,151 acres at a reservoir elevation of 5546.10 feet. Since closure in 1964, the reservoir has accumulated a sediment volume of 4,106 acre-feet below elevation 5546.10 feet. This volume represents a 2.3 percent loss in capacity and an average annual loss of 114.7 acre-feet. The revised area-capacity table was put into effect on October 1, 2001, reflecting the new storage levels.

Entering water year 2010 the hydrologic conditions in the Beaverhead River Basin trended toward average conditions, showing a few signs of improvements from the previous 8 years. Valley precipitation during August and September was 107 and 81 percent of average, respectively, while the mountain precipitation varied from 111 and 23 percent of average, respectively. Although, there was not an overall significant change in the streamflows above Clark Canyon Reservoir, the improved mountain precipitation during August, as well as irrigation return flows, did help to sustain the inflows as the water year came to a close. Inflows to Clark Canyon Reservoir during August and September were 83 and 79 percent of average, respectively. Full allotments during water year 2009 once again placed a heavy demand on storage in Clark Canyon Reservoir. Following the conclusion of the irrigation season, releases from Clark Canyon Reservoir were gradually reduced during October to the fall flow of 200 cfs. As poor snowpack conditions developed the releases were cut to 180 cfs in mid January and cut again to 100 cfs in mid February which is still in the range of the minimum recommended fishery flow of between 100-200 cfs. In September, storage in Clark Canyon Reservoir was held stable with higher releases which caused the reservoir to end 2009 with a content of 139,727 acre-feet at elevation 5539.11 feet. This was 112 percent of average, 75,212 acre-feet or 19.83 feet higher than at the end of water year 2008, and a huge recovery from the year before thanks to timely showers, and cooler fall temperatures.

The 2010 water year began with some storm activity, resulting in October valley and mountain precipitation being above average. The valley and mountain precipitation during October was 242 and 186 percent of average respectively. Weather conditions were mixed during November as the valley precipitation increased to 354 percent of average while the mountain precipitation decreased to 43 percent of average.

By the end of December, the valley precipitation had reached a year to date average of 221 percent while the mountain precipitation had only reached a year to date average of 76 percent.

On January 1, the NRCS measured snowpack in the Beaverhead River Basin at 72 percent of average. This was a decrease of 35 percent from the snowpack experienced on January 1, 2009. Snow fell in the Beaverhead River Basin at below average rates and by February 1, the snowpack was measured at 76 percent of average. This was a 27 percent decrease from the snowpack measured on February 1, 2009. Precipitation conditions turned dry during February and on March 1. The measured snowpack in the Beaverhead River Basin had dropped to 69 percent of average. However, during March, the year to date valley precipitation was above average at 156 percent of normal while the mountain precipitation was only at 66 percent of average, leaving us with mixed conclusions on what was to come. Inflow for October through March was 95,200 acre-feet, or 84 percent of normal. This was 17,895 acre-feet or 23 percent more than the inflows experienced during that period in 2009.

On April 1, the NRCS measured the mountain snowpack to be 68 percent of average. The precipitation started to fall at near average to above average rates in the Beaverhead Valley during April. Valley and mountain precipitation was 206 and 100 percent of average, respectively, contributing to the cumulative valley precipitation being 170 percent of average by the beginning of May. The mountain snowmelt in the Beaverhead River Basin normally begins in late April or early May. By May 1, the snowpack remained below normal at 67 percent of average, but was improving at a fast rate from where it had been just a couple weeks before.

April was a wet month with valley precipitation averaging 206 percent of normal and mountain precipitation averaging 100 percent of normal, respectively. Precipitation during the month of May was again above average in both the valley and the mountains. Precipitation in the valley was 114 percent of average while precipitation in the mountains was 112 percent of average. Cumulative valley precipitation through May was above average at 151 percent while the mountain cumulative precipitation was only 78 percent of average. The inflows to Clark Canyon Reservoir during May totaled approximately 10,900 acre-feet which is only 40 percent of average. This can be attributed to the very cool temperatures that would not allow the snowpack to start melting.

Based on the mountain snowpack, the water supply forecast prepared on April 1, indicated the April-July runoff into Clark Canyon Reservoir would be 33 percent of normal, totaling approximately 37,000 acre-feet. This was a decrease of 41,000 acre-feet from the April 1 forecast in 2009. Conference calls were held with the Clark Canyon Joint Board in both March and April to discuss the water supply outlook for the 2010 irrigation season. The Joint Board, which consists of three representatives from each water user entity, set initial allotments in March for full allotments of 4.0 acre-feet per acre for Clark Canyon Water Supply Company (CCWSC) and 3.1 acre-feet per acre for East Bench Irrigation District (EBID). Even with the poor runoff predictions the carryover storage of 169,000 acre-feet influenced their decision.

In July, the water users in the Beaverhead River Basin met once again and agreed to increase the water allotments by 1 acre-foot to 5.0 acre-feet per acre for CCWSC and 4.1 acre-feet per acre for EBID.

By September, it was apparent that high flows would be needed through the upcoming winter and the shoulder season (fall water deliveries based on good supply) was initiated to try to put as much water as possible to beneficial use for the irrigators.

Snowmelt runoff during April through July was about normal at 84 percent of average. Daily inflows into Clark Canyon Reservoir averaged 289 cfs during April, 177 cfs during May, 692 cfs during June, and 411 cfs during July. These resulted in respective monthly total inflows of 17,000 acre-feet, 10,900 acre-feet, 41,200 acre-feet and 25,300 acre-feet. The total April through July inflow decreased 9,700 acre-feet from what was experienced in 2009.

Releases during this time averaged 137 cfs during April, 280 cfs during May, 390 cfs during June, and 711 cfs during July. As a result, storage slowly increased to a peak for the year of 189,853 acre-feet at elevation 5549.06 feet on July 5, before downstream flow constrictions allowed storage to begin drafting. This was 137 percent of normal and 109 percent of full capacity. This was also 13,472 acre-feet or 2.57 feet higher than the peak storage which occurred in 2009. The peak inflow for the year was recorded on June 18 at 1,223 cfs. The total April-July inflow to Clark Canyon Reservoir was 84 percent of average totaling 94,418 acre-feet and was the second highest runoff total since 1999, and was the 27th highest April-July inflow recorded.

Precipitation during the majority of the summer months remained variable in both the valley and mountain areas. The valley precipitation during June, July, and August was 129, 57, and 109 percent of average respectively. The mountain precipitation, which is factored into the snowmelt runoff volume, was 143, 31, and 89 percent of average for June, July, and August respectively. During September, valley and mountain precipitation declined to 93 and 76 percent of average.

By the end of September, the total cumulative valley precipitation for the year was 127 percent of average while the total cumulative mountain precipitation for the Beaverhead Basin was 82 percent of average. Due to the frequent showers and cooler than average temperatures in the basin, storage demands out of Clark Canyon Reservoir were less than average, but the irrigators had a long wait to see the crops mature due to the low number of growing degree days during the summer. Storage in Clark Canyon Reservoir remained high throughout the summer, and finished the water year at a level higher than it has seen since 1984. As irrigation demands decreased, releases out of Clark Canyon Reservoir were held at higher than average rates to try to hold the reservoir down. Irrigators were also able to take advantage of the higher releases and put fall water on their fields to help keep the water table high going into water year 2011. Releases for the winter are expected to remain near 210 cfs throughout the winter.

The majority of the storage water released from Clark Canyon Reservoir during water year 2010 to meet the downstream irrigation demands was released during the period from May 1 through September. During this time, releases reached a peak for the year of 870 cfs on July 25 to satisfy the downstream water needs, and to control the rate of fill in the reservoir. Beginning in early July, storage in Clark Canyon Reservoir declined from a peak of 189,853 acre-feet at elevation 5549.06 feet on July 5 to 142,912 acre-feet at elevation 5539.78 feet on September 30. This was an unprecedented change from what had been experienced in the drought years of the 2000's. During September, releases averaged 443 cfs out of Clark Canyon Reservoir to try to bring the reservoir down to levels that could help capture the runoff for next year.

The Joint Board was able to decide that winter releases would be able to be maintained at or above the desired levels that Montana Fish Wildlife and Parks (MFWP) desires with a flow no less than 210 cfs. The desired levels are between 100-200 cfs.

EBID water users received approximately 73,973 acre-feet and CCWSC received approximately 89,202 acre-feet during water year 2010. The court appointed river commissioner ended the water year in September, while diversions to the East Bench Canal ended the 2010 water season in October. The total diversion recorded by the river commission for the "non-signer" users on the Beaverhead River was approximately 34,446 acre-feet. The total annual inflow to Clark Canyon Reservoir during 2010 was 87 percent of average, totaling 230,521 acre-feet.

By comparison, this was 17,000 acre-feet more than the total annual inflow of water year 2009. The total annual release to the Beaverhead River from Clark Canyon Reservoir was 227,336 acre-feet or 90 percent of normal. This release was low due to the low release to start the water year coming out of 2009, and then higher releases through the runoff season as the reservoir was in the flood pool. This pattern allowed the reservoir to remain essentially full and provide good carryover going into water year 2011 as well as a desired winter release pattern.

Lima Reservoir is a private irrigation facility located upstream of Clark Canyon Reservoir on the Red Rock River, a tributary of the Beaverhead River. Lima Reservoir was able to fill to the top of the conservation pool in water year 2010 and peaked at 77,401 acre-feet, which was 91 percent of full capacity on June 23. The drainage area above Lima Reservoir accounts for about 25 percent of the total drainage area above Clark Canyon Reservoir. Streamflow of the Beaverhead River at Barretts peaked at 993 cfs on June 18, due to irrigation releases from storage, but the streamflow would have peaked at 1,834 cfs on June 18 if Clark Canyon Reservoir would not have been controlling the releases.

The Corps determined that during 2010, Clark Canyon Reservoir prevented $323,300 in local flood damages, but did not contribute to the reduction of flood damages on the Missouri River below Fort Peck. Since construction of the Clark Canyon Dam in 1965, Clark Canyon Reservoir has reduced flood damages by a total of $14,431,400.

Important Events – 2010

October 1, 2009: Clark Canyon Reservoir enters the water year with 139,727 acre-feet of storage at elevation 5539.11 feet. The lowest elevation it would see during the year.

October 30, 2009: Following the 2009 irrigation season, releases from Clark Canyon Reservoir to the Beaverhead River were reduced to approximately 200 cfs maintain pool levels at the desired level to meet the flood control target for the next spring.

January 12, 2010: Releases were cut to 185 cfs to conserve storage after receiving the latest forecasts based on the low snowpack.

February 14, 2010: Releases were cut to 100 cfs to conserve storage after receiving the latest forecasts based on the low snowpack.

April 20, 2010: This marked the beginning of when releases from Clark Canyon Reservoir were increased to control the rate of fill in the reservoir. This is also the day that the reservoir entered the exclusive flood pool.

May 16, 2010: This marked the beginning of when releases from Clark Canyon Reservoir were increased for irrigation demand. Also the day the reservoir drafted out of the flood pool.

June 11, 2010: Clark Canyon Reservoir reentered the flood pool for the second time.

June 18, 2010: Inflow to Clark Canyon Reservoir reached a peak for the year at 1,223 cfs.

July 5, 2010: Clark Canyon Reservoir reached a peak storage content of 189,853 acre-feet at elevation 5549.06 feet. This was 109 percent of full capacity and 15,486 acre-feet or 2.96 feet above the top of the joint-use pool.

July 25, 2010: Releases from Clark Canyon Reservoir reached a peak of 870 cfs to meet downstream water demands from the Beaverhead River, as well as to continue evacuating the flood pool.

July 28, 2010: Clark Canyon Reservoir drafted to a level below the top of the joint use pool for a second time.

September 30, 2010: Clark Canyon Reservoir ends the water year with 142,912 acre-feet of storage at elevation 5539.78 feet.

October 11, 2010: East Bench Irrigation District discontinues diversions to the Canal.

Additional hydrologic and statistical information pertaining to the operation of Clark Canyon Reservoir during 2010 can be found in Table MTT5 and Figure MTG3.

TABLE MTT5
HYDROLOGIC DATA FOR 2010
CLARK CANYON - EAST BENCH UNIT
NEW SEDIMENT SURVEY DATA EFFECTIVE 10/1/2001

RESERVOIR ALLOCATIONS	ELEVATION (FEET)	TOTAL RESERVOIR STORAGE (AF)	STORAGE ALLOCATION (AF)
TOP OF INACTIVE AND DEAD	5470.60	1,061	1,061
TOP OF ACTIVE CONSERVATION	5535.70	124,160	123,099
TOP OF JOINT USE	5546.10	174,367	50,207
TOP OF EXCLUSIVE FLOOD CONTROL	5560.40	253,442	79,075

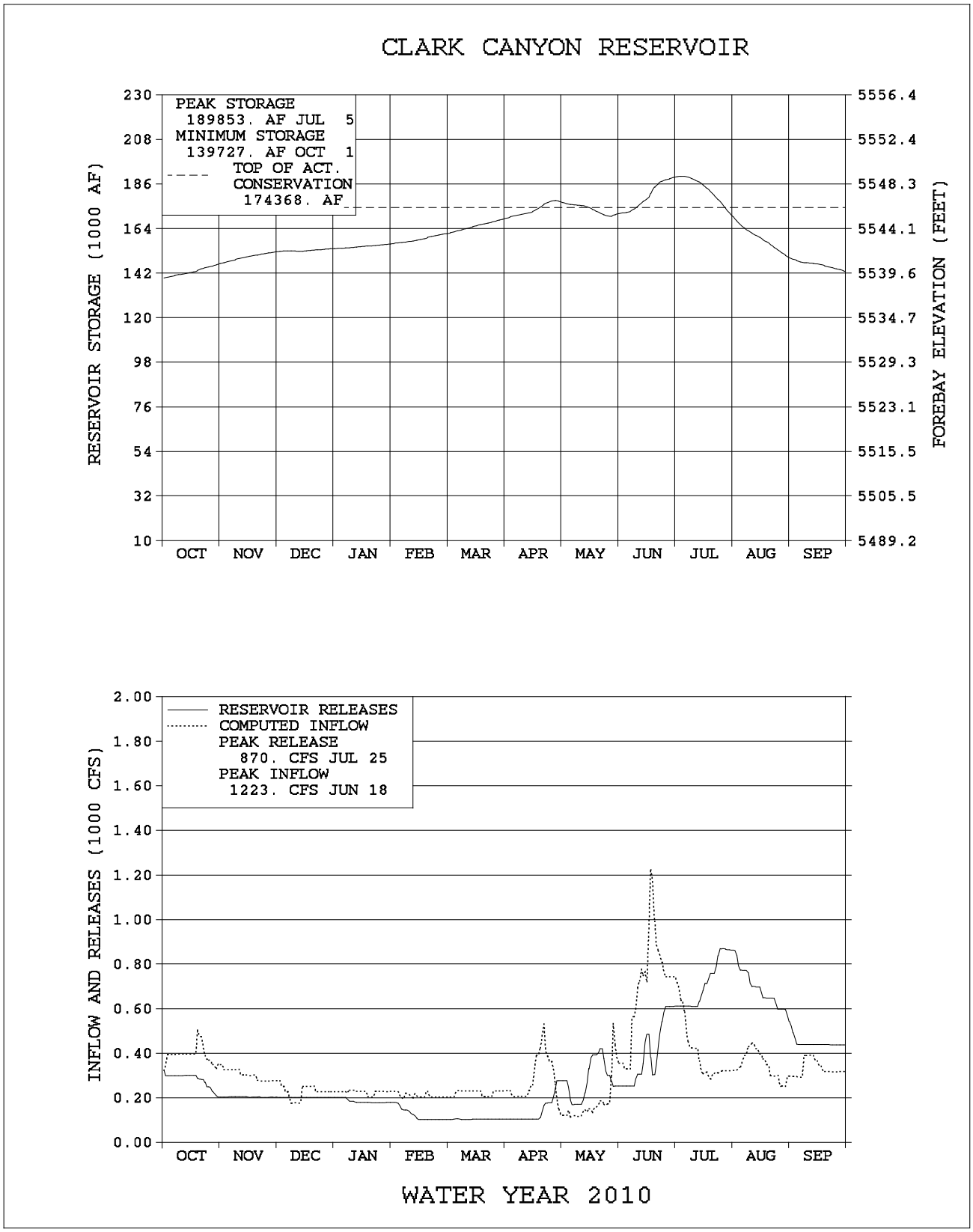
STORAGE-ELEVATION DATA	ELEVATION (FT)	STORAGE (AF)	DATE
BEGINNING OF YEAR	5539.11	139,727	OCT 01, 2009
END OF YEAR	5539.78	142,912	SEP 30, 2010
ANNUAL LOW	5539.11	139,727	OCT 01, 2009
ANNUAL HIGH	5549.06	189,853	JUL 05, 2010
HISTORIC HIGH	5564.70	283,073	JUN 25, 1984

INFLOW-OUTFLOW DATA	INFLOW	DATE	OUTFLOW	DATE
ANNUAL TOTAL (AF)	230,521	OCT 09-SEP 10	227,336	OCT 09-SEP 10
DAILY PEAK (CFS)	1,223	JUNE 18, 2010	870	JUL 25, 2010
DAILY MINIMUM (CFS)	113	MAY 06, 2010	103	FEB 14, 2010
DAILY FLOW AT BARRETTS (CFS)			993	JUN 18, 2010
DAILY FLOW AT BARRETTS W/O CLARK CANYON RESERVOIR (CFS)			1,834	JUN 18, 2010
PEAK SPILL (CFS)			0	NONE
TOTAL SPILL (AF)			0	NONE

MONTH	INFLOW		OUTFLOW*		CONTENT	
	KAF	% OF AVG	KAF	% OF AVG	KAF	% OF AVG
OCTOBER	24.0	103	17.1	122	146.6	117
NOVEMBER	18.0	81	12.1	91	152.5	115
DECEMBER	14.0	73	12.4	99	154.0	113
JANUARY	13.9	87	11.4	109	156.5	112
FEBRUARY	11.7	80	6.8	73	161.4	114
MARCH	13.6	73	6.4	64	168.6	114
APRIL	17.0	78	8.1	66	177.5	112
MAY	10.9	40	17.3	61	171.1	103
JUNE	41.2	115	23.2	59	189.1	113
JULY	25.3	92	43.7	95	170.7	113
AUGUST	21.3	110	42.3	111	149.6	117
SEPTEMBER	19.7	98	26.4	131	142.9	115
ANNUAL	230.5	87	227.3	90		
APRIL-JULY	94.4	84				

*Average for the 1965-2010 period.

FIGURE MTG3


CLARK CANYON RESERVOIR
PEAK STORAGE
189853. AF JUL 5
MINIMUM STORAGE
139727. AF OCT 1
TOP OF ACT.
CONSERVATION
174368. AF
RESERVOIR STORAGE (1000 AF)
FOREBAY ELEVATION (FEET)
230
208
186
164
142
120
98
76
54
32
10
5556.4
5552.4
5548.3
5544.1
5539.6
5534.7
5529.3
5523.1
5515.5
5505.5
5489.2
OCT NOV DEC JAN FEB MAR APR MAY JUN JUL AUG SEP
RESERVOIR RELEASES
COMPUTED INFLOW
PEAK RELEASE
870. CFS JUL 25
PEAK INFLOW
1223. CFS JUN 18
INFLOW AND RELEASES (1000 CFS)
2.00
1.80
1.60
1.40
1.20
1.00
0.80
0.60
0.40
0.20
0.00
OCT NOV DEC JAN FEB MAR APR MAY JUN JUL AUG SEP
WATER YEAR 2010

Canyon Ferry Lake and Powerplant

Canyon Ferry Lake (P-S MBP), formed by Canyon Ferry Dam, is located on the Missouri River near Helena, Montana. It has a total capacity of 1,992,977 acre-feet. The top 3 feet were allocated to exclusive flood control in February 1966. The next 27 feet are allocated to joint conservation and flood control purposes. The joint use space will be evacuated for flood control purposes only to the extent that refill during the spring runoff are reasonably assured. The conservation space was constructed mainly for power generation and to provide replacement storage for several new irrigation developments located on the Missouri River and its tributaries above Great Falls, Montana. To date, however, the conservation storage has been used primarily for power production. The only new areas under irrigation are 5,000 acres being irrigated on the Crow Creek Unit (P-S MBP), 13,900 acres on the Helena Valley Unit (P-S MBP), and 28,000 acres on the East Bench Unit (P-S MBP). In addition, about 5,200 acres in the Helena Valley Unit that was once irrigated by pumping from Lake Helena and from other streams are now irrigated by pumping from Canyon Ferry Reservoir. About 33,700 acres on the East Bench Unit also receives a supplemental water supply. A small amount of municipal water is also furnished to the city of Helena, Montana, through facilities for the Helena Valley Unit.

In 1997, a hydrographic and a topographic survey were conducted and a new elevation-area-capacity table and curve was developed. The 1997 survey determined that Canyon Ferry Lake has a storage capacity of 1,992,977 acre-feet and a surface area of 34,048 acres at reservoir elevation 3800 feet. Since closure in 1953, the reservoir has accumulated a sediment volume of 59,746 acre-feet below reservoir elevation 3800 feet. This volume represents a 2.91 percent loss in capacity and an average annual loss of 1,345.6 acre-feet. The revised area-capacity table was put into effect on October 1, 1998, reflecting the new storage levels.

During September, there was little to no precipitation reported in the Missouri River Basin above Canyon Ferry Lake. Valley precipitation was only 54 percent of average while the mountain precipitation was much worse at only 13 percent of average. With storage in Canyon Ferry Lake near average in early September, releases to the Missouri River were maintained near or above 4,100 cfs, allowing storage in Canyon Ferry Lake to slowly decline to 1,679,615 acre-feet at elevation 3790.50 feet by the end of September. This was 98 percent of average and about 76,770 acre-feet or 2.38 feet lower than at the beginning of water year 2009.

At the beginning of the water year, precipitation in the Missouri River Basin above Canyon Ferry Lake started out good. The valley and mountain precipitation was about 165 percent of average during October, but quickly diminished to well below normal during November through March. The accumulated valley precipitation during November through March was 63 percent of average while the accumulated mountain precipitation during this same period was only 51 percent of average. With inflows at 86 percent of average during October and November and the releases maintained at about 88 percent of average, storage slowly increased to 1,743,087 acre-feet at elevation 3792.47 feet by November 18, about average for this time of year.

By the end of November, the mountain snowpack in the Missouri River Basin upstream of Canyon Ferry had fallen to below average and continued to fall at below normal rates through March. On December 1, NRCS measured the mountain snowpack in the Missouri River Basin at 89 percent of average, about 12 percent higher than in December 2008. By January 1, the snowpack conditions had declined to only 76 percent of average, nearly 25 percent lower than a year ago. Snowpack in the Jefferson, Madison, and Gallatin River Basins, major tributaries of the Missouri River Basin was 80, 71, and 77 percent of normal, respectively.

With storage near average on November 19, releases to the Missouri River were maintained near 4,550 cfs during late November through January. By January 12, storage in Canyon Ferry Lake had been drafted to 1,589,068 acre-feet at elevation 3787.65 feet. Plans were made to maintain river flows downstream of Holter Dam near or above 4,100 cfs; the MFWP recommended minimum fishery flow, through the fall and early winter.

On February 1, storage in Canyon Ferry Lake was at 1,587,186 acre-feet at elevation 3787.59 feet. This was 9,443 acre-feet or 0.30 feet lower than a year ago. By late February, the NRCS measured the mountain snowpack in the Missouri River Basin above Canyon Ferry Lake at only 70 percent of average. It was at that time, Reclamation began making plans to conserve storage in Canyon Ferry Lake and provide a greater opportunity to assure the reservoir of filling to the top of the joint-use pool at elevation 3797 feet near the end of June. Due to scheduled maintenance on one unit of the powerplant, Reclamation took this opportunity to reduce releases to 2-unit capacity and conserve storage in Canyon Ferry Lake.

By April 1, the mountain snowpack above Canyon Ferry Lake was measured at only 69 percent of average. Due to conservative operations at Canyon Ferry, storage in Canyon Ferry Lake was recorded at 1,570,874 acre-feet at elevation 3787.07 feet on April 1. This was about 108 percent of average and 50,908 acre-feet or 1.64 feet higher than on April 1, 2009.

At the annual Upper Missouri River Advisory Group meeting held on April 14, several interest groups remarked how the higher flows released out of Canyon Ferry Lake to the Missouri River in 2009 benefited the fishery and aquatic live in the Missouri River downstream of Canyon Ferry Lake. If possible, many of the same interests expressed concerns these same similar flows would again benefit the river fishery.

The water supply forecast prepared in early April, indicated the April-July runoff into Canyon Ferry Lake would be 55 percent of average, totaling 1,117,000 acre-feet. This was about 863,000 acre-feet less than a year ago. With storage at 109 percent of average, planned operations indicated there may be a possibility to increase the release out of Canyon Ferry Lake to the Missouri River to produce a peak flow in the Missouri River below Holter Dam of around 10,000 cfs. However, it would all depend on how the runoff into Canyon Ferry Lake would occur.

By late April, weather conditions changed significantly. During April, valley precipitation in the basin increased to 145 percent of average while the mountain precipitation increased to 112 percent of average.

This was a considerable improvement of what was experienced in March at only 63 and 53 percent of average, respectively. However, by May 1 the mountain snowpack conditions had remained near 67 percent of average.

Temperatures remained cooler than normal during May, delaying the high elevation snowmelt runoff into Canyon Ferry. It was not until late May when inflows into Canyon Ferry began to increase significantly. Temperatures warmed up and the snowmelt runoff finally got underway. Heavy rains in late May and June caused a dramatic increase in streamflows. During May and June, the valley precipitation was recorded at 117 and 164 percent of average, respectively, while the mountain precipitation was recorded at 118 and 160 percent of average, respectively. The delayed snowmelt runoff accompanied by heavy precipitation during May and June caused inflows to increase rapidly from about 6,000 cfs in late May to a peak for the year of 24,002 cfs on June 20.

In late May, storage in Canyon Ferry began to increase dramatically. On May 18, storage increased from 1,615,279 at elevation 3788.48 feet to a peak for the year of 1,967,168 acre-feet at elevation 3799.24 feet on June 28. This was 104 percent of average and 75,280 acre-feet or 2.24 feet above the top of the joint-use pool. To control the rate of fill of storage in Canyon Ferry Lake, the releases to the Missouri River were gradually increased from about 3,500 cfs in early June to a peak for the year of 18,340 cfs on June 20. Inflows into Canyon Ferry Lake during May totaled 317,569 acre-feet. This was 55 percent of average. During June, the inflows increased to 143 percent of average totaling 1,102,008 acre-feet.

In late June, the inflow to Canyon Ferry Lake began to slowly decline. In response, the releases were gradually decreased to bring some relief to the river. During the month of June, releases to the Missouri River averaged about 13,570 cfs while the inflows averaged 18,520 cfs. However, it was not until after July 7 that releases out of Canyon Ferry to the Missouri River could be decreased to less than 15,000 cfs. By July 18, all releases in excess of full powerplant capacity had been discontinued. On July 21, all storage in the exclusive flood pool was successfully evacuated and releases to the Missouri River were gradually decreased to rates that would maintain flows below Holter Dam at or above 4,100 cfs. This was the minimum flow required to sustain a healthy river fishery in the Missouri River downstream of Holter Dam.

By July, the precipitation patterns changed. The valley and mountain precipitation declined to only 59 and 49 percent of average, respectively. Even though the precipitation was well below average during July, the residual effects of the delayed snowmelt runoff seemed to maintain the inflow into Canyon Ferry during July at 133 percent of average, totaling 449,586 acre-feet.

The April-July runoff into Canyon Ferry Lake during 2010 was 105 percent of average, totaling 2,127,934 acre-feet. The annual inflow to Canyon Ferry Lake was 98 percent of average, totaling 3,877,412 acre-feet. This was only 239,957 acre-feet greater that the total annual inflow experienced in water year 2009.

Precipitation in the Missouri River Basin above Canyon Ferry Lake improved considerably in August.

The valley and mountain precipitation was 158 and 132 percent of average, respectively. As a result, the inflow into Canyon Ferry Lake remained at about 105 percent of average during August and September. With storage in Canyon Ferry Lake slightly above average in September, releases to the Missouri River were maintained at or above 4,100 cfs, allowing storage in Canyon Ferry Lake to slowly decline to 1,766,465 acre-feet at elevation 3793.19 feet. This was 103 percent of average and about 86,850 acre-feet or 2.69 feet higher than at the end of water year 2009.

During 2010, Canyon Ferry Lake powerplant generated 358,614,000 kilowatt-hours, 93 percent of the long-term average dating back to 1967. This was 129,443,000 kilowatt-hours more than generated during the record low year of 2002 and 27,316,000 kilowatt-hours less than generated in 2009. The plant used 76 percent of the water released from the dam in 2010 (2,861,936 acre-feet).

The remainder of the water was released to meet the irrigation needs of the Helena Valley Irrigation District (171,307 acre-feet) and spilled through the river outlet gates (22,668 acre-feet) and through the spillway gates (734,674 acre-feet).

The Corps estimated that during 2010, Canyon Ferry Lake prevented $1,239,600 of local flood damages and also prevented $8,434,600 in flood damages downstream on the Missouri River below Fort Peck Reservoir for a total of $9,674,200. Since construction of the Canyon Ferry Dam in 1954, Canyon Ferry Reservoir has reduced flood damages by a total of $195,601,600.

Important Events - Water Year 2010

October 1: All irrigation deliveries to the Helena Valley Unit were discontinued for the 2009 irrigation season. To continue conserving storage in Canyon Ferry Lake, the total release was decreased to 3,500 cfs (≈ 3,500 cfs through the powerplant and 0 cfs for the Helena Valley Project).

November 2: To allow for installation and testing of a new voltage regulator on Unit No. 1 of the Canyon Ferry Powerplant, turbine releases were restricted to 2-unit capacity and maintained at 3,500 cfs (≈ 3,500 cfs through the powerplant and 0 cfs for the Helena Valley Project).

November 16-25: A 10-day maintenance outage was scheduled on Unit No. 1 of the Canyon Ferry Powerplant. To allow for the annual maintenance and continue evacuating storage from Canyon Ferry Lake as projected, turbine releases were restricted to 2-unit capacity. The turbine releases from Canyon Ferry Lake were maintained at 3,500 cfs (≈ 3,500 cfs through the powerplant and 0 cfs for the Helena Valley Project).

November 18-26: The November water supply forecast indicated a need to increase releases out of Canyon Ferry Reservoir. PPL-MT also reported maintenance was completed at one of their downstream powerplants. In response, the total release out of Canyon Ferry was gradually increased to 5,000 cfs (≈ 5,000 cfs through the powerplant and 0 cfs for the Helena Valley Project).

December 21-26: Storage in Canyon Ferry Reservoir is drafting faster than desired. To slow the evacuation rate of storage in Canyon Ferry, total release from Canyon Ferry were gradually decreased to 4,500 cfs (≈ 4,500 cfs through the powerplant and 0 cfs for the Helena Valley Project).

January 12: With mountain snowpack at only 77 percent of average, the water supply forecast indicated a need to decrease releases in an effort to conserve storage. In response, the total release was decreased to 4,000 cfs (≈ 4,000 cfs through the powerplant and 0 cfs for the Helena Valley Project).

February 22-March 18: A 25-day maintenance outage was scheduled on Unit No. 3 of the Canyon Ferry powerplant. To allow for the annual maintenance and continue evacuating storage from Canyon Ferry Lake as projected, turbine releases were restricted to 2-unit capacity and maintained at 3,650 cfs (≈ 3,650 cfs through the powerplant and 0 cfs for the Helena Valley Project).

March 22-27: To perform governor alignments on all three powerplant turbines, allow for the annual maintenance and continue evacuating storage from Canyon Ferry Lake as projected, turbine releases were restricted to 2-unit capacity and maintained at 3,650 cfs (≈ 3,650 cfs through the powerplant and 0 cfs for the Helena Valley Project).

April 1: Irrigation deliveries to Helena Valley Unit were initiated on April 1 when the first irrigation deliveries for the 2010 irrigation season began and were adjusted periodically throughout the irrigation season to meet the irrigation demands. Total release from Canyon Ferry Lake was increased to 3,970 cfs (≈ 3,650 cfs through the powerplant and 320 cfs for the Helena Valley Project).

April 7: To repair leaky cooling water pipe on Unit No. 2 of the Canyon Ferry powerplant, total release from Canyon Ferry was maintained at 3,970 cfs (≈ 3,650 cfs through the powerplant and 320 cfs for the Helena Valley Project).

April 14: Reclamation attended and participated in the Upper Missouri River Advisory Group meeting held in the Director's Conference Room at MFWPs Building in Helena, Montana. Tim Felchle, Chief of Reservoir and River Operations, presented the water supply outlook for the Upper Missouri River Basin and the proposed operations for Canyon Ferry Lake for 2010.

April 15: Helena Valley Irrigation District decreased irrigation deliveries. In response, total release from Canyon Ferry Lake was decreased to 3,905 cfs (≈ 3,700 cfs through the powerplant and 205 cfs for the Helena Valley Project).

April 19-21: DC motor starters were replaced on each of the DC turbine bearing oil pumps. Turbine releases were restricted and limited to 2-unit capacity and the total release was maintained at 3,905 cfs (≈ 3,700 cfs through the powerplant and 205 cfs for the Helena Valley Project).

April 23-27: Helena Valley Irrigation District increased irrigation deliveries. The water supply forecast remains near 60 percent of average and also indicates a need to decrease releases out of Canyon Ferry to conserve storage. In response, the total release from Canyon Ferry Lake was gradually decreased to 3,530 cfs (≈ 3,150 cfs through the powerplant and 380 cfs for the Helena Valley Project).

May 14-19: Helena Valley Irrigation District increased irrigation deliveries. In response, total release from Canyon Ferry Lake was gradually increased to 3,915 cfs (≈ 3,170 cfs through the powerplant and 745 cfs for the Helena Valley Project).

May 27: During 1300 hour through 1730 hour, the excitation system on Unit No. 3 was tested and turbine release was restricted and limited to 2-unit capacity. In response, the total release from Canyon Ferry Lake was maintained at 3,915 cfs (≈ 3,170 cfs through the powerplant and 745 cfs for the Helena Valley Project).

May 28-June 1: Helena Valley Irrigation District decreased irrigation deliveries. In response, total release from Canyon Ferry Lake was gradually decreased to 3,645 cfs (≈ 3,170 cfs through the powerplant and 475 cfs for the Helena Valley Project).

June 4-7: The water supply forecast prepared in June improved to 76 percent of average. To control the rate of fill of storage in Canyon Ferry Lake, the total release from Canyon Ferry was gradually increased to 5,875 cfs (≈ 5,400 cfs through the powerplant and 475 cfs for the Helena Valley Project).

June 7-11: Generous precipitation accompanying the delayed snowmelt runoff increased inflows to Canyon Ferry Lake to over 21,000 cfs. Helena Valley Irrigation District also increased irrigation deliveries. In response and to control the rate of fill of storage in Canyon Ferry, the total release was gradually increased to 16,365 cfs (≈ 5,200 cfs through the powerplant, 10,500 cfs through the spillway gates, and 665 cfs for the Helena Valley Project).

June 17: Heavy precipitation accompanying the delayed snowmelt runoff increased inflows to Canyon Ferry to over 22,000 cfs. Helena Valley Irrigation District also decreased irrigation deliveries. In response and to control the rate of fill of storage in Canyon Ferry, the total release was gradually increased to 18,500 cfs (≈ 5,100 cfs through the powerplant, 12,850 cfs through the spillway gates, and 550 cfs for the Helena Valley Project).

June 18: Helena Valley Irrigation District decreased irrigation deliveries. Inflow to Canyon Ferry also continues to remain over 22,000 cfs. In response and to control the rate of fill of storage in Canyon Ferry, the total release was maintained at 18,420 cfs (≈ 5,100 cfs through the powerplant, 12,850 cfs through the spillway gates, and 470 cfs for the Helena Valley Project).

June 21: Helena Valley Irrigation District decreased irrigation deliveries. Inflow to Canyon Ferry also continues to remain over 22,000 cfs. In response and to control the rate of fill of storage in Canyon Ferry, the total release was maintained at 18,315 cfs (≈ 5,100 cfs through the powerplant, 12,850 cfs through the spillway gates, and 365 cfs for the Helena Valley Project).

June 24: Western Area Power Administration requested a 5 MW-Hour reduction in generation. During 0245 hour through 0730 hour, the total release was decreased to 17,860 cfs (≈ 4,645 cfs through the powerplant, 12,850 cfs through the spillway gates, and 365 cfs for the Helena Valley Project). After fulfilling this request and because inflow to Canyon Ferry Lake remained over 22,000 cfs, the total release from Canyon Ferry was increased to 18,245 cfs (≈ 5,030 cfs through the powerplant, 12,850 cfs through the spillway gates, and 365 cfs for the Helena Valley Project) to control the rate of fill of storage in Canyon Ferry Lake.

July 7-10: With the high elevation snowmelt essentially over, inflow to Canyon Ferry Lake had quickly receded. Helena Valley Irrigation District also increased irrigation deliveries. To slow the evacuation rate of storage in Canyon Ferry Lake, the total release from Canyon Ferry was gradually decreased to 10,290 cfs (≈ 5,000 cfs through the powerplant, 4,800 cfs through the spillway gates, and 490 cfs for the Helena Valley Project).

July 12-15: Inflow to Canyon Ferry Lake continued to quickly recede. Helena Valley Irrigation District also increased irrigation deliveries. To slow the evacuation rate of storage in Canyon Ferry Lake, the total release from Canyon Ferry was gradually decreased to 7,715 cfs (≈ 5,000 cfs through the powerplant, 2,000 cfs through the river outlet gates, and 715 cfs for the Helena Valley Project).

July 16-18: Inflow to Canyon Ferry Lake continued to quickly recede. To slow the evacuation rate of storage in Canyon Ferry Lake, the total release from Canyon Ferry was gradually decreased to 5,715 cfs (≈ 5,000 cfs through the powerplant and 715 cfs for the Helena Valley Project).

July 21-22: Inflow to Canyon Ferry Lake continued to quickly recede. To conserve storage in Canyon Ferry Lake, the total release from Canyon Ferry was gradually decreased to 4,710 cfs (≈ 4,000 cfs through the powerplant and 710 cfs for the Helena Valley Project).

July 28: Inflow to Canyon Ferry Lake continued to quickly recede. To conserve storage in Canyon Ferry Lake, the total release from Canyon Ferry was gradually decreased to 4,210 cfs (≈ 3,500 cfs through the powerplant and 710 cfs for the Helena Valley Project).

July 21-22: Inflow to Canyon Ferry Lake continued to quickly recede. To conserve storage in Canyon Ferry Lake, the total release from Canyon Ferry was gradually decreased to 4,710 cfs (≈ 4,000 cfs through the powerplant and 710 cfs for the Helena Valley Project).

August 6: Flows in the Missouri River at the Holter gaging station had dropped to less than the desired minimum fishery flow of 4,100 cfs. In response, the total release from Canyon Ferry was increased to 4,410 cfs (3,700 cfs through the powerplant and 710 cfs for the Helena Valley Project).

August 24: Helena Valley Irrigation District decreased irrigation deliveries. In response the total release from Canyon Ferry was decreased to 4,290 cfs (3,680 cfs through the powerplant and 610 cfs for the Helena Valley Project).

August 31: Helena Valley Irrigation District decreased irrigation deliveries. In response the total release from Canyon Ferry was decreased to 4,135 cfs (3,680 cfs through the powerplant and 455 cfs for the Helena Valley Project).

September 9: Helena Valley Irrigation District decreased irrigation deliveries. In response the total release from Canyon Ferry was decreased to 3,995 cfs (3670 cfs through the powerplant and 325 cfs for the Helena Valley Project).

September 19: All irrigation deliveries to the Helena Valley Unit were discontinued for the 2010 irrigation season. To continue conserving storage in Canyon Ferry Reservoir, total release was decreased to 3,700 cfs (≈ 3,700 cfs through the powerplant and 0 cfs for the Helena Valley Project).

Additional statistical information of Canyon Ferry Reservoir and its operations during 2010 can be found on Table MTT6 and Figure MTG4.

TABLE MTT6
HYDROLOGIC DATA FOR 2010
CANYON FERRY RESERVOIR

RESERVOIR ALLOCATIONS	ELEVATION (FEET)	TOTAL RESERVOIR STORAGE (AF)	STORAGE ALLOCATION (AF)
TOP OF INACTIVE AND DEAD	3728.00	396,031	396,031
TOP OF ACTIVE CONSERVATION	3770.00	1,097,599	701,568
TOP OF JOINT USE	3797.00	1,891,888	794,289
TOP OF EXCLUSIVE FLOOD CONTROL	3800.00	1,992,977	101,089

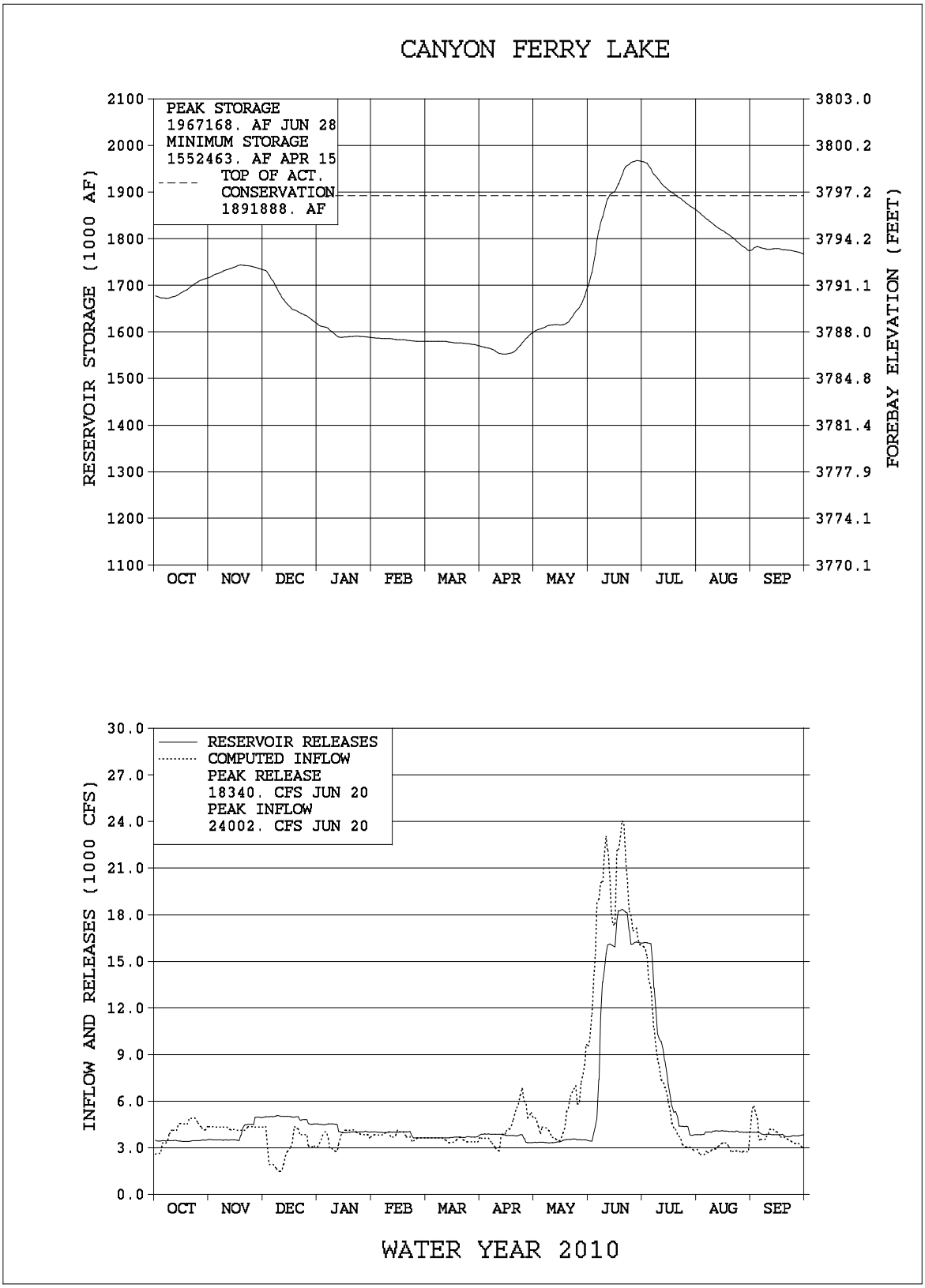
STORAGE-ELEVATION DATA	ELEVATION (FT)	STORAGE (AF)	DATE
BEGINNING OF YEAR	3790.50	1,679,615	OCT 01, 2009
END OF YEAR	3793.19	1,766,465	SEP 30, 2010
ANNUAL LOW	3786.48	1,552,463	APR 15, 2010
ANNUAL HIGH	3799.24	1,967,168	JUN 28, 2010
HISTORIC HIGH	3800.00	2,050,900	JUN 23, 1964

INFLOW-OUTFLOW DATA	INFLOW	DATE	OUTFLOW	DATE
ANNUAL TOTAL (AF)	3,877,410	OCT 09-SEP 10	3,704,531	OCT 09-SEP 10
DAILY PEAK (CFS)	24,002	JUN 20, 2010	18,340	JUN 20, 2010
DAILY MINIMUM (CFS)	1,477	DEC 11, 2009	3,308	MAY 10, 2010
PEAK SPILL (CFS)			13,021	JUN 21, 2010
TOTAL SPILL (AF)			757,248	11/18-25/09 04/29/10 06/07-07/18/10

MONTH	INFLOW		OUTFLOW*				CONTENT	
	KAF	% OF AVG	PUMPED TO HELENA VALLEY (KAF)	% OF AVG	RIVER KAF	% OF AVG	KAF	% OF AVG
OCTOBER	250.8	88	0.1	14	213.1	82	1,717.2	99
NOVEMBER	253.7	85	0.0	---	237.3	88	1,733.7	99
DECEMBER	184.1	76	0.0	---	300.9	102	1,616.9	97
JANUARY	227.9	103	0.0	---	257.5	88	1,587.2	101
FEBRUARY	210.6	95	0.0	---	217.5	82	1,580.3	104
MARCH	215.7	80	0.0	---	225.1	76	1,570.9	108
APRIL	258.8	74	9.1	147	224.6	221	1,596.0	109
MAY	317.6	55	15.4	110	211.2	59	1,687.0	103
JUNE	1,102.0	143	15.2	91	807.3	167	1,966.5	104
JULY	449.6	133	18.9	103	534.5	149	1,862.6	102
AUGUST	179.0	105	20.6	120	246.7	98	1,774.3	103
SEPTEMBER	227.8	107	6.7	78	228.9	99	1,766.5	103
ANNUAL	3,877.4	98	86.1	104	3,704.5	101		
APRIL-JULY	2,127.9	105						

* Average for the 1955-2010 period.

FIGURE MTG4


CANYON FERRY LAKE
PEAK STORAGE
1967168. AF JUN 28
MINIMUM STORAGE
1552463. AF APR 15
TOP OF ACT.
CONSERVATION
1891888. AF
RESERVOIR STORAGE (1000 AF)
FOREBAY ELEVATION (FEET)
2100
2000
1900
1800
1700
1600
1500
1400
1300
1200
1100
3803.0
3800.2
3797.2
3794.2
3791.1
3788.0
3784.8
3781.4
3777.9
3774.1
3770.1
OCT NOV DEC JAN FEB MAR APR MAY JUN JUL AUG SEP
RESERVOIR RELEASES
COMPUTED INFLOW
PEAK RELEASE
18340. CFS JUN 20
PEAK INFLOW
24002. CFS JUN 20
INFLOW AND RELEASES (1000 CFS)
30.0
27.0
24.0
21.0
18.0
15.0
12.0
9.0
6.0
3.0
0.0
OCT NOV DEC JAN FEB MAR APR MAY JUN JUL AUG SEP
WATER YEAR 2010

Helena Valley Reservoir

Helena Valley Reservoir is a regulating offstream reservoir for Helena Valley Unit (P-S MBP), located west of Canyon Ferry Reservoir. It has a total capacity of 10,451 acre-feet, which is used for irrigation and for furnishing a supplemental municipal supply to the city of Helena, Montana. Helena Valley Reservoir receives its entire water supply by pumping from Canyon Ferry Reservoir. When fully developed, Helena Valley Unit will irrigate about 14,100 acres of full-service land plus 3,500 acres of supplemental service lands. Present development is about 13,867 full-service acres, including 5,200 acres previously irrigated by pumping from Helena Valley Reservoir or from other streams.

At the beginning of the year, storage in Helena Valley Reservoir was 6,868 acre-feet at an elevation of 3812.09 feet. Helena Valley Reservoir reached a low for the year of 5,808 acre-feet at an elevation of 3809.09 feet on March 31, 2010. With new operating criteria in place, goals were to fill Helena Valley Reservoir by May 1, and maintain it nearly full through June. In response, diversions to the Helena Valley Unit from Canyon Ferry Reservoir were started on April 1. Storage in Helena Valley Reservoir then steadily increased to a peak for the year of 10,702 acre-feet at an elevation of 3820.55 feet on April 26, 2010. By the end of water year 2010, Helena Valley Reservoir ended with a storage content of 8,510 acre-feet at elevation 3816.06 feet. During 2010, 86,059 acre-feet of water was pumped to Helena Valley Reservoir from Canyon Ferry Reservoir. Helena Valley Irrigation District released 60,708 acre-feet for irrigation. All irrigation deliveries were discontinued for the 2010 season on September 19.

The reservoir provided an adequate water supply to satisfy all irrigation requirements for the Helena Valley Unit in 2010 and supplement the city of Helena's municipal water supply.

Statistical information pertaining to Helena Valley Reservoir is shown on Table MTT7 below.

TABLE MTT7
HYDROLOGIC DATA FOR 2010

RESERVOIR ALLOCATIONS	ELEVATION (FEET)	RESERVOIR STORAGE (AF)	STORAGE ALLOCATION (AF)
Top of Inactive Storage	3805.00	4,554	4,554
Top of Active Conservation Storage	3820.07	10,451	5,897
STORAGE ELEVATION DATA	**ELEVATION (FEET)**	**STORAGE (AF)**	**DATE**
Beginning of Year	3812.09	6,868	10/01/09
End of Year	3816.06	8,510	09/30/10
Annual Low	3809.09	5,808	03/31/10
Annual High	3820.55	10,702	04/26/10
Historic High	3820.60	10,738	6/02/75

INFLOW-OUTFLOW DATA	ANNUAL
Pumped from Canyon Ferry to Helena Valley Unit	86,059 AC-FT
Inflow to Helena Valley Reservoir	63,770 AC-FT
Released from reservoir for irrigation	60,708 AC-FT
Delivered to the City of Helena for municipal use	1,419 AC-FT

MONTH	RESERVOIR		
	FOREBAY ELEVATION (FEET)	STORAGE CONTENT (KAF)	PUMPED TO HELENA VALLEY (KAF)
OCTOBER	3811.61	6.7	0.1
NOVEMBER	3811.10	6.5	0
DECEMBER	3810.79	6.4	0
JANUARY	3810.20	6.2	0
FEBRUARY	3809.56	6.0	0
MARCH	3809.09	5.8	0
APRIL	3820.33	10.6	9.1
MAY	3819.82	10.3	15.4
JUNE	3819.39	10.1	15.2
JULY	3814.68	7.9	18.9
AUGUST	3818.50	9.7	20.6
SEPTEMBER	3816.06	8.5	6.7
ANNUAL			86.1

Sun River Project

Storage for the Sun River Project is provided by Gibson, Willow Creek, and Pishkun Reservoirs, which are all single purpose irrigation structures. The project serves 95,000 acres on the Greenfields and Fort Shaw Irrigation Districts. A diversion dam is located on the Sun River about 3 miles below Gibson Reservoir to allow flows to be diverted down the Pishkun Supply Canal to Pishkun Reservoir, or down the Willow Creek Feeder Canal to Willow Creek Reservoir. Releases are made from Pishkun Reservoir to supply the canals of the Greenfields Irrigation District. Releases from Willow Creek Reservoir re-enter the Sun River where they can be diverted at the Fort Shaw Diversion Dam to supply the canals of the Fort Shaw Irrigation District.

Gibson Reservoir is located on the Sun River above Augusta, Montana, and has a total capacity of 96,477 acre-feet. In 1996, a hydrographic and topographic survey was conducted to measure the reservoir volume lost due to sediment accumulations that occurred in the drainage basin since the major forest fires that occurred in 1988. As a result of the survey, a new elevation-area-capacity table and curve was developed.

The 1996 survey determined that Gibson Reservoir has a storage capacity of 96,477 acre-feet and a surface area of 1,296 acres at reservoir elevation 4724 feet. Since closure in 1929, the reservoir has accumulated a sediment volume of 8,383 acre-feet below reservoir elevation 4724 feet. This volume represents a 7.99 percent loss in capacity and an average annual loss of 125.7 acre-feet. The 1996 survey also showed the average annual rate of sediment deposition since 1973 was 113.1 acre-feet per year and that most of the sediment contribution came after the 1988 fires. The revised area-capacity table was developed and put into effect on October 1, 1997, reflecting the new storage levels.

The spillway crest is at elevation 4712.0 feet (81,255 acre-feet). Depending on the runoff conditions and reservoir levels, the spillway gates remain open during the spring until the inflows and remaining snow cover indicate that the runoff is receding. Once it is apparent that the runoff has peaked and started to recede, the spillway gates are progressively closed to allow the reservoir to fill to the top of the conservation pool at elevation 4724.0 feet (96,477 acre-feet).

The near average conditions in 2009 provided some relief to the water users, and the cool spring runoff conditions helped boost the late fall inflows as stream flows in the Sun River were close to average for Gibson Reservoir heading into water year 2010. The August through September inflow to Gibson Reservoir was 94 percent of average, totaling 43,000 acre-feet at the end of water year 2009.

With the inflows averaging 241 cfs and releases averaging 61 cfs during September, storage in Gibson Reservoir increased slowly and entered water year 2010 with a storage content of 5,600 acre-feet at elevation 4610.93 feet.

This was 20 percent of average and only 6 percent of full capacity. This was also 90,877 acre-feet or 113.07 feet below the top of the conservation pool and was 16,380 acre-feet or 24.63 feet less than at the beginning of water year 2009.

At the conclusion of the 2009 irrigation season, fall and winter releases from Gibson Reservoir to the Sun River were reduced in mid-September and maintained between 90-110 cfs with the expectation that with normal snowpack they could be increased later. During November releases were increased to transfer water to Pishkun Reservoir so that snow in the canal would not slow down trying to move water in the spring. In December the reservoir gradually filled, and by the end of December storage had increased to approximately 14,500 acre-feet.

Precipitation in the Sun River Basin varied from much above average too much below average during water year 2010. Cumulative precipitation for October through December was below average for mountain areas, and near average in valley areas in the Sun River Basin. By January 1, the NRCS measured the mountain snowpack in the Sun River Basin at 80 percent of average, which was a 2 percent decrease from a year ago. During January, precipitation was below average in the mountain and valley areas causing snowpack to decrease to 66 percent of average by February 1.

During February, precipitation was below average in the valley, and mountain regions of the basin. By March 1, snowpack had dropped to 53 percent of average. March precipitation was below average in both the mountain and valley areas. The cumulative precipitation through the end of March was 56 and 79 percent of average for the mountain and valley areas, respectively.

On April 1, the NRCS measured the snowpack at 44 percent of average. In 2010, the snowpack in the Sun River Basin reached its peak accumulation on April 15 and was 66 percent of the average peak. Snowmelt runoff began entering Gibson Reservoir in mid-April, and then really started in early May. Releases to Pishkun Reservoir were initiated on May 4 and Gibson Reservoir storage drafted until May 15 when inflows increased above releases. On May 4, storage in Gibson Reservoir was at 56,708 acre-feet at elevation 4690.04 feet, 39,769 acre-feet or 34 feet below the top of the conservation pool. The combination of cooler temperatures, and spring rain showers produced a peak inflow for the year of 2,990 cfs on May 19.

During April and May, precipitation in both the valley and mountain areas was above average. Valley and mountain precipitation during June was 120 and 93 percent of average, respectively. The below average snowpack and the below average spring precipitation produced an April-July runoff that was about 58 percent of average for the basin. However; due to the cooler temperatures early on, more of the water was able to be stored and used as irrigation was in full swing before a lot of the runoff made its way out of the mountains. The inflows during April, May, and June were 79, 47, and 62 percent of average, respectively.

As Gibson Reservoir began filling, releases during late April were started to move water to Pishkun Reservoir. With the high elevation snowmelt essentially over and to assure filling Gibson Reservoir to the top of the conservation pool, the spillway gates were closed on May 27. By now it appeared the peak inflows had passed. On June 5, Gibson Reservoir reached the full pool (96,477 acre-feet at elevation 4724 feet), and remained within a 1 foot of full pool elevation until June 29.

The peak discharge to the Sun River over the Sun River Diversion Dam was recorded on June 6 at 2,589 cfs. The snowmelt runoff peaked in mid May with the inflow reaching a peak of 2,990 cfs on May 29. The actual April-July inflow totaled 278,000 acre-feet, approximately 58 percent of average and 111,000 acre-feet or 29 percent less than the previous year.

Weather conditions remained fairly mild in July when precipitations in both the valley and mountain areas were below average at 64 and 57 percent of average, respectively. The dry conditions changed to normal conditions in August, resulting in the cumulative water year precipitation through August for valley and mountain areas totaling 95 and 77 percent of average, respectively. Concluding, the water year conditions improved during September when valley and mountain precipitation were 139 and 103 percent of average, respectively. The August-September inflow to Gibson Reservoir totaled about 35,300 acre-feet, 77 percent of average. During September, the average inflow was approximately 341 cfs. Gibson Reservoir ended the water year with a content of 16,240 acre-feet of storage at elevation 4635.23 feet on September 30. This was 58 percent of average and 17 percent of normal full capacity or 80,237 acre-feet or 88.77 feet below the top of the conservation pool. This was 10,640 acre-feet or 14.30 feet more than at the end of water year 2009.

Total annual inflow for water year 2010 was 61 percent of average, totaling 378,400 acre-feet. This was 131,400 acre-feet or 26 percent less than the inflow experienced during water year 2009.

Diversions to the Pishkun Supply Canal were started on May 4 and for Willow Creek Reservoir on March 23. During late April and early May, storage was moved from Gibson Reservoir to refill Pishkun and Willow Creek Reservoirs. The total net inflow to Pishkun Reservoir during water year 2010 was 238,100 acre-feet, 104 percent of average. Spring diversions to Willow Creek Reservoir were discontinued on June 23. Pishkun Reservoir reached its spring runoff peak elevation on June 24. Willow Creek Reservoir elevations increase until June 21 when the reservoir reached peak content. Diversions to Willow Creek Reservoir were discontinued in mid June, as the storage was near full capacity. The net inflow for the water year to Willow Creek Reservoir was 6,300 acre-feet, 44 percent of average.

Greenfields Irrigation District discontinued water delivery on September 15. Supplemental water contracts served by Greenfields were satisfied while Gibson Reservoir releases were in excess of senior irrigation demands.

Based on average diversions to Pishkun Reservoir and supplemental water delivered, Greenfields delivered full allotments to all of its water users in 2010. The total diversion for Fort Shaw Irrigation District was average during 2010. The total water diverted during May 1 through October 17 was approximately 44,822 acre-feet, which is 105 percent of average.

Even though there is no space allocated to flood control in Gibson Reservoir, the Corps still estimates flood damages prevented by Gibson Reservoir. The Corps determined that during 2010, Gibson Reservoir prevented $2,600 in local flood damages, but did not contribute to the reduction of flood damages downstream on the Missouri River below Fort Peck Reservoir. Since 1950 Gibson Reservoir has prevented $3,066,100 in flood damages.

Pishkun Reservoir, near Augusta, Montana, is an off-stream reservoir supplied by a feeder canal which diverts water from the Sun River below Gibson Reservoir. The reservoir serves the 81,000 acre Greenfields Division. The total capacity of the reservoir is 46,670 acre-feet at elevation 4370.0 feet.

All canal diversions from the Sun River to Pishkun Reservoir during the 2009 irrigation season were discontinued on November 3, 2010. Reservoir content in Pishkun Reservoir at the beginning of water year 2010 was 23,900 acre-feet at elevation 4351.68 feet. This was 73 percent of average and was about 3,628 acre-feet less than it was at the start of the 2010 water year.

Storage during the fall and winter of 2010 was held slightly above average at about 6 feet from the top of the active conservation pool. Diversion to refill the reservoir began in mid-May and by the end of May storage had reached the top of active conservation pool. Once irrigation releases began, storage fluctuated based on meeting irrigation demands. Due to the precipitation in late May, demands decreased allowing storage to increase to a spring peak content of 48,175 acre-feet at elevation 4370.96 feet on June 24.

Irrigation releases from Pishkun Reservoir were started on May 15 with a maximum release of 1,690 cfs recorded on June 15. The maximum inflow was 1,403 cfs on July 17, 2010. All diversions from the Sun River to Pishkun Reservoir were discontinued on August 29, 2010. All irrigation releases from Pishkun Reservoir were discontinued on September 15, 2010.

Approximately 241,700 acre-feet of water, 106 percent of average, was released from Pishkun Reservoir during May 15 through September 15 to help meet the irrigation demands on the Sun River Project. By the end of the water year, the reservoir storage was 20,272 acre-feet at elevation 4347.52 feet. This was 73 percent of average and 43 percent of full capacity. This is 4.16 feet or 3,628 acre-feet less than in 2009.

Additional hydrologic and statistical data pertaining to Pishkun Reservoir can be found in Table MTT8-B and Figure MTG6.

Willow Creek Reservoir obtains its water supply from Willow Creek and the Sun River via the Willow Creek Feeder Canal. The total reservoir capacity is 32,300 acre-feet at elevation 4142.0 feet. Releases from Willow Creek Reservoir enter the Sun River and can be diverted for irrigation at the Fort Shaw Diversion Dam, the Floweree Canal of the Broken O Ranch, and other downstream senior water users.

All diversions from the Sun River to Willow Creek Reservoir during the 2010 irrigation season were discontinued on June 20, 2010. Reservoir content in Willow Creek at the beginning of water year 2010 was 25,186 acre-feet at elevation 4137.27 feet. This was 145 percent of average and 78 percent of full capacity.

Storage in Willow Creek Reservoir increased gradually throughout the winter. Diversions from the Sun River to Willow Creek Reservoir during 2010 were initiated on March 16 at a rate of approximately 38 cfs. The diversions began to reach Willow Creek Reservoir on April 21 and storage increased through April and May to a peak storage content for the year of 31,090 acre-feet at elevation 4141.48 feet on June 21. This storage level was 100 percent of average and was at 99 percent of full capacity. Due to the good carryover from water year 2009 diversions to Willow Creek Reservoir were continued until June 21. The peak inflow during this time period was 116 cfs.

To help meet irrigation demands within the Sun River Irrigation Project, releases were made from July 13 through August 19. Approximately 8,400 acre-feet of storage was released from Willow Creek Reservoir to help meet the irrigation demands in 2010. As a result, storage was maintained at near full pool through the irrigation season. No fall diversions were needed to refill Willow Creek Reservoir this year. Willow Creek Reservoir ended the water year with a storage content of 23,138 acre-feet at elevation 4135.74 feet. This was 133 percent of average and 73 percent of normal full capacity. This was also 2,018 acre-feet or 1.53 feet lower than at the end of water year 2009.

Additional hydrologic and statistical data pertaining to Willow Creek Reservoir can be found in Table MTT8-C and Figure MTG7.

Important Events – 2010

March 16, 2010 : Diversions to Willow Creek Feeder Canal were started to move water to Willow Creek Reservoir.

May 4, 2010: Diversions to Pishkun Reservoir were initiated.

May 15, 2010: Diversions from Pishkun Reservoir were initiated to water up the canals for irrigation.

May 19, 2010: Peak Inflow to Gibson Reservoir is 2,990 cfs.

June 8, 2010: Gibson Reservoir reaches Full Pool Elevation of 4624.0 feet.

June 15, 2010: Peak Release from Pishkun Reservoir is 1,690 cfs.

June 16, 2010: Willow Creek Reservoir has a peak inflow of the year of 116 cfs.

June 17, 2010: Peak Release from Gibson Reservoir is 2,548cfs.

June 21, 2010: Diversions to Willow Creek Feeder Canal were discontinued for the year.

June 21, 2010: Willow Creek Reservoir reaches peak elevation for year at 4141.48 feet.

June 23, 2010: Gibson Reservoir drops below full conservation pool of 4724.0 feet.

June 24, 2010: Pishkun Reservoir reaches peak elevation for year at 4370.96 feet.

July 5, 2010: Gibson Reservoir reaches peak for year at elevation 4724.18 feet.

July 17, 2010: Inflows into Pishkun Reservoir peak at approximately 1,403 cfs.

August 10, 2010: Willow Creek Reservoir has its peak release of 120 cfs.

September 15, 2010: Releases from Pishkun Reservoir were discontinued for the season.

November 4, 2010: Diversions to Pishkun Reservoir discontinued for the year.

TABLE MTT8-A
HYDROLOGIC DATA FOR 2010
GIBSON RESERVOIR (SUN RIVER PROJECT)

RESERVOIR ALLOCATIONS	ELEVATION (FEET)	TOTAL RESERVOIR STORAGE (AF)	STORAGE ALLOCATION (AF)
TOP OF INACTIVE AND DEAD	4557.50	0	0
TOP OF ACTIVE CONSERVATION	4724.00	96,477	96,477

STORAGE-ELEVATION DATA	ELEVATION (FT)	STORAGE (AF)	DATE
BEGINNING OF YEAR	4610.93	5,600	OCT 01, 2009
END OF YEAR	4635.23	16,240	SEP 30, 2010
ANNUAL LOW	4609.30	5,102	AUG 29, 2010
ANNUAL HIGH	4724.18	96,711	JUN 05, 2010
HISTORIC HIGH	4732.23	116,400	JUN 08, 1964

INFLOW-OUTFLOW DATA	INFLOW	DATE	OUTFLOW	DATE
ANNUAL TOTAL (AF)	378,431	OCT 09-SEP 10	367,806	OCT 09-SEP 10
DAILY PEAK (CFS)	2,990	MAY 19, 2010	2,548	JUN 17, 2010
DAILY MINIMUM (CFS)	101	MAR 19, 2010	18	MAR 13, 2010

MONTH	INFLOW		OUTFLOW*				CONTENT	
	KAF	% OF AVG	TOTAL CANAL KAF	% OF AVG	RIVER KAF	% OF AVG	KAF	% OF AVG
OCTOBER	13.0	69	0.0	---	9.9	100	13.8	46
NOVEMBER	16.0	93	15.2	1088	4.6	42	10.5	30
DECEMBER	7.5	48	0.0	---	5.2	45	14.5	38
JANUARY	11.4	83	0.0	---	5.7	57	22.5	54
FEBRUARY	7.1	58	0.0	---	9.1	112	22.8	51
MARCH	10.1	70	2.5	262	6.3	65	27.8	58
APRIL	31.8	79	3.7	43	6.6	30	52.7	99
MAY	80.2	47	33.1	84	16.5	17	85.4	100
JUNE	122.7	62	54.2	95	71.0	54	94.7	107
JULY	43.3	63	84.1	116	12.2	46	42.1	72
AUGUST	21.0	80	49.4	123	10.0	76	5.5	17
SEPTEMBER	14.3	75	0.0	---	6.5	65	16.2	58
ANNUAL	378.4	61	242.2	103	163.7	46		
APRIL-JULY	278.0	58						

* Average for the 1931-2010 period.

FIGURE MTG5

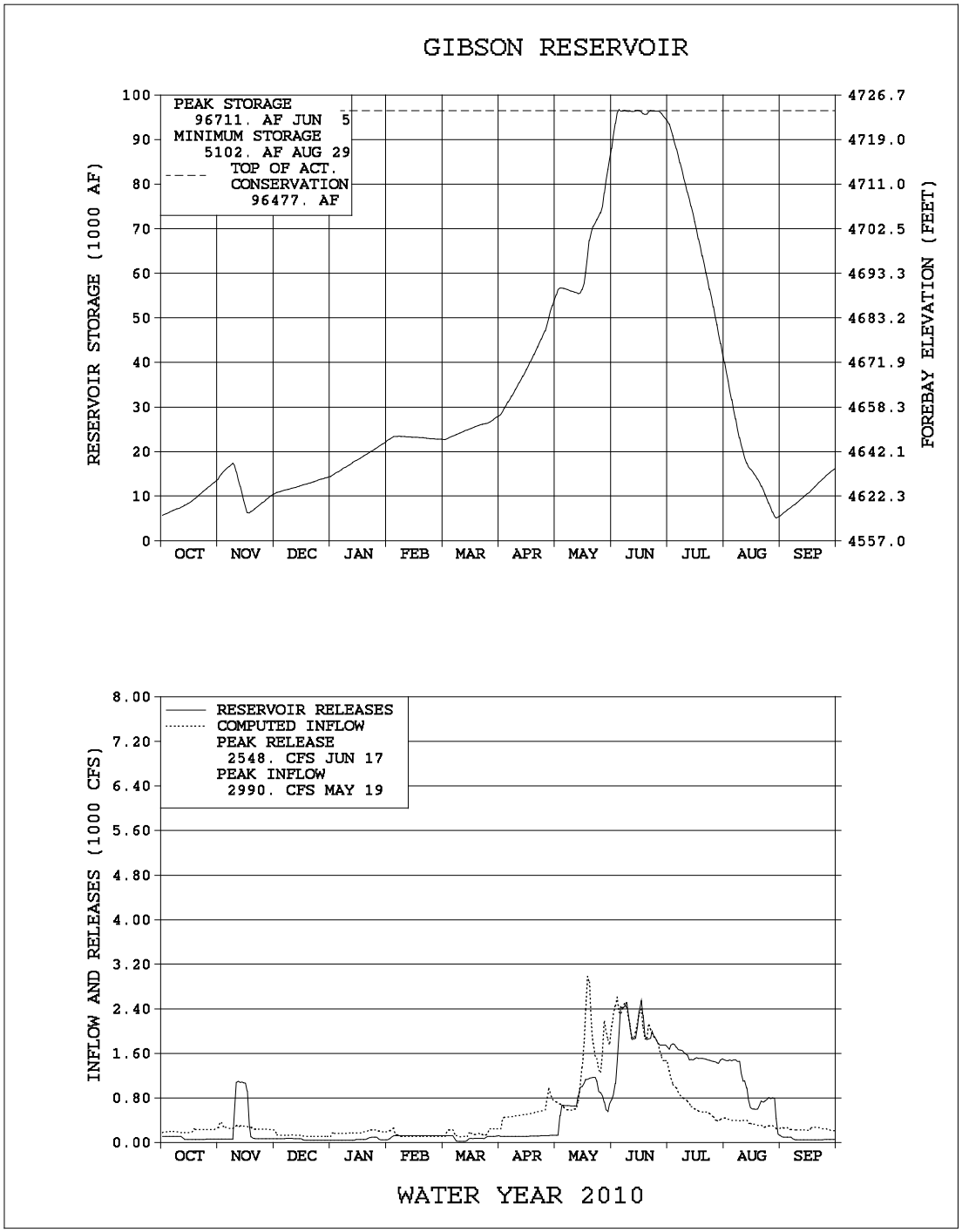

GIBSON RESERVOIR
PEAK STORAGE
96711. AF JUN 5
MINIMUM STORAGE
5102. AF AUG 29
TOP OF ACT.
CONSERVATION
96477. AF
RESERVOIR STORAGE (1000 AF)
FOREBAY ELEVATION (FEET)
100
90
80
70
60
50
40
30
20
10
0
4726.7
4719.0
4711.0
4702.5
4693.3
4683.2
4671.9
4658.3
4642.1
4622.3
4557.0
OCT
NOV
DEC
JAN
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP
RESERVOIR RELEASES
COMPUTED INFLOW
PEAK RELEASE
2548. CFS JUN 17
PEAK INFLOW
2990. CFS MAY 19
INFLOW AND RELEASES (1000 CFS)
8.00
7.20
6.40
5.60
4.80
4.00
3.20
2.40
1.60
0.80
0.00
WATER YEAR 2010

TABLE MTT8-B
HYDROLOGIC DATA FOR 2010
PISHKUN RESERVOIR (SUN RIVER PROJECT)
NEW SEDIMENT SURVEY DATA EFFECTIVE 10/01/2005

RESERVOIR ALLOCATIONS	ELEVATION (FEET)	TOTAL RESERVOIR STORAGE (AF)	STORAGE ALLOCATION (AF)
TOP OF INACTIVE AND DEAD	4342.00	16,008	16,008
TOP OF ACTIVE CONSERVATION	4370.00	46,694	30,686

STORAGE-ELEVATION DATA	ELEVATION (FT)	STORAGE (AF)	DATE
BEGINNING OF YEAR	4351.68	23,900	OCT 01, 2009
END OF YEAR	4347.52	20,272	SEP 30, 2010
ANNUAL LOW	4347.00	19,845	SEP 14, 2010
ANNUAL HIGH	4370.96	48,175	JUN 24, 2010
HISTORIC HIGH	4371.40	48,950	JUL 04, 1953

INFLOW-OUTFLOW DATA	INFLOW	DATE	OUTFLOW	DATE
ANNUAL TOTAL (AF)	238,099	OCT 09-SEP 10	241,730	OCT 09-SEP 10
DAILY PEAK (CFS)	1,403	JUL 17, 2010	1,690	JUN 15, 2010
DAILY MINIMUM (CFS)	0	*	0	*

* During nonirrigation season

MONTH	INFLOW*		OUTFLOW*		CONTENT	
	KAF	% OF AVG	KAF	% OF AVG	KAF	% OF AVG
OCTOBER	-0.6	---	0.0	---	23.3	68
NOVEMBER	14.5	2061	0.0	---	37.8	110
DECEMBER	-0.4	---	0.0	---	37.4	109
JANUARY	-0.4	---	0.0	---	37.0	108
FEBRUARY	-0.4	---	0.0	---	36.6	108
MARCH	-0.4	---	0.0	---	36.2	106
APRIL	-0.4	---	0.0	---	35.8	88
MAY	34.3	94	22.9	75	47.1	103
JUNE	55.4	95	55.5	90	47.0	111
JULY	81.8	117	88.3	118	40.6	109
AUGUST	53.8	129	54.9	127	39.5	112
SEPTEMBER	1.0	8	20.2	128	20.3	62
ANNUAL	238.1	104	241.7	106		
APRIL-JULY	171.0	100				

* Average for the 1947-2010 period.

FIGURE MTG6

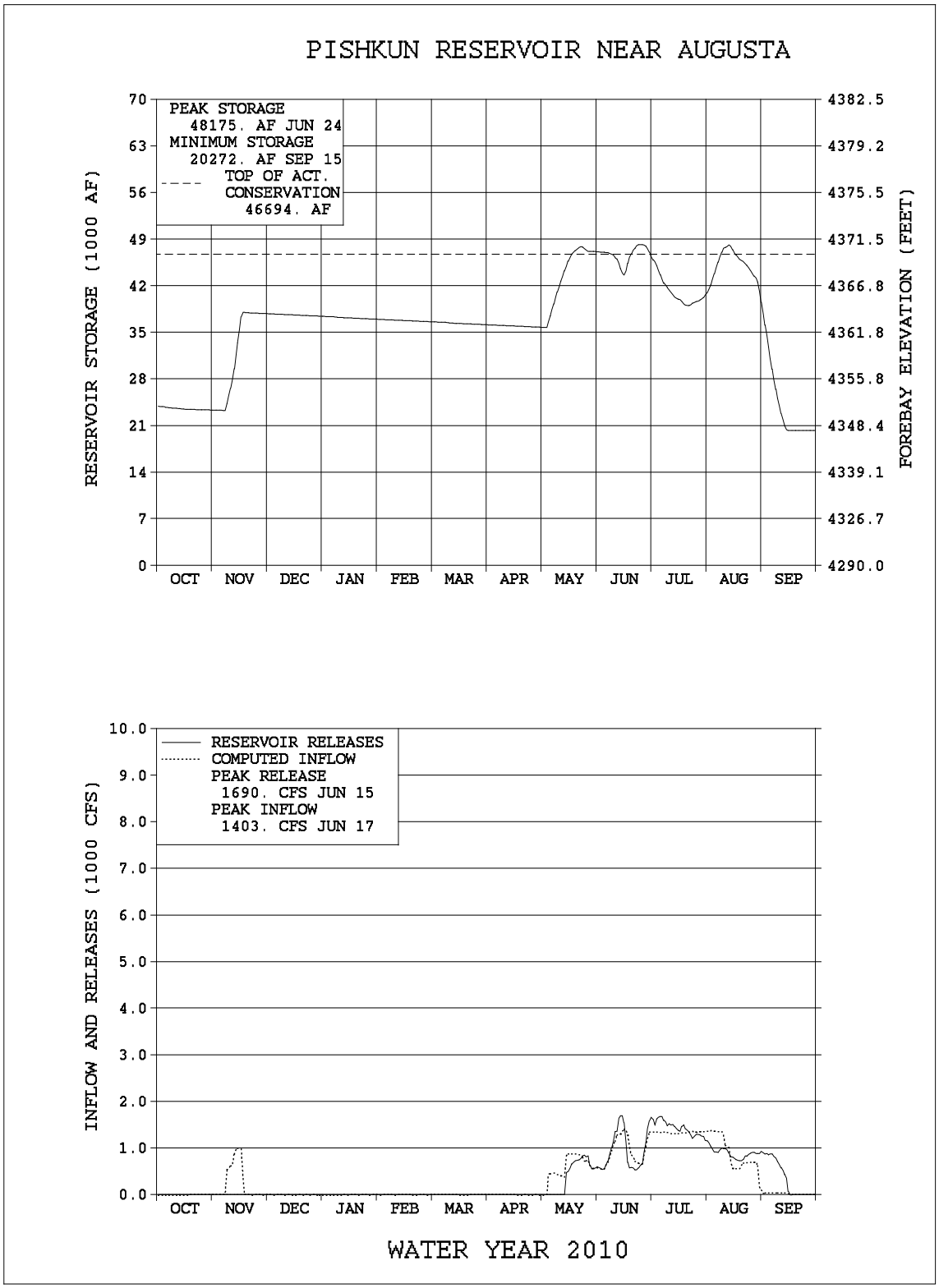

PISHKUN RESERVOIR NEAR AUGUSTA
PEAK STORAGE
48175. AF JUN 24
MINIMUM STORAGE
20272. AF SEP 15
TOP OF ACT.
CONSERVATION
46694. AF
RESERVOIR STORAGE (1000 AF)
FOREBAY ELEVATION (FEET)
70
63
56
49
42
35
28
21
14
7
0
4382.5
4379.2
4375.5
4371.5
4366.8
4361.8
4355.8
4348.4
4339.1
4326.7
4290.0
OCT NOV DEC JAN FEB MAR APR MAY JUN JUL AUG SEP
RESERVOIR RELEASES
COMPUTED INFLOW
PEAK RELEASE
1690. CFS JUN 15
PEAK INFLOW
1403. CFS JUN 17
INFLOW AND RELEASES (1000 CFS)
10.0
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
OCT NOV DEC JAN FEB MAR APR MAY JUN JUL AUG SEP
WATER YEAR 2010

TABLE MTT8-C
HYDROLOGIC DATA FOR 2010
WILLOW CREEK RESERVOIR (SUN RIVER PROJECT)
NEW SEDIMENT SURVEY DATA EFFECTIVE 10/01/2005

RESERVOIR ALLOCATIONS	ELEVATION (FEET)	TOTAL RESERVOIR STORAGE (AF)	STORAGE ALLOCATION (AF)
TOP OF INACTIVE AND DEAD	4085.28	1	1
TOP OF ACTIVE CONSERVATION	4142.00	31,848	31,847

STORAGE-ELEVATION DATA	ELEVATION (FT)	STORAGE (AF)	DATE
BEGINNING OF YEAR	4137.27	25,186	OCT 01, 2009
END OF YEAR	4135.74	23,138	SEP 30, 2010
ANNUAL LOW	4135.67	23,045	SEP 08, 2010
ANNUAL HIGH	4141.48	31,090	JUN 21, 2010
HISTORIC HIGH	4144.00	35,300	JUN 22, 1975

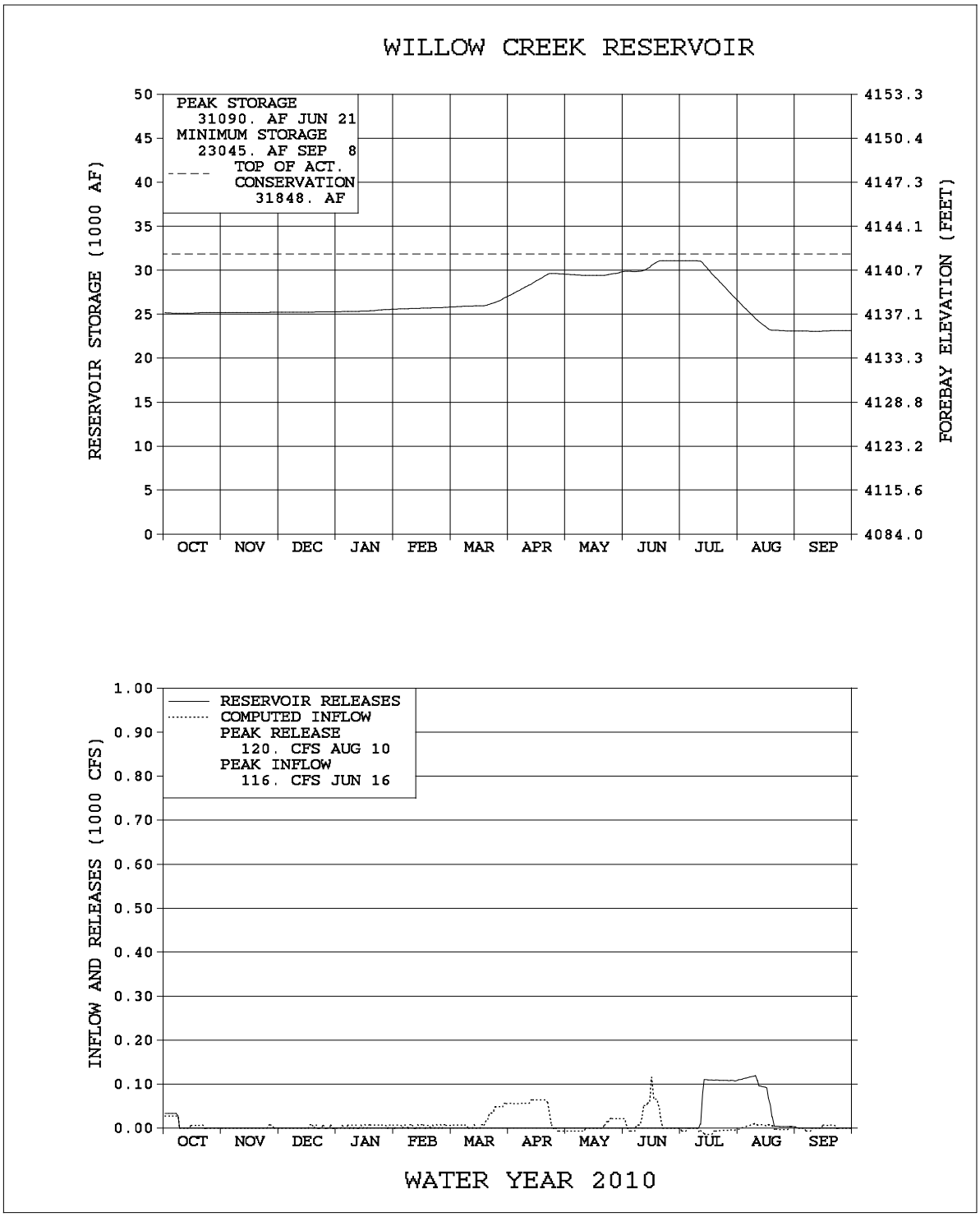
INFLOW-OUTFLOW DATA	INFLOW	DATE	OUTFLOW	DATE
ANNUAL TOTAL (AF)	6,316	OCT 09-SEP 10	8,364	OCT 09-SEP 10
DAILY PEAK (CFS)	116	JUN 16, 2010	120	AUG 10, 2010
DAILY MINIMUM (CFS)	0	*	0	*

* During nonirrigation season

MONTH	INFLOW*		OUTFLOW*		CONTENT	
	KAF	% OF AVG	KAF	% OF AVG	KAF	% OF AVG
OCTOBER	0.5	65	0.5	261	25.2	132
NOVEMBER	0.1	5	0.0	---	25.2	129
DECEMBER	0.1	16	0.0	---	25.3	127
JANUARY	0.3	73	0.0	---	25.6	126
FEBRUARY	0.2	56	0.0	---	25.8	125
MARCH	1.2	131	0.0	---	27.0	123
APRIL	2.6	128	0.0	---	29.6	119
MAY	0.2	5	0.0	---	29.8	108
JUNE	1.3	34	0.0	---	31.1	104
JULY	-0.4	---	4.0	76	26.7	114
AUGUST	0.2	---	3.8	104	23.1	125
SEPTEMBER	0.1	12	0.0	---	23.1	133
ANNUAL	6.3	44	8.4	59		
APRIL-JULY	3.8	37				

* Average for the 1952-2010 period.

FIGURE MTG7


WILLOW CREEK RESERVOIR
PEAK STORAGE
31090. AF JUN 21
MINIMUM STORAGE
23045. AF SEP 8
TOP OF ACT.
CONSERVATION
31848. AF
RESERVOIR STORAGE (1000 AF)
FOREBAY ELEVATION (FEET)
0
5
10
15
20
25
30
35
40
45
50
4084.0
4115.6
4123.2
4128.8
4133.3
4137.1
4140.7
4144.1
4147.3
4150.4
4153.3
OCT
NOV
DEC
JAN
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP
RESERVOIR RELEASES
COMPUTED INFLOW
PEAK RELEASE
120. CFS AUG 10
PEAK INFLOW
116. CFS JUN 16
INFLOW AND RELEASES (1000 CFS)
0.00
0.10
0.20
0.30
0.40
0.50
0.60
0.70
0.80
0.90
1.00
WATER YEAR 2010

Lake Elwell (Tiber Dam)

Lake Elwell (Tiber Dam) (P-S M.B.P.) is located on the Marias River near Chester, Montana. It was built to provide an adequate water supply for 127,000 acres in the Lower Marias Unit and for flood control. The crest section of Tiber Dam spillway began settling in 1956, following initial filling of the reservoir. Restrictions were placed on reservoir operating levels in the late 1950s to safeguard the structure until repairs could be made. The settling continued despite attempts to halt it. The rate of settlement was alarming following the flood of 1964 and the heavy runoff of 1965. This settlement was attributed to a weakness of the underlying shale formation in which small lenses of gypsum were slowly being dissolved as water passed through the shale. Measures to protect the structure were approved by Congress, and construction was initiated in 1967 and completed in 1970. This construction consisted of modifying the canal outlet works for use as an auxiliary outlet works and closing the entrance channel of the spillway by a temporary earthfill cofferdam. To accommodate these changed conditions, the reservoir operating criteria was further revised and the active capacity was eliminated. Work on modification of the spillway to restore active conservation capacity started in 1976 and completed in October 1981. This construction consisted of replacing the upstream section of the spillway and raising the dam 5 feet. Since that time, all restrictions on operating levels were lifted and normal operations were restored at Lake Elwell.

Because the irrigation distribution works have not yet been constructed, the reservoir is operated primarily for flood control and for increased fishery and recreation benefits. However, the reservoir provides irrigation water to several individual operators by water service contracts and provides about 1,500 acre-feet to the Tiber County Water District for municipal, industrial, rural domestic, and livestock use. The city of Chester, Montana, receives a small amount of water from the reservoir annually for municipal use. Approximately 3,000 acres are irrigated by contract from Lake Elwell storage.

In 2002, Reclamation surveyed Lake Elwell to develop a topographic map and compute a present storage-elevation relationship (area-capacity tables). The data was used to calculate reservoir capacity lost due to sediment accumulation since dam closure in October of 1957. The 2002 survey determined that Lake Elwell has a storage capacity of 925,649 acre-feet and a surface area of 18,275 acres at a reservoir elevation of 2993.00 feet. Since closure in 1957, the reservoir has accumulated a sediment volume of 42,179 acre-feet below elevation 2993.00 feet. This volume represents a 4.4 percent change in total capacity at this elevation. The revised area-capacity table was put into effect on October 1, 2005, reflecting the new storage levels.

In September of 2003, construction of a powerplant was permitted by the Federal Energy Regulatory Commission (FERC). The river outlet works underwent extensive modification to incorporate the addition of a 7.5 MW powerplant, privately owned by Tiber Montana, LLC.

A bifurcation pipe was installed in the river outlet works tunnel at the downstream end to divert flow from the existing 72-inch outlet pipe through a bifurcation and 96-inch butterfly valve to the powerplant. Construction of the powerplant was completed and brought on-line in June 2004.

During August and September of 2009, both valley and mountain precipitation in the Marias River Basin above Lake Elwell was below normal. Valley precipitation was recorded at 60 and 38 percent of average, respectively, while mountain precipitation was 72 and 21 percent of average, respectively. By year end, the total annual valley precipitation in the Marias River Basin was 82 percent of average while the total annual mountain precipitation was 79 percent of average. Inflow to Lake Elwell during July through September totaled 58,010 acre-feet which was 29,475 acre-feet less than experienced in 2008. The total annual runoff into Lake Elwell during 2009 was 425,754 acre-feet, 63 percent of normal and 157,233 acre-feet less than experienced in 2008. By the end of the year, normal operations of Lake Elwell drafted storage to 841,617 acre-feet at an elevation of 2988.18 feet. This was 107 percent of normal and 0.40 feet higher than reported on September 30, 2008.

Water year 2010 started off very wet with both valley and mountain precipitation in the Marias River Basin above Lake Elwell being above average. Valley precipitation during October was 159 percent of average while the mountain precipitation was 153 percent of average. During November, both the valley and mountain precipitation decreased to below average. Valley precipitation during November was 2 percent of average while the mountain precipitation was 56 percent of average. Valley precipitation was above average during December and January and then fell to below average during February and March. Mountain precipitation continued to remain below average during December through March. The valley precipitation amounts during December, January, February, and March were 159, 174, 51, and 15 percent of average, respectively, while the mountain precipitation was 77, 33, 21, and 43 percent of average, respectively.

During the winter of 2009-2010, mountain snowpack in the Marias Basin above Lake Elwell began to accumulate at above normal rates until mid-October. As the winter progressed, snow fell in the mountains at near normal rates until mid-November. On December 1, the NRCS measured the mountain snowpack in the Marias River Basin above Lake Elwell to be 75 percent of average. Inflow into Lake Elwell during October-December totaled 34,839 acre-feet and was 55 percent of normal. On January 1, the NRCS reported the mountain snowpack in the Marias River Basin above Lake Elwell had improved slightly but was still only 78 percent of average. The January 1 water supply forecast, based on mountain snowpack, indicated the April-July runoff into Lake Elwell would be 317,000 acre-feet, which was 65 percent of normal.

On February 1, the NRCS reported the mountain snowpack in the Marias River Basin above Lake Elwell had declined to 63 percent of average. The February 1 water supply forecast, based on mountain snowpack, indicated the April-July runoff into Lake Elwell would be 332,000 acre-feet, which was 68 percent of normal.

On March 1, the NRCS reported the mountain snowpack in the Marias River Basin above Lake Elwell had declined to 54 percent of average.

The March 1 water supply forecast indicated the April-July runoff into Lake Elwell would be 266,000 acre-feet, which was 55 percent of average. In an effort to conserve storage in Lake Elwell, releases to the Marias River were decreased to 550 cfs on March 4 and to 500 cfs on March 9.

On April 1, the NRCS reported the mountain snowpack in the Marias River Basin above Lake Elwell had declined even further and was reported at only 50 percent of average. The water supply forecast prepared on April 1 indicated the April-July runoff into Lake Elwell was only expected to be 41 percent of average, totaling 200,000 acre-feet. This was about 118,000 acre-feet less than a year ago. In an effort to conserve storage, releases out of Lake Elwell to the Marias River were decreased to 400 cfs on April 16. Storage in Lake Elwell slowly drafted to a low content for the year of 713,199 acre-feet at elevation 2979.51 feet on April 19.

By late April weather conditions changed dramatically. During April, valley precipitation in the basin increased to 218 percent of average while the mountain precipitation increased to 118 percent of average. This was a significant improvement over what was experienced in March at only 15 and 43 percent of average respectively.

On May 1, the NRCS reported the mountain snowpack in the Marias River Basin above Lake Elwell was 48 percent of average. With storage at 103 percent of average, the May 1 water supply forecast indicated May-July runoff into Lake Elwell would be 206,000 acre-feet, which was 49 percent of average. Temperatures remained cooler than normal which delayed the start of the snowmelt. It was not until the middle of May that the snowmelt runoff actually began to enter Lake Elwell. Inflows to Lake Elwell gradually increased from about 210 cfs at the middle of April to the peak for the year of 4,069 cfs on June 19. In an effort to continue conserving storage and still meet the increased irrigation demands downstream of Lake Elwell, releases to the Marias River were increased to 550 cfs on June 7. Actual April-July runoff into Lake Elwell totaled 267,598 acre-feet and was 38,580 acre-feet less than in 2009.

The accumulated valley precipitation during April through June was 153 percent of average while the accumulated mountain precipitation during this same period was only 110 percent of average.

Snowmelt runoff during April through July was below normal at 55 percent of average. Daily inflows into Lake Elwell averaged 443 cfs during April, 1,140 cfs during May, 2,228 cfs during June, and 627 cfs during July. These resulted in respective monthly total inflows of 26,381 acre-feet, 70,089 acre-feet, 132,571 acre-feet, and 38,559 acre-feet. Releases during this time averaged 448 cfs during April, 402 cfs during May, 506 cfs during June, and 546 cfs during July. As a result, storage slowly increased to a peak for the year of 880,325 acre-feet at elevation 2990.47 feet on July 13. This was 45,324 acre-feet and 2.53 feet below the top of the joint-use pool.

Valley precipitation in the Marias River Basin above Lake Elwell was above normal during July, August, September, and mountain precipitation was below normal during July but was above average during August and September.

Valley precipitation was recorded at 117, 133, and 107 percent of average, respectively, while mountain precipitation was 61, 116, and 102 percent of average, respectively.

Inflow to Lake Elwell during August totaled 14,546 acre-feet which was 75 percent of average and 3,116 acre-feet less than experienced in 2009. In an effort to conserve storage in Lake Elwell, releases from Lake Elwell to the Marias River were reduced to 500 cfs on September 8.

By year end, the total annual valley precipitation was above average at 128 percent of average and the total annual mountain precipitation in the Marias River Basin was below average at 79 percent of average. The total annual runoff into Lake Elwell during 2010 was 388,323 acre-feet, 58 percent of normal and 37,431 acre-feet less than experienced in 2009.

By the end of the year, normal operations of Lake Elwell drafted storage to 842,438 acre-feet at an elevation of 2988.23 feet. This was 108 percent of normal and 0.05 feet higher than reported on September 30, 2009.

The Corps determined that during 2010, Lake Elwell prevented no local flood damages, but prevented $3,344,200 in flood damages downstream on the Missouri River below Fort Peck Reservoir. Since closure of Tiber Dam in 1954, Lake Elwell has reduced flood damages by a total of $78,605,700.00.

Important Events – 2010

November 4, 2009: To allow Tiber Montana Company, L.L.C., to perform routine maintenance on the powerplant, flows were maintained at the current rate of 600 cfs but were switched from the powerplant to the river outlet works for approximately 5 hours.

December 1, 2009: NRCS reported snowpack conditions in the watershed above Lake Elwell were 75 percent of normal.

January 1, 2010: NRCS reported snowpack conditions in the watershed above Lake Elwell were about 78 percent of normal. The January water supply forecast indicates the April-July runoff into Lake Elwell would be 317,000 acre-feet which is 65 percent of normal.

February 1, 2010: NRCS reported snowpack conditions in the watershed above Lake Elwell were about 63 percent of normal. The February water supply forecast indicates the April-July runoff into Lake Elwell would be 332,000 acre-feet which was 68 percent of average.

March 1, 2010: NRCS reported snowpack conditions in the Marias River Basin upstream of Lake Elwell were about 54 percent of average. The March water supply forecast indicates the April-July runoff into Lake Elwell would be 266,000 acre-feet which is 55 percent of normal.

March 4-9, 2010: Snowpack in the Marias River Basin upstream of Lake Elwell is 56 percent of average. In an effort to conserve storage in Lake Elwell, releases to the Marias River were decreased to 500 cfs.

March 23 2010: To allow Tiber Montana Company, L.L.C., to perform routine maintenance on the powerplant, flows were maintained at the current rate of 500 cfs but were switched from the powerplant to the river outlet works for approximately 3 hours.

April 1, 2010: NRCS reported snowpack conditions in the watershed above Lake Elwell were 50 percent of normal. Water supply forecast indicated the April-July runoff into Lake Elwell would be 200,000 acre-feet or 41 percent of normal.

April 13, 2010: Personnel from the Reservoir and River Operations Branch met with the Marias Management Committee to present and discuss the projected water supply for the Marias River Basin and proposed operations of Lake Elwell.

April 19, 2010: Storage in Lake Elwell reaches the minimum elevation for the year of 2979.51 feet.

May 1, 2010: NRCS reported snowpack conditions in the watershed above Lake Elwell were 48 percent of average. The May 1 water supply forecast indicates the May-July runoff into Lake Elwell would be 206,000 acre-feet which is 49 percent of normal.

June 1, 2009: NRCS reported snowpack conditions in the watershed above Lake Elwell were 85 percent of average. The June 1 water supply forecast indicates the June-July runoff into Lake Elwell would be 144,000 acre-feet which is 57 percent of normal.

June 7, 2010: Above average precipitation improved the water supply outlook for the Marias River Basin. Releases to the Marias River were increased to 550 cfs.

June 9, 2010: To allow for review and inspection of the penstock, river outlet works, and gates, flows were discontinued through the powerplant and initiated through the auxiliary outlet works at the current rate of 550 cfs for approximately 4 hours.

July 13, 2010: Storage in Lake Elwell reaches the maximum elevation for the year of 2990.47 feet.

September 8, 2010: In an effort to conserve storage in Lake Elwell, releases from Lake Elwell to the Marias River were decreased to 500 cfs.

September 16, 2010: To allow Tiber Montana, L.L.C., to conduct an efficiency test of their turbine unit, releases from Lake Elwell were decreased from 500 cfs to 450 cfs and held for 15 minutes; then increased 50 cfs every 15 minutes until reaching 650 cfs and then returned to the current rate of 500 cfs.

Additional hydrologic and statistical information pertaining to the operation of Lake Elwell during 2010 can be found in Table MTT9 and Figure MTG8.

TABLE MTT9
HYDROLOGIC DATA FOR 2010
LAKE ELWELL (TIBER DAM)
NEW SEDIMENT SURVEY DATA EFFECTIVE 10/01/2005

RESERVOIR ALLOCATIONS	ELEVATION (FEET)	TOTAL RESERVOIR STORAGE (AF)	STORAGE ALLOCATION (AF)
TOP OF INACTIVE AND DEAD	2966.40	554,330	554,330
TOP OF ACTIVE CONSERVATION	2976.00	667,213	112,883
TOP OF JOINT USE	2993.00	925,649	258,436
TOP OF EXCLUSIVE FLOOD CONTROL	3012.50	1,328,723	403,074

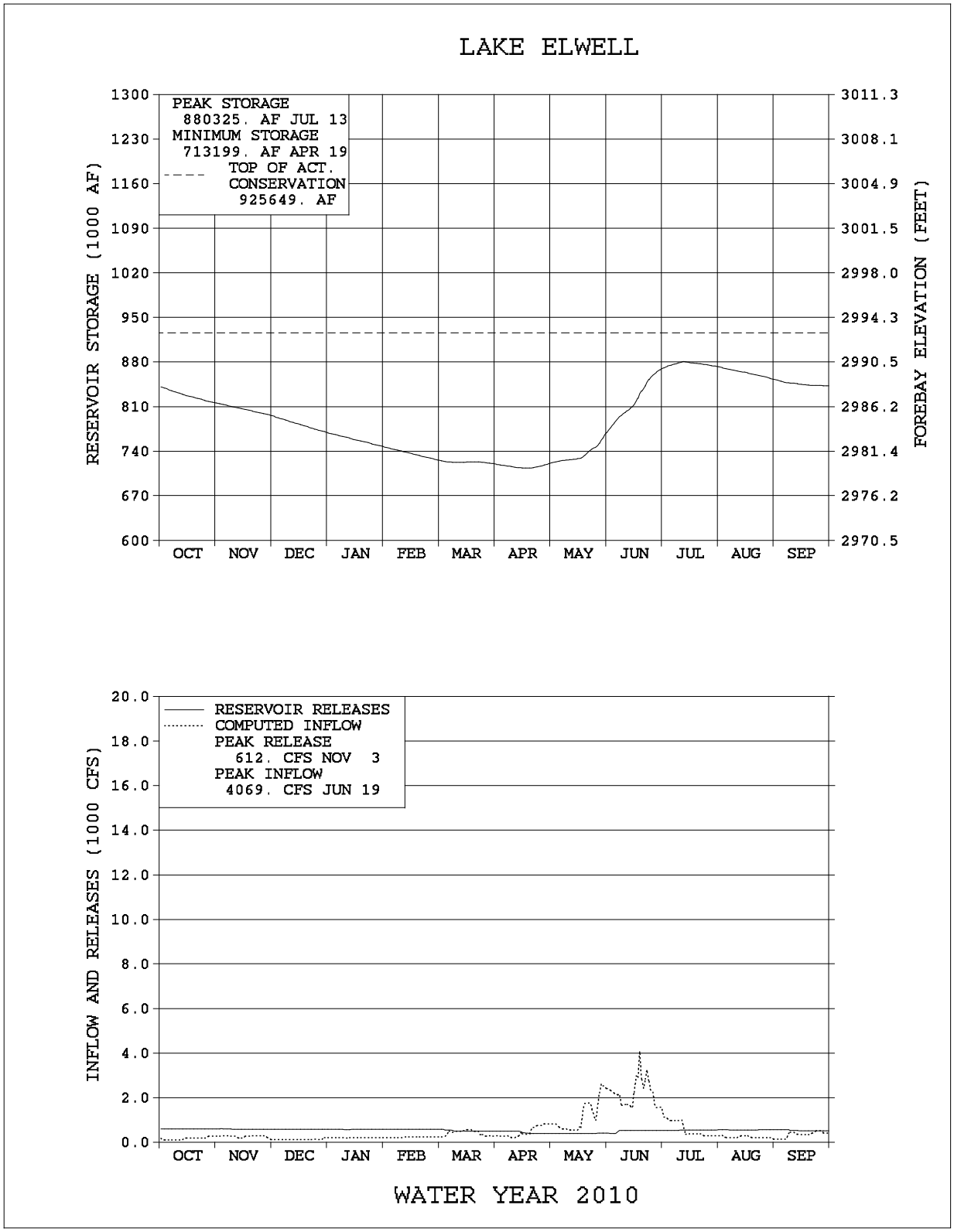
STORAGE-ELEVATION DATA	ELEVATION (FT)	STORAGE (AF)	DATE
BEGINNING OF YEAR	2988.18	841,617	OCT 01, 2009
END OF YEAR	2988.23	842,438	SEP 30, 2010
ANNUAL LOW	2979.51	713,199	APR 19, 2010
ANNUAL HIGH	2990.47	880,325	JUL 13, 2010
HISTORIC HIGH	3005.59	1,214,417	JUL 12, 1965

INFLOW-OUTFLOW DATA	INFLOW	DATE	OUTFLOW	DATE
ANNUAL TOTAL (AF)	388,323	OCT 09-SEP10	387,502	OCT 09-SEP 10
DAILY PEAK (CFS)	4,069	JUN 19, 2010	612	NOV 03, 2009
DAILY MINIMUM (CFS)	105	OCT 05, 2009	398	APR 20, 2010
PEAK SPILL (CFS)			0	NONE
TOTAL SPILL (AF)			0	NONE

MONTH	INFLOW		OUTFLOW*		CONTENT	
	KAF	% OF AVG	KAF	% OF AVG	KAF	% OF AVG
OCTOBER	10.8	48	36.7	83	815.7	109
NOVEMBER	15.6	70	35.2	100	796.0	109
DECEMBER	8.5	46	35.6	128	768.9	109
JANUARY	13.2	82	35.6	137	746.5	109
FEBRUARY	12.6	58	32.3	127	726.8	109
MARCH	24.9	50	31.5	90	720.2	107
APRIL	26.4	42	26.7	61	719.9	103
MAY	70.1	42	24.7	38	765.3	96
JUNE	132.6	69	30.1	32	867.7	94
JULY	38.6	62	33.6	45	872.7	96
AUGUST	14.5	75	34.2	59	853.0	101
SEPTEMBER	20.6	129	31.2	62	842.4	108
ANNUAL	388.3	58	387.5	67		
APRIL-JULY	267.7	55				

* Average for the 1957-2010 period.

FIGURE MTG8


LAKE ELWELL
PEAK STORAGE
880325. AF JUL 13
MINIMUM STORAGE
713199. AF APR 19
TOP OF ACT.
CONSERVATION
925649. AF
RESERVOIR STORAGE (1000 AF)
FOREBAY ELEVATION (FEET)
1300
1230
1160
1090
1020
950
880
810
740
670
600
3011.3
3008.1
3004.9
3001.5
2998.0
2994.3
2990.5
2986.2
2981.4
2976.2
2970.5
OCT NOV DEC JAN FEB MAR APR MAY JUN JUL AUG SEP
RESERVOIR RELEASES
COMPUTED INFLOW
PEAK RELEASE
612. CFS NOV 3
PEAK INFLOW
4069. CFS JUN 19
INFLOW AND RELEASES (1000 CFS)
20.0
18.0
16.0
14.0
12.0
10.0
8.0
6.0
4.0
2.0
0.0
OCT NOV DEC JAN FEB MAR APR MAY JUN JUL AUG SEP
WATER YEAR 2010

Milk River Project

The 117,000-acre Milk River Project, located in north-central Montana, is served by Sherburne, Fresno, and Nelson Reservoirs. Sherburne and Nelson Reservoirs are single-purpose irrigation structures. Fresno Reservoir has joint-use flood control space, provides a municipal water supply to several municipalities on or near the project, and serves as the primary irrigation storage structure for the Milk River Project. Approximately 101,500 acres are presently served by irrigation districts, 9,500 acres are served by private facilities; and between 5,000 and 6,000 acres are served supplemental water by the Fort Belknap Indian Irrigation Project.

Lake Sherburne is located in Glacier National Park on Swiftcurrent Creek, a tributary of the St. Mary River in the Hudson Bay Drainage Basin. Lake Sherburne has a total capacity of 66,147 acre-feet at elevation 4788.0 feet. The use of boundary waters of the St. Mary and Milk Rivers are divided between Canada and the United States by the 1909 Boundary Waters Treaty. The United States utilizes its entitlement to St. Mary River water by regulating flows through storage in Lake Sherburne and diverting St. Mary River flows through the St. Mary Canal to the Milk River Basin. The river outlet works has a capacity of 2,100 cfs at elevation 4788.0 feet. The maximum combined discharge of the spillway and river outlet works is 4,000 cfs at a maximum water surface elevation of 4810.0 feet.

In 2002, Reclamation surveyed Lake Sherburne to develop a topographic map and compute a present storage-elevation relationship (area-capacity tables). The data was used to calculate reservoir capacity lost due to sediment accumulation since dam closure in 1919. The 2002 survey determined that Lake Sherburne has a storage capacity of 66,147 acre-feet and a surface area of 1,719 acres at a reservoir elevation of 4788.00 feet. Since Lake Sherburne closure in 1919, the measured total volume change at reservoir elevation 4788.00 feet was estimated to be 343 acre-feet between the 1948 and 2002 surveys and 1,707 acre-feet between the 1983 and 2002 surveys. It is assumed the volume differences between the surveys are due to survey methods and the vertical datum. The revised area-capacity table was put into effect on October 1, 2005, reflecting the new storage levels.

Water year 2009 provided below average mountain precipitation and near average precipitation in the valley areas of the St. Mary River Basin. The latter part of the water year produced below average conditions in the mountain and valley areas, with July mountain precipitation being the only exception. Valley areas for August and September were 67 and 31 percent of average respectively, while mountain areas were 75 and 26 percent of average respectively. With precipitation below average the inflow to Lake Sherburne followed suit at 4,100 acre-feet, 64 percent of average for September.

With inflows below average and releases being made until September 30, reservoir levels continued to decrease until the end of the water year. On September 30, the reservoir held 13,668 acre-feet, 163 percent of average and 21 percent of normal full capacity, at elevation 4746.44 feet. Both releases from Lake Sherburne and diversions to the St. Mary Canal were discontinued on September 30, 2009, until spring of 2010.

The new water year began with above average precipitation in October in both valley and mountain areas. Cumulative valley precipitation from October to the end of December was 92 percent of average. During the same period, cumulative mountain precipitation was only 87 percent of average. Inflows during October through December were 73, 116, and 64 percent of average, respectively. This resulted in storage at the end of December of 27,100 acre-feet, 155 percent of average.

On January 1, the NRCS reported that mountain snowpack in the St. Mary Basin was 95 percent of normal. With the below normal snowpack, the prospect of continued drought in the St. Mary and Milk River Basins was once again relayed to the water users. Precipitation in the valley and in the mountains was below average during January and resulted in the February 1 snowpack for the St. Mary Basin falling to 78 percent of average. Storm patterns disappeared during February with precipitation in the valleys, and mountains barely noticeable. By March 1, snowpack for the St. Mary Basin was reported to be at 70 percent of average. Total inflow during January through March was approximately 4,388 acre-feet, 57 percent of average.

Generally, diversions into the St. Mary Canal in the spring begin as soon as weather permits, which in mild years can be as early as March. In 2010, the above average storage in Fresno Reservoir and near average storage in Nelson Reservoir indicated that irrigation water would possibly not be needed very early in the season. Storage in Lake Sherburne was near 120 percent of average in the middle of March. In response, releases out of Lake Sherburne were initiated at a rate of 60 cfs on March 18 and diversions to the St. Mary Canal were initiated on March 22 at a rate of 30 cfs. With the St. Mary Canal essentially free of any snow, canal diversions and releases out of Lake Sherburne were gradually increased until April 1 when they were brought above 300 cfs by about 30 cfs per day, with the objective of slowly filling Fresno Reservoir and providing more available storage space to store the anticipated spring runoff into Lake Sherburne.

The recorded valley and mountain precipitation during March was below average. By April 1 mountain snow water content had decreased considerably to 60 percent of average. The snow pack peaked on April 15, slightly later than normal at 76 percent of average, and 8 percent less than in 2009. The April 1 water supply forecast for April through July runoff indicated that the runoff would be 79,000 acre-feet, 76 percent of normal.

Once releases were started, storage decreased until May 4 when precipitation events started to take place throughout the entire St. Mary and Milk Basins. Fresno's natural inflows increased sharply and caused the reservoir to start spilling water. The St. Mary Canal was reduced rapidly and was not significantly used until July 9. Sherburne releases were likewise cut dramatically, allowing the reservoir to start filling earlier than projected.

The storm activity also deposited a fair amount of water in the mountains in Glacier Park increasing the runoff projections for the reservoir.

Diversions to the St. Mary Canal averaged 496 cfs during April and 197 cfs during May. Releases from Lake Sherburne were adjusted during April and late May to maintain diversion rates for the St. Mary Canal and satisfy Treaty obligations to Canada. On June 20, releases were increased to try to control the rate of fill as the reservoir was nearly full and this would prevent releases through the spillway. In addition, diversions into the St. Mary Canal were maintained at or above 100 cfs which did not utilize the United States portion of the natural St. Mary flow, but with flood conditions on the Lower Milk the water was not wanted. Flows in excess of the United States storage and diversion capacity were delivered to Canada and continued for several weeks through mid July. Overall precipitation for April was above average, and remained that way through June. Cooler temperatures during these months allowed the snowpack to melt out at a slower rate and therefore extended the runoff season.

The snowmelt runoff was essentially melted out by mid-July, which is about normal compared to the long term average. Lake Sherburne storage peaked on July 19 at 66,146 acre-feet, at elevation 4788.00 feet, the top of normal full capacity. The peak inflow for the year was 1,080 cfs which occurred on June 21. The actual April through July runoff was 89 percent of average, totaling 92,800 acre-feet.

Storms during July brought below average precipitation to the mountain regions and above average precipitation to valley regions. Mountain precipitation was below average during August but was above average during September. Valley precipitation was above average during both August and September. The cumulative precipitation through the end of September for valley and mountain areas was 106 and 86 percent of average, respectively. Inflows during June, July, August, and September were 107, 88, 100, and 198 percent of average, respectively. Inflow for the water year totaled 132,900 acre-feet, 92 percent of average. This was 28,700 acre-feet or 20 percent more than the inflow experienced during water year 2009. Storage on September 30, 2010, was 30,888 acre-feet, 369 percent of normal.

According to preliminary data, diversions from the St. Mary River to the Milk River totaled 110,244 acre-feet, 73 percent of the long-term average. The long-term average annual diversion is 150,500 acre-feet and the 1972-2002 average is 168,900 acre-feet. The largest diversion previously recorded was 277,500 acre-feet during 1989. Canal diversions were discontinued on September 7, and releases from Lake Sherburne were discontinued for water year 2010 on September 30.

During the 2010 irrigation season, there were three conference calls held with the International Joint Commission Field Representatives to discuss accumulated deficits by the United States and Alberta, Canada, on the St. Mary and Milk Rivers, respectively.

During the first call held on July 13, there were concerns that there was too much water in the basin rather than too little.

Following the next call on August 23, it was decided to wait until the end of the season to balance the system, since Canada had not created any deficit on the Milk. The final call was on September 16, and the 1921 Letter of Intent Deficit on the St. Mary had 2000 cfs-days left which was repaid in full the next accounting period.

During 2010, Lake Sherburne did not contribute to the reduction of flood damages locally or downstream on the Missouri River below Fort Peck Reservoir. Since 1950 Lake Sherburne has prevented $7,946,500 in flood damages.

Additional hydrologic and statistical information pertaining to the operation of Sherburne Reservoir during 2010 can be found in Table MTT10-A and Figure MTG9.

Fresno Reservoir is located above all project lands on the Milk River near Havre, Montana. A sediment re-survey done during 1999 and finalized during 2000 determined the normal full pool capacity was 92,880 acre-feet, a loss of 10,517 acre-feet from the previous capacity. The new revised elevation-area-capacity data was used beginning in water year 2001. The top 32,534 acre-feet is used jointly for flood control and conservation and is not filled until the start of the spring runoff. Fresno Reservoir stores the natural flow of the Milk River along with water diverted into the Milk River from the St. Mary River and Lake Sherburne. Stored water is used principally for irrigation, but Havre and Chinook, Montana, have contracted for a minimum flow in the river of 25 cfs during the winter to maintain suitable water for municipal use. The city of Harlem and the Hill County Water District have also contracted for municipal use.

During water year 2009, there was relief to the drought conditions in the Milk River Basin. Cumulative precipitation was 84 percent of normal at the end of September. Inflow into Fresno Reservoir during September was 24,700 acre-feet, 95 percent of average. As irrigation wound down for the year, Fresno Reservoir gained a little storage as the water year concluded ending with storage of 41,100 acre-feet, 103 percent of normal and 44 percent of full capacity to begin water year 2010. On September 21, releases for irrigation for the Milk River Project users were discontinued, but releases for the Fort Belknap Indian Irrigation Project (FBIIP) were still needed. Therefore, Fresno Reservoir releases were maintained at approximately 60 cfs to satisfy the FBIIP demand. Releases from Fresno Reservoir were reduced to winter levels of between 35-45 cfs on October 23 during the beginning of water year 2010. Precipitation during the start of water year 2010 was above average; however, as the winter progressed, precipitation patterns changed and rates were below average until April. The accumulated precipitation from October through March was 73 percent of normal.

Reservoir inflows were much below average from October until December, which resulted in storage decreasing by the end of December. The end of December storage was 39,400 acre-feet, 105 percent of average and 42 percent of normal full capacity.

By January 1, the NRCS reported the snowpack in the Milk River Basin was 46 percent of average, coinciding with the below average fall precipitation in the mountains. These same precipitation trends continued during January resulting in a monthly total of only 79 percent of average. However, by February 1, the NRCS reported snowpack had increased, producing a March through July runoff forecast for Fresno Reservoir of 65,000 acre-feet, 78 percent of average.

Storage at the end of February was 35,700 acre-feet, 100 percent of average. In the Milk River Basin, the spring runoff season generally occurs from March through June. Therefore, the peak snowpack and most reliable water supply runoff forecast for the Milk River Basin is generally considered to be around the first of March. During 2010, the precipitation in February was below average, resulting in the snowpack in the Milk River Basin to also remain below average. On March 1, the snowpack was reported at 60 percent of average. Based on the March 1 water supply forecast, the March-July runoff into Fresno Reservoir was expected to be 61 percent of average or equal to 51,000 acre-feet. Based upon this forecast, Fresno Reservoir was expected to fill to the top of the conservation pool.

When the runoff below Fresno Reservoir began in mid March, diversions to Nelson Reservoir were initiated. Diversion into Nelson Reservoir began on March 20. Due to the good carryover storage in Fresno Reservoir, and Lake Sherburne, as well as above average precipitation in April, Nelson Reservoir was filled and excess water was delivered to Bowdoin National Wildlife Refuge (Bowdoin). Other excess water was used to flush canals, and help wet canal perimeters before demands took hold. This time period was before releases were adjusted from Fresno Reservoir for significant irrigation demands.

By May 1, cumulative valley precipitation was 144 percent of normal. Below average precipitation in March was offset by the significant rain events in April. This resulted in the above average natural inflow to Fresno Reservoir, even though the snowpack was below average. The natural inflow during these months allowed storage to enter the flood pool where it would remain for over a month. During May and June, precipitation patterns increased and inflows to Fresno were generally occurring from natural runoff, since diversions into the St. Mary Canal were only approximately 100 cfs during May 7 through July 9.

The initial meeting of the Milk River Joint Board of Control (MRJBC) regarding water supply was held in April at which time the allotment was set at 1.7 acre-feet/acre. Then in May, there was a meeting with MRJBC to reassess allotments after the large precipitation events. Based on storage conditions and modeling runs by Reclamation the MRJBC elected to increase the irrigation allotment to 2.3 acre-feet per acre. At this meeting, it was decided that this would be the final allotment for the season.

Once again, Fresno Reservoir storage was able to remain at good levels through the summer months. Spillway releases were made from Fresno from May 3 until July 9. To control the high inflows into Fresno Reservoir and minimize the effects of these flows if passed downstream, releases through the outlet works were adjusted to maintain a total release out of Fresno Reservoir near 1800 cfs whenever possible.

Once the spillway releases increased above 1,800 cfs, the river outlets were gradually closed to reduce the potential for downstream flooding. The peak release of 3040 cfs from Fresno Reservoir was made on June 22 after a large storm produced over 5 inches of precipitation over a large portion of the Milk River drainage in Canada. The storage in Fresno Reservoir peaked at 107,186 acre-feet at elevation 2577.74 feet or 2.74 feet above the spillway crest on June 22. During this event, a pilot was hired to fly the Milk River and photograph the effects of the high flows as they moved through the Chinook area. Approximately 190 photos were taken and are on file in the MTAO.

The average releases for June and July were 1729 cfs and 755 cfs, which were 213 and 85 percent of average, respectively. Releases from Fresno Reservoir peaked at 3,041 cfs on June 22. The actual March through July inflow for Fresno Reservoir, excluding St. Mary Canal water was approximately 94,179 acre-feet, 94 percent of average based on the United States Geological Survey (USGS) computation for natural flow at the Milk River at Eastern Crossing gauging station. Inflow to Fresno Reservoir peaked during this time at 6,179 cfs, on June 21.

The cumulative precipitation through the end of June was 111 percent of average, however, as the summer continued the precipitation patterns improved slightly. July and August valley precipitation were 118 and 198 percent of average, respectively. Total inflow for the year was 346,258 acre-feet, 131 percent of average. This was 125,256 acre-feet or 47 percent more than the inflow experienced during water year 2009. Diversions from the St. Mary River Basin to the Milk River Basin accounted for about 73 percent of the inflow to Fresno Reservoir during 2009. Storage on September 30, 2009, was 76,344 acre-feet, 191 percent of average and 82 percent of normal full capacity. Releases continued into October in an attempt to draw storage in Fresno Reservoir down to the desired spring flood control target level at elevation 2567 feet.

The Corps determined that during 2010, Fresno Reservoir prevented $1,118,700 in local flood damages, but did not contribute to the reduction of flood damages downstream on the Missouri River below Fort Peck Reservoir. Since 1950 Fresno Dam and Reservoir has reduced flood damages by a total of $14,245,500.

Additional hydrologic and statistical information pertaining to the operation of Fresno Reservoir during 2010 can be found in Table MTT10-B and Figure MTG10.

Nelson Reservoir, located near Malta, Montana, is an off-stream reservoir which receives its water supply from the Milk River by diversion through the Dodson South Canal. Nelson Reservoir is the only source of supply for the lower portion of the Malta Irrigation District. Nelson Reservoir can also serve the Glasgow Irrigation District when water is not available from Fresno Reservoir. In 1999 a sediment re-survey was performed and then finalized during 2000-01. Since Nelson Reservoir operation began in 1916, the measured total volume loss due to sedimentation was 446 acre-feet. The new revised elevation-area capacity data was implemented at the beginning of water year 2002. Nelson Reservoir now has a total capacity of 78,950 acre-feet and an active capacity of 60,810 acre-feet.

At the end of water year 2009, releases from Fresno Reservoir to satisfy the Fort Belknap Indian Irrigation Project (FBIIP) irrigation demand were made during September. This allowed diversions to Nelson Reservoir to continue until the end of September. Therefore, storage increased during September and Nelson Reservoir began the 2010 water year with a storage content of 71,166 acre-feet, at elevation 2219.74 feet, 126 percent of average and 96 percent of normal full capacity. Storage slowly decreased due to seepage through the winter until mid March.

Diversions to Nelson Reservoir began in mid March. The total inflow prior to irrigation season, March 19 through May 11, was approximately 10,000 acre-feet. Irrigation releases from Nelson Reservoir began on May 11 through the Nelson South Canal and continued though September 27. Since much of the demand from Malta Irrigation District is for early irrigation, releases are generally discontinued in mid-June for harvest. This was the case once again when releases from Nelson South Canal were discontinued from June 22-July 5.

From mid-March, storage steadily increased until early May the reservoir reached full pool. Storage in Nelson Reservoir peaked for the summer at 79,167 acre-feet at elevation 2221.65 feet on May 06, which was approximately 117 acre-feet or 0.05 ft above normal full pool. Storage was then maintained above 2220.4 feet through the end of the water year. The district actually preferred to keep the reservoir about a foot below full pool to reduce the wave action on the dikes.

During 2010, piping plovers were not observed nesting on the shores of Nelson Reservoir. Biologists did some surveys looking for nests, but due to the high reservoir levels throughout the summer little to no desired nesting habitat was available for the birds.

Inflows to Nelson Reservoir during June through July totaled approximately 18,700 acre-feet. Releases to the Milk River were made for use by Glasgow Irrigation District and to control the reservoir elevation intermittently from May through September. The total storage released for Glasgow was approximately 2,844 acre-feet.

In September, irrigation releases were discontinued and inflows to the reservoir were discontinued as the reservoir had remained at near full pool all summer.

Water that was diverted into Nelson Reservoir during August through September totaled approximately 22,131 acre-feet. Total net inflow to Nelson Reservoir during water year 2010 was 6,322 acre-feet. Storage on September 30, 2010, was 71,488 acre-feet at elevation 2221.26 feet, 137 percent of average and 98 percent of normal full capacity.

Additional hydrologic and statistical information pertaining to the operation of Nelson Reservoir during 2010 can be found in Table MTT10-C and Figure MTG11.

Important Events - 2010

March 1, 2010: Milk River runoff forecast indicates 61 percent of normal runoff.

March 18, 2010: Releases begin from Lake Sherburne.

March 22, 2010: St. Mary Canal begins to divert water to the Milk River.

April 1, 2010: Lake Sherburne runoff forecast indicates 76 percent of normal runoff.

April 20, 2010: MRJBC sets the irrigation allotment to 1.7 acre-feet per acre.

May 2, 2010: Reductions in flows are initiated on the St. Mary Canal to reduce Fresno inflows. Flows are reduced to about 100 cfs.

May 3, 2010: Releases from Fresno Reservoir were increased to transfer water to Nelson Reservoir and hold the reservoir down as rains caused the reservoir to start making releases over the spillway. Inflows were 1,100 cfs and climbing.

May 6, 2010: Storage in Nelson Reservoir peaked for the summer at 79,167 acre-feet at elevation 2221.65 feet on which was approximately 0.05 ft above normal full pool.

May 11, 2010: Irrigation releases are initiated from Nelson Reservoir.

May 18, 2010: The MRJBC increases the irrigation allotment to 2.3 acre-feet per acre due to the large rain events and improved snowpack.

June 22, 2010: Fresno Reservoir storage peaks for the year at 107,186 acre-feet at elevation 2577.74 feet, 2.4 feet above normal full pool.

June 21, 2010: Inflow to Fresno Reservoir peaked at 6,179 cfs.

June 21, 2010: Inflow to Lake Sherburne peaked at 1,080 cfs.

July 9, 2010: Flow increases made on St. Mary Canal as Fresno Reservoir exited the flood pool and releases are no longer being made through the spillway.

July 13, 2010: A conference call was held with the International Joint Commission (IJC) Field Representatives to discuss St. Mary and Milk River apportionments.

July 19, 2010: Lake Sherburne storage peaks for the year at 66,146 acre-feet, at elevation 4788.00 feet, which is normal full pool.

August 23, 2010: A conference call was held with the IJC Field Representatives to discuss St. Mary and Milk River deficit repayments. It was agreed to wait till the end of the season to see how the repayment would take place. U S has a 2,000 c fs-day deficit on t he St. Mary, no Canadian deficit has occurred on the Milk River.

September 7, 2010: St. Mary Canal diversions are discontinued.

September 24, 2010: Lake Sherburne releases are discontinued.

September 27, 2010: Releases from Nelson Reservoir for irrigation are discontinued.

October 12, 2010: Releases from Nelson Reservoir end for the season.

October 15, 2010 : Releases from Fresno Reservoir are set at approximately 90 cfs for the duration of the winter, due to high inflows and above average storage. The release of 90 cfs was set to meet the spring flood control target.

TABLE MTT10-A
HYDROLOGIC DATA FOR 2010
SHERBURNE RESERVOIR (MILK RIVER PROJECT)
NEW SEDIMENT SURVEY DATA EFFECTIVE 10/01/2005

RESERVOIR ALLOCATIONS	ELEVATION (FEET)	TOTAL RESERVOIR STORAGE (AF)	STORAGE ALLOCATION (AF)
TOP OF INACTIVE AND DEAD	4729.30	1,899	1,899
TOP OF ACTIVE CONSERVATION	4788.00	66,147	64,248

STORAGE-ELEVATION DATA	ELEVATION (FT)	STORAGE (AF)	DATE
BEGINNING OF YEAR	4746.44	13,668	OCT 01, 2009
END OF YEAR	4763.48	30,888	SEP 30, 2010
ANNUAL LOW	4746.44	13,668	OCT 01, 2009
ANNUAL HIGH	4788.00	66,146	JUL 19, 2010
HISTORIC HIGH	4788.30	68,371	JUN 30, 1986

INFLOW-OUTFLOW DATA	INFLOW	DATE	OUTFLOW	DATE
ANNUAL TOTAL (AF)	132,901	OCT 09-SEP 10	115,687	OCT 09-SEP 10
DAILY PEAK (CFS)	1,080	JUN 21, 2010	680	AUG 27, 2010
DAILY MINIMUM (CFS)	9	OCT 06, 2009	0	*

* During nonirrigation season

MONTH	INFLOW		OUTFLOW*		CONTENT	
	KAF	% OF AVG	KAF	% OF AVG	KAF	% OF AVG
OCTOBER	4.5	73	0.0	---	18.2	193
NOVEMBER	6.5	116	0.0	---	24.7	181
DECEMBER	2.4	64	0.0	---	27.1	155
JANUARY	1.9	68	0.0	---	29.0	143
FEBRUARY	1.1	44	0.0	---	30.0	133
MARCH	1.6	52	3.9	87	27.7	123
APRIL	10.1	112	22.9	155	14.9	79
MAY	19.5	60	4.5	23	29.9	102
JUNE	44.6	107	8.8	48	65.6	125
JULY	18.6	88	23.9	95	60.4	126
AUGUST	9.5	100	34.4	106	35.5	151
SEPTEMBER	12.7	198	17.3	80	30.9	369
ANNUAL	132.9	92	115.7	82		
APRIL-JULY	92.8	89				

* Average for the 1955-2010 period.

FIGURE MTG9

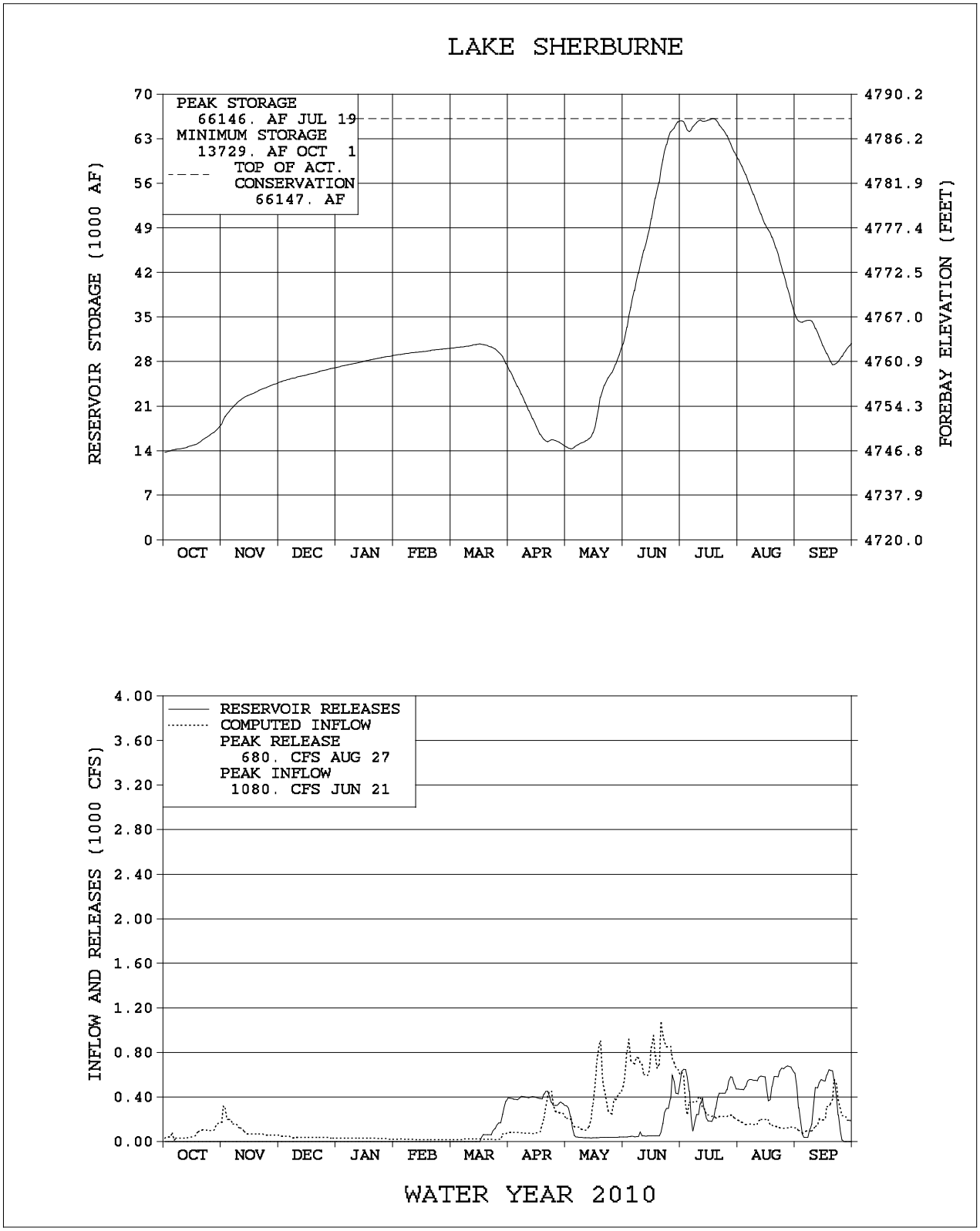

LAKE SHERBURNE
PEAK STORAGE
66146. AF JUL 19
MINIMUM STORAGE
13729. AF OCT 1
TOP OF ACT.
CONSERVATION
66147. AF
RESERVOIR STORAGE (1000 AF)
FOREBAY ELEVATION (FEET)
70
63
56
49
42
35
28
21
14
7
0
4790.2
4786.2
4781.9
4777.4
4772.5
4767.0
4760.9
4754.3
4746.8
4737.9
4720.0
OCT NOV DEC JAN FEB MAR APR MAY JUN JUL AUG SEP
RESERVOIR RELEASES
COMPUTED INFLOW
PEAK RELEASE
680. CFS AUG 27
PEAK INFLOW
1080. CFS JUN 21
INFLOW AND RELEASES (1000 CFS)
4.00
3.60
3.20
2.80
2.40
2.00
1.60
1.20
0.80
0.40
0.00
OCT NOV DEC JAN FEB MAR APR MAY JUN JUL AUG SEP
WATER YEAR 2010

TABLE MTT10-B
HYDROLOGIC DATA FOR 2010
FRESNO RESERVOIR (MILK RIVER PROJECT)
NEW SEDIMENT SURVEY DATA EFFECTIVE 10/1/2000

RESERVOIR ALLOCATIONS	ELEVATION (FEET)	TOTAL RESERVOIR STORAGE (AF)	STORAGE ALLOCATION (AF)
TOP OF INACTIVE AND DEAD	2530.00	448	448
TOP OF ACTIVE CONSERVATION	2567.00	60,346	59,898
TOP OF JOINT USE	2575.00	92,880	32,534

STORAGE-ELEVATION DATA	ELEVATION (FT)	STORAGE (AF)	DATE
BEGINNING OF YEAR	2559.94	41,119	OCT 01, 2009
END OF YEAR	2571.33	76,344	SEP 30, 2010
ANNUAL LOW	2557.32	35,229	MAR 06, 2010
ANNUAL HIGH	2577.74	107,186	JUN 22, 2010
HISTORIC HIGH	2579.35	154,023	APR 03, 1952

INFLOW-OUTFLOW DATA	INFLOW	DATE	OUTFLOW	DATE
ANNUAL TOTAL (AF)	346,259	OCT 09-SEP 10	311,034	OCT 09-SEP 10
DAILY PEAK (CFS)	6,179	JUN 21, 2010	3,041	JUN 22, 2010
DAILY MINIMUM (CFS)	0	*	39	JAN 09, 2010

* During nonirrigation season

MONTH	INFLOW		OUTFLOW*		CONTENT	
	KAF	% OF AVG	KAF	% OF AVG	KAF	% OF AVG
OCTOBER	4.5	60	3.5	49	42.2	108
NOVEMBER	1.9	92	2.4	80	41.7	108
DECEMBER	0.3	30	2.6	102	39.4	105
JANUARY	1.2	241	2.5	100	38.1	106
FEBRUARY	-0.1	---	2.3	98	35.7	100
MARCH	16.7	55	2.6	38	49.8	95
APRIL	40.8	103	2.7	15	87.9	124
MAY	89.0	203	73.2	151	103.7	158
JUNE	99.7	218	102.9	220	100.5	162
JULY	35.4	100	46.4	84	89.5	202
AUGUST	40.7	124	42.9	95	87.4	234
SEPTEMBER	16.2	62	27.2	125	76.3	191
ANNUAL	346.3	129	311	119.5		
APRIL-JULY	264.9	161				

* Average for the 1949-2010 period.

FIGURE MTG10

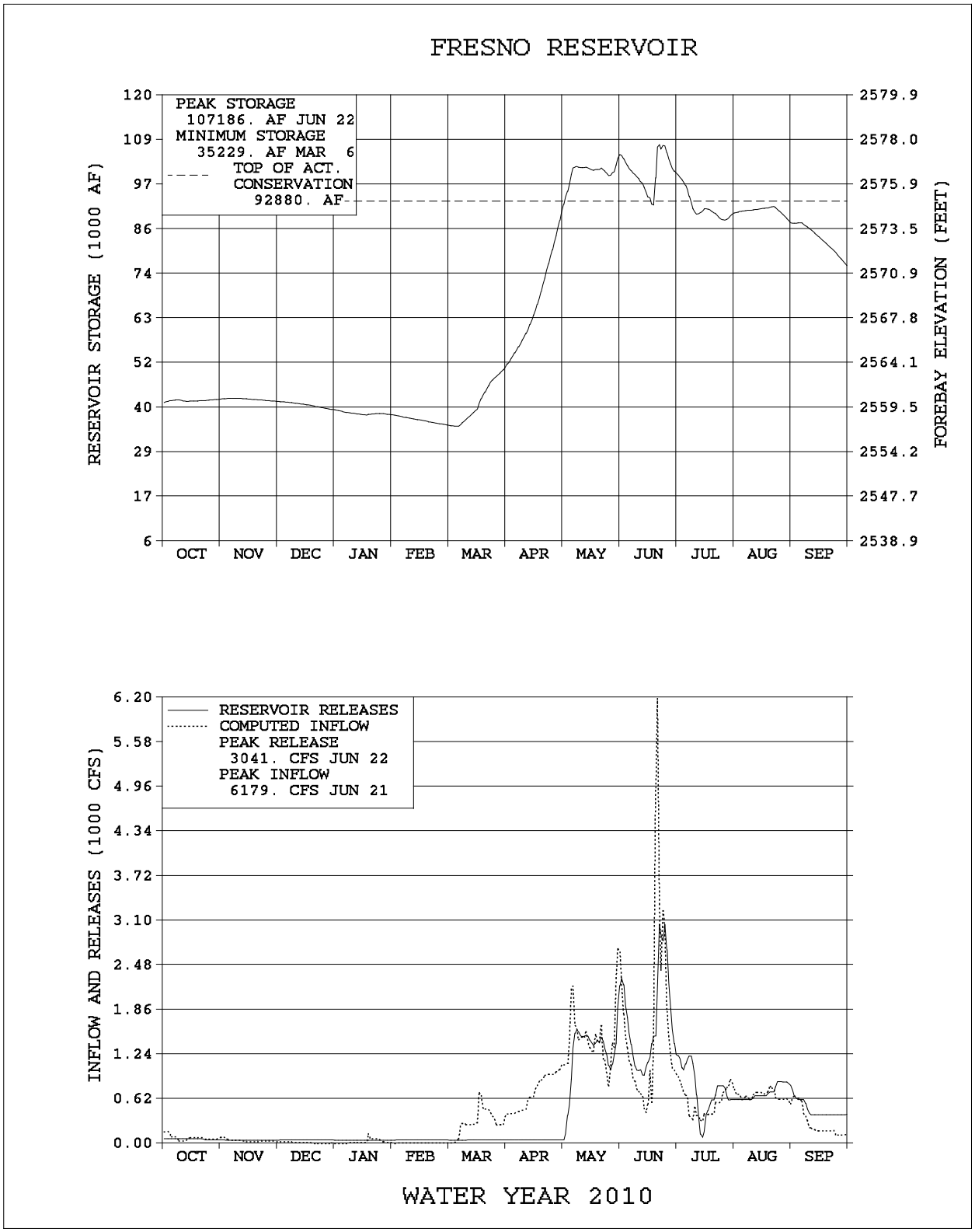


TABLE MTT10-C
HYDROLOGIC DATA FOR 2010
NELSON RESERVOIR (MILK RIVER PROJECT)
NEW SEDIMENT SURVEY DATA EFFECTIVE 10/1/2001

RESERVOIR ALLOCATIONS	ELEVATION (FEET)	TOTAL RESERVOIR STORAGE (AF)	STORAGE ALLOCATION (AF)
TOP OF INACTIVE AND DEAD	2200.00	18,140	18,140
TOP OF ACTIVE CONSERVATION	2221.60	78,950	60,810

STORAGE-ELEVATION DATA	ELEVATION (FT)	STORAGE (AF)	DATE
BEGINNING OF YEAR	2219.74	71,166	OCT 01, 2009
END OF YEAR	2221.26	77,488	SEP 30, 2010
ANNUAL LOW	2216.94	60,269	MAR 18, 2010
ANNUAL HIGH	2221.65	79,167	MAY 06, 2010
HISTORIC HIGH	2221.68	79,297	JUN 01, 2007

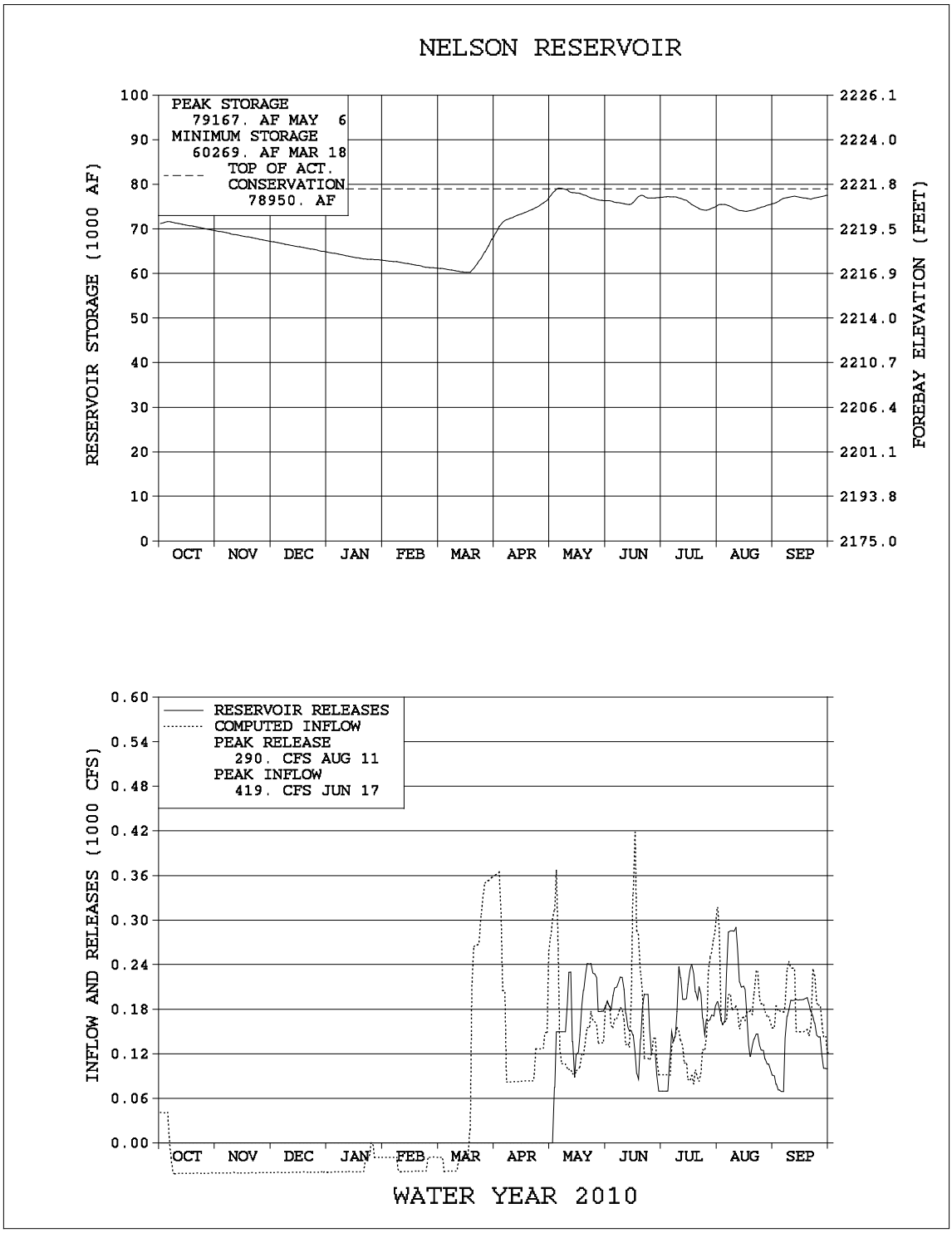
INFLOW-OUTFLOW DATA	INFLOW	DATE	OUTFLOW	DATE
ANNUAL TOTAL (AF)	55,812	OCT 09-SEP 10	49,490	OCT 09-SEP 10
DAILY PEAK (CFS)	419	JUN 17, 2010	290	AUG 11, 2010
DAILY MINIMUM (CFS)	0	*	0	*

* During nonirrigation season

MONTH	INFLOW*		OUTFLOW*		CONTENT	
	KAF	% OF AVG	KAF	% OF AVG	KAF	% OF AVG
OCTOBER	-1.5	---	0.0	---	69.6	117
NOVEMBER	-2.4	---	0.0	---	67.2	115
DECEMBER	-2.4	---	0.0	---	64.8	114
JANUARY	-1.8	---	0.0	---	62.9	114
FEBRUARY	-1.7	---	0.0	---	61.2	114
MARCH	6.4	410	0.0	---	67.6	124
APRIL	8.8	118	0.0	---	76.4	127
MAY	9.7	143	5.7	76	76.3	126
JUNE	10.5	135	16.0	216	77.1	129
JULY	8.2	164	14.1	135	75	137
AUGUST	11.5	160	7.3	92	75.6	140
SEPTEMBER	10.6	171	8.7	240	77.5	137
ANNUAL	55.8	136	49.5	124		
APRIL-JULY	37.2	138				

* Average for the 1947-2010 period.

FIGURE MTG11



Bighorn Lake and Yellowtail Powerplant

Bighorn Lake (P-S, MBP) is located on the Bighorn River about 45 miles southwest of Hardin, Montana. It has a total capacity of 1,328,360 acre-feet. The dam and reservoir were built for power generation, irrigation, flood control, fish, wildlife, and recreation. The nameplate capacity of Yellowtail Powerplant is 250,000 kilowatts. Provisions have been made for gravity diversions from the reservoir to the proposed Hardin Unit which contains 42,600 acres of irrigable lands needing a full water supply and 950 acres to receive a supplemental supply. Stored water can also be used to irrigate additional lands along the Yellowstone River. Reclamation has negotiated an industrial water service contract with Pennsylvania Power and Light, MT (PPL-MT), formerly known as Montana Power Company (MPC) for 6,000 acre-feet. All other industrial water service contracts with different entities expired as of May 1982 and none were renewed. Bull Lake, Boysen, and Buffalo Bill Reservoirs are three major tributary reservoirs located in Wyoming upstream of Bighorn Lake. Because these reservoirs are operated and managed by the Wyoming Area Office (WYAO), all reservoir and river operations in the Bighorn River Basin are closely coordinated between the Montana Area Office (MTAO) and WYAO.

In 1982, a hydrographic and a topographic survey were conducted and a new elevation-area-capacity table and curve was developed. The 1982 survey determined that Bighorn Lake has a storage capacity of 1,328,360 acre-feet and a surface area of 17,279 acres at reservoir elevation 3657.0 feet (the top of the spillway gates). Since closure in 1965, the reservoir has accumulated a sediment volume of 53,950 acre-feet below reservoir elevation 3657 feet. This volume represents a 3.9 percent loss in capacity and an average annual loss of 3,224 acre-feet from November 1965 through July 1982. Sediment was deposited at the annual rate of 0.314 acre-feet per square mile during that period.

The revised area-capacity table was put into effect on August 1, 1986, reflecting the new storage levels.

Valley precipitation in the Bighorn River Basin was respectively 128 percent and 112 percent of average during July and August of 2009, while the mountain precipitation was respectively 106 and 122 percent of average. This precipitation essentially made it possible to maintain releases out of Bighorn Lake to the Bighorn River near or above 3,000 cfs during August and September. It was not until September 22, that all storage in the exclusive flood pool was successfully evacuated. During September, the valley and mountain precipitation had dropped to 33 and 37 percent of average respectively. Storage in Bighorn Lake continued to slowly decline and ended water year 2009 at 1,060,795 acre-feet at elevation 3639.26 feet. This was 104 percent of average and only 9,234 acre-feet or 0.74 feet below the top of the joint-use pool. This was also 6,973 acre-feet or 0.56 feet lower than the level experienced at the end of water year 2008 and the 3rd highest level ever recorded for this time of year since construction of Bighorn Lake in 1967.

Water year 2010 started out good with precipitation in the Bighorn Basin upstream of Bighorn Lake being well above average during October. However, by November climatic conditions quickly changed. Valley precipitation was 183 percent of average and dropped to only 8 percent of average in November while the mountain precipitation was 134 percent of average in October, dropping to only 34 percent of average in November. During the remainder of the winter, the precipitation continued to remain well below normal through March. The valley precipitation during December through March was 80 percent of average while the mountain precipitation during this period was only 61 percent of average.

At the end of water year 2009, storages in Boysen and Buffalo Bill Reservoirs located on the Wind and Shoshone Rivers were drafted to 110 and 111 percent of average, respectively, to meet irrigation demands. With the carry-over storages in Boysen and Buffalo Bill Reservoirs slightly higher than levels a year ago, the WYAO established the minimum winter releases out of these reservoirs at flow rates of 900 and 350 cfs, respectively.

Even though the precipitation during November through March was well below normal in the Bighorn River Basin, the inflows still remained about 91 percent of average during October through March. This was due largely to the good fall and winter releases out of Boysen and Buffalo Bill Reservoirs which were 83 percent of average and 106 percent of average, respectively.

On October 8, Reclamation hosted a public meeting in Billings, MT, to discuss the water supply outlook and projected fall and winter operations of the Bighorn River Basin. With no objections to the information that was presented, the fall and winter releases out of Bighorn Lake to the Bighorn River were set at 2,775 cfs. On November 1, total storage in Bighorn Lake was 1,063,770 acre-feet at elevation 3639.50 feet. This was the 3rd highest level ever recorded for this time of year. Based on the October through March inflow projections, it was anticipated that by maintaining this release rate, the level of Bighorn Lake would reach elevation 3620.62 feet with 878,400 acre-feet of storage by the end of March. This release rate was 88 percent of average.

Beginning in November and continuing through the middle of April, snow accumulated in the higher elevations at well below normal rates. On January 1, the NRCS measured mountain snowpack in the Bighorn Basin at about 72 percent of average. The Wind and Shoshone River Basins, major tributaries of the Bighorn River, were both measured at 75 and 69 percent of average, respectively. By April 1, snowpack in the Wind River Basin had declined to 67 percent of average while the Shoshone River Basin declined to 61 percent of average. With snow conditions a little better in the Bighorn Mountains of Montana/Wyoming, the overall snowpack in Bighorn River Basin above Bighorn Lake was reported at 73 percent of average.

With mountain snowpack in the Bighorn Basin at only 67 percent of average on February 1, the water supply forecast indicated the April-July inflow forecast was estimated at 625,000 acre-feet or only 56 percent of average. Because of the unusually low water supply forecast, the decision was made to reduce the releases out of Bighorn Lake to the Bighorn River from 2,775 cfs to 2,500 cfs, the desired minimum river fishery flow, in an effort to conserve storage in Bighorn Lake. On February 11, the river releases were reduced to 2,500 cfs.

By the end of February, there was no sign of improvement in the water supply outlook and the inflow forecast into Bighorn Lake only continued to deteriorate. During February 24-25, the releases were gradually further decreased to 2,000 cfs and were maintained at that rate through April.

Weather conditions finally began to change about the middle of April. Several spring storms frequented the Bighorn Basin during late April through June, bringing with them above normal precipitation. The valley and mountain precipitation during April through June were each measured at 129 percent of average.

Even though above normal precipitation fell in late April and early May, the inflows into Bighorn Lake did not begin to increase noticeably until the second week of May. Temperatures remained cool during May, delaying the normal snowmelt runoff into Bighorn Lake. Due to the lack of normal spring precipitation, upstream irrigation demands were greater than normal. Streamflows were being depleted to meet the irrigation demands, resulting in the inflows to Bighorn Lake to drop to only 74 percent of average during April.

The heaviest precipitation in the Bighorn Basin fell during May and June. Inflows into Bighorn Lake gradually increased from nearly 1,500 cfs on May 5 to a peak for the year of 16,232 cfs on June 17. The inflow into Bighorn Lake during May totaled 340,852 acre-feet and was the 10th highest May inflow of record since construction of the dam in 1967. The June inflow totaled 761,330 acre-feet and was the 6th highest June inflow of record. As the inflows slowly increased, the releases to the Bighorn River were gradually increased to control the rate of fill of storage in Bighorn Lake. Beginning on May 4, the releases to the Bighorn River were gradually increased from 2,250 cfs to near 10,000 cfs on June 16. The actual peak release to the Bighorn River for the year was recorded on June 24 at 9,993 cfs. The actual total peak release for the year was recorded on June 27, at 10,371 cfs when combined with the diversions to the Bighorn Canal to meet the irrigation demands. Storage in Bighorn Lake steadily increased from 948,145 acre-feet at elevation 3628.80 feet on May 20, to the peak for the year of 1,146,056 acre-feet at elevation 3645.59 feet on July 4. This was 5.59 feet above the top of the joint-use pool and 111 percent of average for this time of year, making it the 6th highest level ever recorded on this date.

By early July, the frequency of the spring storms had greatly diminished. The valley precipitation dropped to 64 percent of average during July, while the mountain precipitation dropped to 47 percent of average. With the snowmelt runoff essentially over and precipitation at well below average, inflows into Bighorn Lake dropped from 184 percent of average in June to about 97 percent of average in July. As the inflows into Bighorn Lake slowly declined, the releases to the Bighorn River were gradually decreased from about 9,900 cfs on July 7 to 3,500 cfs on July 19 to slow the evacuation rate of storage in Bighorn Lake. By July 28, inflows into Bighorn Lake were recorded at less than 2,000 cfs and all storage in the exclusive flood pool of Bighorn Lake was successfully evacuated. In response and to conserve storage in Bighorn Lake, releases to the Bighorn River were further reduced to 3,000 cfs on July 29.

The April-July inflows were 135 percent of average, totaling 1,504,354 acre-feet. This was about 152,180 acre-feet less than experienced in water year 2009 and was recorded as the 13th highest April-July inflow of record, as compared to the April-July inflow a year ago being the 9th highest of record.

The valley and mountain precipitation in the Bighorn River Basin upstream of Bighorn Lake during August were recorded at 139 and 93 percent of average, respectively. During September, the valley and mountain precipitation had dropped to only 17 and 59 percent of average, respectively. Below normal precipitation combined with heavy upstream irrigation demands, caused inflows into Bighorn Lake to drop to only 73 percent of average during August and September averaging about 2,000 cfs per day. To slow the evacuation rate of storage in Bighorn Lake, the releases to the Bighorn River were further gradually decreased to 2,500 cfs on August 12-13 and maintained at this rate through the remainder of the year. Storage in Bighorn Lake continued to slowly decline and ended the water year at 960,869 acre-feet at elevation 3630.14 feet. This was 94 percent of average and 109,160 acre-feet or 9.86 feet below the top of the joint-use pool. This was also 99,926 acre-feet or 9.12 feet lower than the level experienced at the end of water year 2009 and 2.34 feet higher than the average level recorded for this time of year since construction of Bighorn Lake in 1967.

The annual runoff into Bighorn Lake during water year 2010 totaled 2,573,508 acre-feet. This was 109 percent of average and 7 percent or 156,201 acre-feet less than the total runoff experienced during water year 2009.

The total amount of water released to the Bighorn River during 2010 was 2,635,195 acre-feet or 115 percent of average. This was about 2 percent or 43,758 acre-feet less than what was released to the Bighorn River in 2009.

With conservative measures implemented early in the year, it was possible to provide good opportunities for lake recreation on Bighorn Lake, protect the lake fishery interests, and provide limited habitat for the renowned trout fishery downstream of Yellowtail Afterbay Dam. Throughout the fall, winter, and early spring, releases to the Bighorn River were increased and maintained at 2,750 cfs, about 250 cfs greater than the desired minimum flow required by MFWP to support a healthy river fishery. With storage levels at 88 percent of average about March 1 and because of the poor mountain snowpack conditions in 2010, it was necessary to decrease the river releases to 2,000 cfs, about 500 cfs less than the desired minimum of 2,500 cfs. Eventually, the mountain snowpack conditions improved in late April, May, June, and accompanied by heavy precipitation during this time, releases had to be increased to nearly 10,000 cfs to control the runoff into Bighorn Lake. The good water levels of Bighorn Lake during 2010 also allowed for full service recreation at all marinas around Bighorn Lake during the recreation season from Memorial Day weekend through Labor Day weekend.

Total generation produced at Yellowtail Powerplant during 2010 was 872,600,000 kilowatt-hours, 101 percent of the long term average since construction of the powerplant in 1967. This was 558,873 kilowatt-hours more than generated during the record low year of 2003 and 13,441 kilowatt-hours less than generated in 2009. Approximately 89 percent of all the water released from Yellowtail Dam during 2010 was released through the powerplant (2,381,391 acre-feet). The remainder of the water (292,415 acre-feet) was released either through the evacuation outlet gates or the spillway gates during the spring snowmelt runoff season to control the rate of fill of storage in Bighorn Lake.

The Corps estimated that during 2010, Bighorn Lake did not prevent any local flood damages, but did prevent $9,215,600 in flood damages downstream on the Missouri River below Fort Peck Reservoir for a total of $9,215,600. Since construction of Yellowtail Dam in 1965, Bighorn Lake has reduced flood damages by a total of $139,894,400.

Important Events - Water Year 2010

October 1: The Bureau of Indian Affairs (BIA), decreased diversions to the Bighorn Canal. In response the total release out of Bighorn Lake was decreased to 3,130 cfs (2,950 cfs to the Bighorn River and 180 cfs to the Bighorn Canal).

October 1: To slow the evacuation rate of storage in Bighorn Lake, the total release out of Bighorn Lake was decreased to 2,980 cfs (2,800 cfs to the Bighorn River and 180 cfs to the Bighorn Canal).

October 6-7: With the 2009 irrigation season essentially over, the BIA requested all diversions to the Bighorn Canal be gradually discontinued for the year. In response, the total release out of Bighorn Lake was gradually decreased to 2,800 cfs (2,800 cfs to the Bighorn River and 0 cfs to the Bighorn Canal).

October 8: Reclamation hosted a public meeting at the Hampton Inn in Billings, Montana, to discuss the operations of the Bighorn River Basin. Dan Jewell, Area Manager of the MTAO and Tim Felchle, Chief of Reservoir and River Operations for MTAO, presented the water supply outlook and the proposed operations of Bighorn Lake and Bighorn River for the fall and winter of the 2009-2010.

October 14: Power generation indicated actual flows in the Bighorn River were higher than anticipated. Turbine releases were adjusted to maintain total release out of Bighorn Lake at 3,300 cfs (3,300 cfs to the Bighorn River and 0 cfs to the Bighorn Canal).

October 19-21: The Afterbay was nearly emptied and the river releases were gradually decreased from 3,300 cfs to 400 cfs. This release was maintained for approximately 5-6 hours to facilitate the measurement of discharge from springs and seepage located between Yellowtail Dam and Afterbay Dam. Following the measurements, the river releases were gradually increased to 3,300 cfs.

October 28: Streamflow measurements indicated actual flows in the Bighorn River were higher than anticipated. Turbine releases were adjusted to maintain total release out of Bighorn Lake at 3,000 cfs (3,000 cfs to the Bighorn River and 0 cfs to the Bighorn Canal).

November 4: Power generation indicated actual flows in the Bighorn River were higher than anticipated. Turbine releases were adjusted to maintain total release out of Bighorn Lake at 3,000 cfs (3,000 cfs to the Bighorn River and 0 cfs to the Bighorn Canal).

November 5: Based on the November water supply forecast and continue evacuating storage in Bighorn Lake as planned, total release out of Bighorn Lake was decreased to 2,775 cfs (2,775 cfs to the Bighorn River and 0 cfs to the Bighorn Canal).

November 17: Power generation indicated actual flows in the Bighorn River were higher than anticipated. Turbine releases were adjusted to maintain total release out of Bighorn Lake at 2,775 cfs (2,775 cfs to the Bighorn River and 0 cfs to the Bighorn Canal).

November 24: Power generation indicated actual flows in the Bighorn River were higher than anticipated. Turbine releases were adjusted to maintain total release out of Bighorn Lake at 2,775 cfs (2,775 cfs to the Bighorn River and 0 cfs to the Bighorn Canal).

December 7: Streamflow measurements indicated actual flows in the Bighorn River were higher than anticipated. Turbine releases were adjusted to maintain total release out of Bighorn Lake at 2,775 cfs (2,775 cfs to the Bighorn River and 0 cfs to the Bighorn Canal).

January 11: Power generation indicated actual flows in the Bighorn River were higher than anticipated. Turbine releases were adjusted to maintain total release out of Bighorn Lake at 2,775 cfs (2,775 cfs to the Bighorn River and 0 cfs to the Bighorn Canal).

January 26: Power generation indicated actual flows in the Bighorn River were lower than anticipated. Turbine releases were adjusted to maintain total release out of Bighorn Lake at 2,775 cfs (2,775 cfs to the Bighorn River and 0 cfs to the Bighorn Canal).

February 4: Streamflow measurements indicated actual flows in the Bighorn River were lower than anticipated. Turbine releases were adjusted to maintain total release out of Bighorn Lake at 2,775 cfs (2,775 cfs to the Bighorn River and 0 cfs to the Bighorn Canal).

February 11: Snowpack in the Bighorn Basin was only 68 percent of average. Based on the February water supply forecasts, total release out of Bighorn Lake was decreased to 2,500 cfs (2,500 cfs to the Bighorn River and 0 cfs to the Bighorn Canal).

February 24-25: Snowpack in the Bighorn Basin was less than 70 percent of average. Based on the February water supply forecasts and upon close coordination with MFWP, total release out of Bighorn Lake was gradually decreased to 2,000 cfs (2,000 cfs to the Bighorn River and 0 cfs to the Bighorn Canal).

March 4: Streamflow measurements indicated actual flows in the Bighorn River were lower than anticipated. Turbine releases were adjusted to maintain total release out of Bighorn Lake at 2,000 cfs (2,000 cfs to the Bighorn River and 0 cfs to the Bighorn Canal).

March 31: To perform maintenance on sluice gate actuators on the Afterbay Dam, the level of the Afterbay was maintained no lower than elevation 3182 feet.

April 7: Streamflow measurements indicated actual flows in the Bighorn River were lower than anticipated. Turbine releases were adjusted to maintain total release out of Bighorn Lake at 2,000 cfs (2,000 cfs to the Bighorn River and 0 cfs to the Bighorn Canal).

April 8: Reclamation hosted the annual Bighorn Interagency Coordination Meeting in Lovell, Wyoming to discuss the operations of the Bighorn River Basin. Dan Jewell, Area Manager of the MTAO and Tim Felchle, Chief of Reservoir and River Operations for MTAO, presented the water supply outlook and the proposed operations of Bighorn Lake and Bighorn River for the spring and summer of the 2010 irrigation season.

April 12-22: To perform maintenance on river sluice gates on the Afterbay Dam, the level of the Afterbay was maintained no lower than elevation 3182.50 feet.

April 26: Power generation indicated actual flows in the Bighorn River were lower than anticipated. Turbine releases were adjusted to maintain total release out of Bighorn Lake at 2,000 cfs (2,000 cfs to the Bighorn River and 0 cfs to the Bighorn Canal).

April 26-27: A special mock exercise was performed on the Afterbay automated gate control system failure. A failure was assimilated and the Afterbay level was maintained within +/- 1 foot of the elevation of the Afterbay when the system failed.

April 29: Power generation indicated actual flows in the Bighorn River were lower than anticipated. In addition, recent precipitation in the basin prompted an increase in the total release out of Bighorn Lake to 2,250 cfs (2,250 cfs to the Bighorn River and 0 cfs to the Bighorn Canal).

May 4-5: Recent heavy precipitation in the Bighorn Basin, prompted additional gradual increases in the total release out of Bighorn Lake to 2,750 cfs (2,750 cfs to the Bighorn River and 0 cfs to the Bighorn Canal).

May 6-7: Based on the May water supply forecast, releases out of Boysen were being increased to control the runoff into Boysen Reservoir. This increase in Boysen releases accompanying the heavy precipitation in the Bighorn Basin, prompted additional gradual increase in total release out of Bighorn Lake to 3,250 cfs (3,250 cfs to the Bighorn River and 0 cfs to the Bighorn Canal).

May 12-13: Recent storms across the Bighorn Basin increased the mountain snowpack considerably in the upper Bighorn River Basin. In response, the total release out of Bighorn Lake was gradually increased to 4,000 cfs (4,000 cfs to the Bighorn River and 0 cfs to the Bighorn Canal).

May 14 & May 17: Recent storms across the Bighorn Basin increased the mountain snowpack considerably in the upper Bighorn River Basin. In addition, releases out of Boysen Reservoir to the Wind River were being increased. In response, the total release out of Bighorn Lake was gradually increased to 5,700 cfs (5,700 cfs to the Bighorn River and 0 cfs to the Bighorn Canal).

May 19-20: Western Area Power Administration (WAPA) requested a reduction in turbine releases to maintain reserves in the power generation system. Additional heavy precipitation was also forecast in the Bighorn River Basin for the coming week. In response the total release out of Bighorn Lake was gradually increased to 6,500 cfs (decreased releases through the powerplant turbines to 5,200 cfs and initiated and increased releases through the evacuation outlet gates to 1,230 cfs).

May 24-27: Recent spring storms continue to frequent the Bighorn River Basin causing streamflows to increase to over 10,000 cfs. The BIA has also requested irrigation deliveries to the Bighorn Canal to begin at a rate of 100 cfs. In response, the total release out of Bighorn Lake was gradually increased to 9,600 cfs (9,500 cfs to the Bighorn River and 100 cfs to the Bighorn Canal).

June 3: The BIA requested an increase in diversions to the Bighorn Canal. In response, the total release out of Bighorn Lake was gradually increased to 9,700 cfs (9,500 cfs to the Bighorn River and 200 cfs to the Bighorn Canal).

June 7-9: The BIA requested an additional increase in diversions to the Bighorn Canal. In addition, inflows into Bighorn Lake had increased to over 12,000 cfs. In response and control the rate of fill of storage, the total release out of Bighorn Lake was gradually increased to 9,950 cfs (9,500 cfs to the Bighorn River and 450 cfs to the Bighorn Canal).

June 12: Western Area Power Administration (WAPA) requested a reduction in turbine releases to maintain reserves in the power generation system. In response, the turbine releases were decreased and the spills through the spillway gates increased proportionately while maintaining the total release out of Bighorn Lake at 9,950 cfs (9,500 cfs to the Bighorn River and 450 cfs to the Bighorn Canal).

June 14: The BIA requested a decrease in diversions to the Bighorn Canal. In addition, inflows into Bighorn Lake had increased to over 13,400 cfs. In response and control the rate of fill of storage, the total release out of Bighorn Lake was maintained at 9,950 cfs (9,550 cfs to the Bighorn River and 400 cfs to the Bighorn Canal).

June 16: Recent storms across the Bighorn Basin caused inflows into Bighorn Lake to remain over 13,000 cfs. Recent flow measurements also indicated actual flows in the Bighorn River were lower than anticipated. In response and control the rate of fill of storage, the total release out of Bighorn Lake was increased to 10,400 cfs (10,000 cfs to the Bighorn River and 400 cfs to the Bighorn Canal).

June 17: WAPA requested a reduction in turbine releases to maintain reserves in the power generation system. Inflows have increased to near 14,000 cfs. Due to the recent precipitation, the BIA also requested a reduction in diversions to the Bighorn Canal. In response and continue controlling the rate of fill of storage in Bighorn Lake, the total release out of Bighorn Lake was maintained at 10,350 cfs (10,000 cfs to the Bighorn River and 350 cfs to the Bighorn Canal).

June 21-24: Turbine releases out of Bighorn Lake were adjusted to meet the needs of WAPA. Recent flow measurements also indicated actual flows in the Bighorn River were lower than anticipated. In response and continue controlling the rate of fill of storage in Bighorn Lake, the total release out of Bighorn Lake was maintained at 10,350 cfs (10,000 cfs to the Bighorn River and 350 cfs to the Bighorn Canal).

June 28-29: The BIA requested increases in diversions to the Bighorn Canal. In response, the total release out of Bighorn Lake was maintained at 10,350 cfs (9,900 cfs to the Bighorn River and 450 cfs to the Bighorn Canal).

July 7-14: The high elevation snowmelt appeared to be essentially over allowing releases out of Boysen and Buffalo Bill Reservoirs to be gradually decreased. In response, the total release out of Bighorn Lake was gradually decreased to 4,650 cfs (4,200 cfs to the Bighorn River and 450 cfs to the Bighorn Canal). All releases in excess of full powerplant capacity were discontinued on July 10.

July 13-15: Due to the heavy algae growth in the Bighorn Canal, the BIA requested adjustments in diversions to the canal to allow for chemical treatment of the algae. Canal diversions were gradually decreased from 450 cfs to 300 cfs and then gradually increased back up to 450 cfs. In response the total release was adjusted accordingly.

July 16-19: With the high elevation snowmelt essentially over, the inflows into Bighorn Lake continued to gradually decrease. In addition, the BIA requested a reduction in diversions to the Bighorn Canal. In response, the total release out of Bighorn Lake was gradually decreased to 3,900 cfs (3,500 cfs to the Bighorn River and 400 cfs to the Bighorn Canal).

July 22: Due to the heavy algae growth in the Bighorn Canal and diversions to the Bighorn Canal at full canal capacity, diversions to the Bighorn Canal were reduced slightly to prevent the canal banks from being overtopped. In response the total release was decreased to 3,860 cfs (3,500 cfs to the Bighorn River and 360 cfs to the Bighorn Canal).

July 27-29: Due to the heavy algae growth in the Bighorn Canal, the BIA requested adjustments in diversions to the canal to allow for chemical treatment of the algae. Canal diversions were gradually decreased from 360 cfs to 250 cfs and then gradually increased back up to 375 cfs. In response the total release was adjusted accordingly.

July 29: Inflows into Bighorn Lake have decreased to less than 2,000 cfs. To slow the evacuation rate of storage in Bighorn Lake, the total release out of Bighorn Lake was reduced to 3,375 cfs (3,000 cfs to the Bighorn River and 375 cfs to the Bighorn Canal).

August 10-12: Due to the heavy algae growth in the Bighorn Canal, the BIA requested adjustments in diversions to the canal to allow for chemical treatment of the algae. Canal diversions were gradually decreased from 360 cfs to 200 cfs and then gradually increased back up to 350 cfs. In additional, the inflows into Bighorn Lake to remain near 2,200 cfs. In response the total release was adjusted to accommodate the chemical treatment of the algae and was later decreased to 2,850 cfs (2,500 cfs to the Bighorn River and 350 cfs to the Bighorn Canal) to slow the evacuation rate of storage in Bighorn Lake.

August 23-September 2: An 11-day outage was scheduled on the Afterbay Sluiceway gates. During the maintenance outage, the level of the Afterbay was maintained no lower than elevation 3183 feet and no higher than elevation 3190 feet. The total release out of Bighorn Lake was maintained at 2,840 cfs (2,500 cfs to the Bighorn River and 340 cfs to the Bighorn Canal).

August 31: The BIA requested a reduction in diversions to the Bighorn Canal. In response, the total release out of Bighorn Lake was decreased to 2,790 cfs (2,500 cfs to the Bighorn River and 290 cfs to the Bighorn Canal).

September 7-9: Maintenance was performed on the Afterbay Dam's radial gate transducers and couplings. During the maintenance, the level of the Afterbay was maintained between elevations 3175-3178.5 feet. In response, the total release out of Bighorn Lake was maintained at 2,790 cfs (2,500 cfs to the Bighorn River and 290 cfs to the Bighorn Canal).

September 8: The BIA requested a reduction in diversions to the Bighorn Canal. In response, the total release out of Bighorn Lake was decreased to 2,765 cfs (2,500 cfs to the Bighorn River and 265 cfs to the Bighorn Canal).

September 14: The BIA requested a reduction in diversions to the Bighorn Canal. In response, the total release out of Bighorn Lake was decreased to 2,715 cfs (2,500 cfs to the Bighorn River and 215 cfs to the Bighorn Canal).

September 21: A 3 -hour black-start test was conducted for Yellowtail Dam and Powerplant. During the test, the level of the Afterbay was maintained near elevation 3187.50 feet.

September 27-October 5: The Yellowtail Dam spillway tunnel and spillway stilling basin was inspected. To allow for the inspection and maintenance, the level of the Afterbay was maintained no higher than elevation 3190 feet. The total release out of Bighorn Lake was 2,790 cfs (2,500 cfs to the Bighorn River and 215 cfs to the Bighorn Canal.

September 29-30: W ith the 2010 i rrigation season essentially over, the BIA requested all diversions to the Bighorn Canal be gradually discontinued for the year. In response, the total release was gradually reduced to 2,500 cfs (2,500 cfs to the Bighorn River and 0 cfs to the Bighorn Canal).

October 7: Reclamation hosted the annual Bighorn Basin Fall Water Supply Meeting at MSU-Billings downtown to discuss operations of Bighorn Lake and Bighorn River. Dan Jewell, Area Manager of the MTAO and Tim Felchle, Chief of Reservoir and River Operations, presented the water supply outlook and the proposed operations of Bighorn Lake and Bighorn River for the fall and winter season of 2010-2011.

Additional hydrologic and statistical information pertaining to the operations of Bighorn Lake during 2010 can be found on Table MTT11 and MTG12.

For more detailed information on the operations of Boysen and Buffalo Bill Reservoirs during 2010, refer to the narratives for Boysen Reservoir and Powerplant and Shoshone Project under the responsibility of the WYAO.

TABLE MTT11
HYDROLOGIC DATA FOR 2010
BIGHORN LAKE (YELLOWTAIL DAM)

RESERVOIR ALLOCATIONS	ELEVATION (FEET)	TOTAL RESERVOIR STORAGE (AF)	STORAGE ALLOCATION (AF)
TOP OF INACTIVE AND DEAD	3547.00	493,584	493,584
TOP OF ACTIVE CONSERVATION	3614.00	829,687	336,103
TOP OF JOINT USE	3640.00	1,070,029	240,342
TOP OF EXCLUSIVE FLOOD CONTROL	3657.00	1,328,360	258,331

STORAGE-ELEVATION DATA	ELEVATION (FT)	STORAGE (AF)	DATE
BEGINNING OF YEAR	3639.25	1,060,671	OCT 01, 2009
END OF YEAR	3630.14	960,869	SEP 30, 2010
ANNUAL LOW	3627.86	939,449	FEB 25, 2010
ANNUAL HIGH	3645.59	1,146,056	JUL 04, 2010
HISTORIC HIGH	3656.43	1,365,198	JUL 06, 1967

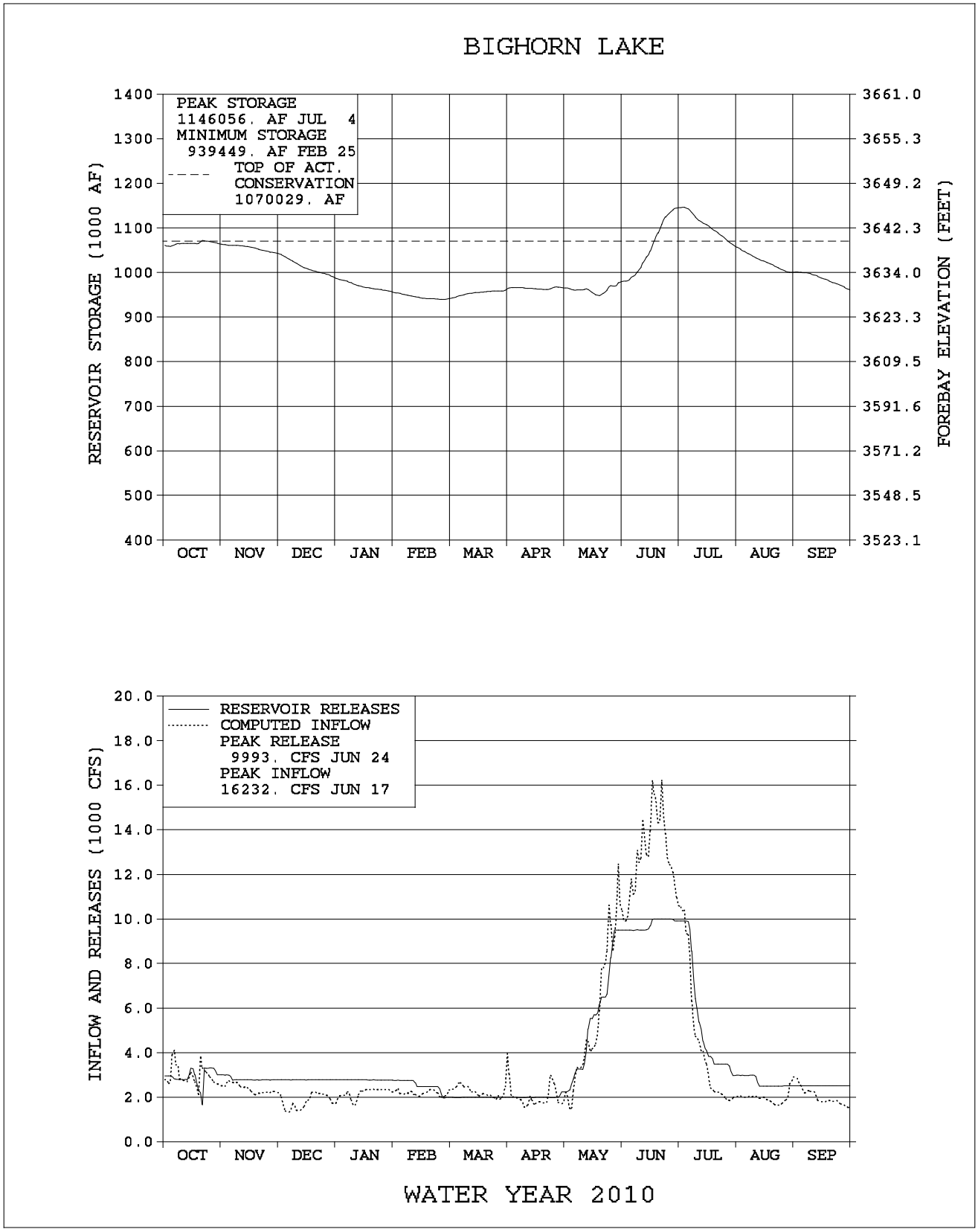
INFLOW-OUTFLOW DATA	INFLOW	DATE	OUTFLOW*	DATE
ANNUAL TOTAL (AF)	2,573,507	OCT 09-SEP 10	2,635,194	OCT 09-SEP 10
DAILY PEAK (CFS)	16,232	JUN 17, 2010	9,993	JUN 24, 2010
DAILY MINIMUM (CFS)	1,330	DEC 06, 2009	1,677	OCT 21, 2009
PEAK SPILL (CFS)			4,681	JUN 20,2010
TOTAL SPILL (KAF)			285.1	05/19-07/10/10

*Discharge to the Bighorn River

MONTH	INFLOW		OUTFLOW*				CONTENT	
	KAF	% OF AVG	CANAL KAF	% OF AVG	RIVER KAF	% OF AVG	KAF	% OF AVG
OCTOBER	180.7	99	2.3	59	179.7	105	1,063.8	106
NOVEMBER	141.4	92	0.0	---	167.5	95	1,042.1	107
DECEMBER	111.8	81	0.0	---	171.2	94	986.8	107
JANUARY	134.8	101	0.0	---	170.9	95	955.2	110
FEBRUARY	120.8	89	0.0	---	139.6	86	940.5	112
MARCH	137.7	81	0.0	---	122.9	68	959.4	115
APRIL	121.4	74	0.0	---	119.1	68	965.8	118
MAY	340.9	138	1.0	10	330.2	175	978.3	112
JUNE	761.3	184	20.3	95	578.8	210	1,144.6	111
JULY	280.8	97	25.2	91	341.0	122	1,058.9	102
AUGUST	122.3	76	20.9	79	164.6	96	1,000.4	99
SEPTEMBER	119.6	70	14.1	76	149.6	99	960.9	94
ANNUAL	2,573.6	109	83.9	77	2,635.2	115		
APRIL-JULY	1,504.4	135						

* Average for the 1967-2010 period.

FIGURE MTG12



CLIMATE SUMMARY

Winter storms began early in water year 2010 as a significant snow storm moved through the Bighorn River Basin on October 5. Locations in the lower end of the Wind River Range reported close to 2 feet of snow from the storm. A Canadian cold front brought additional snow to the basin along with record low temperatures on October 9 and 10. Morning lows of 7 degrees at Cody and 10 degrees at Lander broke records dating back to 1919, while the low of 6 degrees at Riverton was the lowest temperature recorded in the first 20 days of October since official weather records began in 1907.

The average temperature for the first 17 days of October at Riverton of 35.9 degrees was also the lowest of record for that period. The third early season storm of October brought heavy snow to the southern Wind River Mountains on October 27 and 28 with South Pass City receiving 29 inches of snow and the Townsend Creek and Hobbs Park snotel sites reporting 26 inches. During October, 62 inches of snow fell at South Pass City. For the month, precipitation at low elevation stations in the Wind River Basin was 199 percent of average while the mountains above Boysen got 181 percent of normal October precipitation. The last storm of the month missed the Shoshone drainage but precipitation for the month was still above average in the Buffalo Bill watershed. Temperatures during October were over 9 degrees below average in the Shoshone River Basin and over 7 degrees below average in the Wind River Basin.

In contrast to the cold and wet October, very little precipitation fell in November and near record high temperatures was reported at Cody, Lander, and Worland on November 5. The Wind River Basin was especially hard hit with the low elevation precipitation only 1 percent of average and the mountains receiving 17 percent of normal. Precipitation in the Shoshone River Basin was also well below average with the low elevation stations receiving 64 percent of average and the mountains only 43 percent of normal. November temperatures were about 5 degrees above average in both the Shoshone and Wind River Basins. The snowpack on December 1 was 90 percent of average in the Boysen watershed and 76 percent of average in the Buffalo Bill drainage. A strong cold front moved through Wyoming on December 1 and well below average temperatures were experienced during the first 10 days of the month. Overall, temperatures for December were about 9 degrees colder than normal.

Frequent storms passed through Wyoming during December but none brought significant moisture to the Shoshone or Wind River Basins and the snowpack declined to 69 and 78 percent of average on January 1, respectively. Stormy weather continued into January, with extreme cold moving into Wyoming on January 7. Temperatures near Thermopolis fell to -35 degrees and numerous stations reported lows in the 20 to 30 degrees below zero range. Precipitation during the month remained below average, especially in the mountains where the Shoshone and Wind River Basins received 57 and 44 percent of average, respectively.

By February 1, the snowpack above Boysen Reservoir had fallen to 70 percent of average and the mountains in the Buffalo Bill watershed held only 63 percent of normal snowpack. January temperatures were near normal in the Shoshone Basin and about 3 degrees below average in the Wind River Basin. Several storms moved through western Wyoming during the first 3 weeks of February but little appreciable precipitation resulted and the snowpack continued to drop further below average.

In the Wind River Basin, February precipitation in the mountains was less than half of normal for the fourth consecutive month and the snowpack dropped 5 percent to 65 percent of average on March 1. Conditions in the Buffalo Bill drainage were even worse as the March 1 snowpack stood at 57 percent of average, also a 5 percent drop during February.

March finally brought some improvement to the snowpack, especially in the Boysen watershed. The second half of the month saw frequent storms track across the Wind River Mountains bringing much needed snow to the area. Major storms on March 18-19, 22-23, and 26-27 all targeted the eastern slopes of the Wind River Range above Lander, while the last storm of the month on the 29 and 30 brought significant snowfall to the headwaters of the Wind River and further north into the Shoshone Basin.

By April 1, mountain snowpack above Boysen Reservoir increased 12 percent to 77 percent of average, while the snowpack in the Shoshone watershed made a 4 percent gain to 62 percent of normal. Temperatures in both the Wind and Shoshone Basins were about 3 degrees above average for the month of March. The pattern established in March continued in April as the month began with almost 2 feet of snow falling in the southern end of the Wind River Range on April 1 and 2. After a couple days of clearing skies, another slow moving storm followed the same path across the Wind Rivers on April 5-7 with accumulations in excess of 2 feet of snow falling in the Little Wind River drainage. By April 8, 61.9 inches of snow had fallen during the season at Riverton, making it the 2nd snowiest winter of record. Only the winter of 1919-20 had a greater total accumulation, with a total snowfall of 92 inches. While no more major storms rolled through the Wind River Basin during April, the gains that were made early in the month were maintained and the snowpack stood at 91 percent of average on May 1.

The mountains above Buffalo Bill missed out on most of the April snow and fell to 59 percent of average on May 1. April temperatures were right at the 30 year average over the entire Bighorn River Basin. May 2010 brought the second coming of winter as temperatures during the first half of the month ranged between 5 and 15 degrees below normal. Many stations reported lows in the teens or single digits on May 7 and 8. A storm on May 10 brought significant precipitation to Fremont County with about ½ an inch of rain falling at elevations below 7,000 feet and from 3 to 8 inches of snow in the mountains. Immediately following on May 11 and 12, another strong spring storm dropped over 3 feet of snow on the east slopes of the Wind River Mountains and the southern Absaroka Mountains. This storm boosted the total snowfall for the season at Riverton to 75.5 inches.

For the month, temperatures over the Wind and Shoshone Basins were about 6 degrees below average with Riverton and Lander recording the third and fifth coldest May of record, respectively. Downstream of Boysen on the Bighorn River, Worland had the coldest May of record. Precipitation during May was 114 percent of average in the Buffalo Bill watershed while the Boysen drainage reported 213 percent of average. The combination of well below normal temperatures and frequent precipitation events during May held the snow in the mountains at a time when it would normally be melting. On June 1, the snowpack in the Buffalo Bill watershed stood at 90 percent of average, a 31 percent increase from May 1. In the Boysen drainage, the snowpack increased 79 percent during May to 170 percent of average on June 1.

Most of the snow that accumulated in the Boysen watershed was in the mountains drained by the Little Wind River. When more seasonable temperatures finally arrived during the first week of June, the snowpack began to melt rapidly.

This resulted in minor flooding along tributaries of the Little Wind on June 4 and 5. As the snowmelt continued, the Little Wind River rose above flood stage on June 5, requiring the evacuation of homes along the river on June 8. The Little Wind River at Riverton crested at 11.91 feet on June 9. This was 3.91 feet above flood stage and 1.06 feet higher than the highest previous crest of 10.85 feet that occurred on June 17, 1963.

The peak flow in the Little Wind at the Riverton gage was 11,600 cfs with the maximum inflow to Boysen of 16,000 cfs also occurring on June 9. To further complicate the situation, another slow moving storm on June 12 and 13 brought over 2 inches of rain to the already saturated Lander area and well over a foot of snow to the southern Wind River Mountains. The warm temperatures of early June extended into the Shoshone Basin as well with flows on the North and South forks of the Shoshone River rising rapidly in response to the snowmelt.

The maximum daily inflow to Buffalo Bill during the runoff of 13,419 cfs occurred on June 7. For the month, temperatures in both the Boysen and Buffalo Bill watersheds were about 1 degree below average. Little precipitation fell during the remainder of June but the Buffalo Bill drainage still received 150 percent of average with the Boysen drainage getting 113 percent of normal June precipitation. Precipitation was 49 and 32 percent of average, respectively, in the Boysen and Buffalo Bill drainages during July with near normal temperatures over the entire Bighorn Basin as warm dry air settled over Wyoming. Temperatures during August remained near normal with slightly above average precipitation while September was warmer and drier than normal.

The 2010 mountain snow water content for the drainage basins in Wyoming is shown on Table WYT1. The 2010 water supply forecasts are shown on Table WYT2 and the 2010 precipitation in inches and the percent of average is shown on Table WYT3.

TABLE WYT1

2010 MOUNTAIN SNOW WATER CONTENT [1]

AS A PERCENT OF THE 1971-2000 AVERAGE

DRAINAGE BASIN	JAN	1	FEB	1	MAR	1	APR	1	MAY	1
	INCHES	%	INCHES	%	INCHES	%	INCHES	%	INCHES	%
BULL LAKE	4.02	72	5.05	69	5.75	64	8.98	80	10.00	96
BOYSEN	5.14	78	6.53	70	7.42	65	10.79	77	12.79	91
BUFFALO BILL	6.06	69	7.73	63	8.71	57	11.40	62	11.51	59

[1] A composite of the following Natural Resources Conservation Service SNOTEL sites was used to determine snow water content and percent of average for the basins:

Bull Lake.....Cold Springs, Elkhart Park, Hobbs Park, and St. Lawrence Alt;
Boysen.....Burroughs Creek, Cold Springs, Deer Park, Hobbs Park, Little Warm, St. Lawrence Alt, South Pass, Togwotee Pass, and Townsend Creek;
Buffalo Bill, Blackwater, Evening Star, Kirwin, Marquette, Sylvan Lake, Sylvan Road, and Younts Peak

TABLE WYT2

2010 WATER SUPPLY FORECASTS OF APRIL - JULY SNOWMELT RUNOFF

	JAN 1		FEB 1		MAR 1		APR 1		MAY 1		JUN 1		ACTUAL APR-JULY		% OF APRIL FORECAST RECEIVED
	KAF	% OF AVG	KAF	% OF AVG	KAF	% OF AVG	KAF	% OF AVG	KAF	% OF AVG	KAF	% OF AVG	KAF	% OF AVG	
BULL LAKE	125	89	115	82	110	78	110	78	135	96	160	114	150.9	107	137
BOYSEN	450	81	400	72	350	63	400	72	570	103	880	159	860.8	156	215
BUFFALO BILL	550	83	475	72	450	68	450	68	450	68	580	88	674.2	102	150

Averages are based on the 1980-2009 period

TABLE WYT3
PRECIPITATION IN INCHES AND PERCENT OF AVERAGE

BASIN	OCT		NOV		DEC		JAN		FEB		MAR		APR		MAY		JUN		JUL		AUG		SEP	
	IN.	%	IN.	%	IN.	%	IN.	%	IN.	%	IN.	%	IN.	%	IN.	%	IN.	%	IN.	%	IN.	%	IN.	%
VALLEY PRECIPITATION [1]																								
BUFFALO BILL																								
MONTHLY PRECIP AND % OF AVERAGE	1.71	153	0.71	64	0.55	54	0.91	83	0.61	71	1.12	99	1.64	122	2.34	114	3.15	150	0.48	32	1.53	124	0.37	29
YEAR-TO-DATE PRECIP AND % OF AVERAGE	1.71	153	2.42	109	2.97	92	3.88	89	4.49	86	5.61	88	7.25	94	9.59	98	12.74	108	13.22	99	14.75	101	15.12	95
BOYSEN																								
MONTHLY PRECIP AND % OF AVERAGE	1.62	199	0.01	1	0.32	105	0.24	92	0.36	109	0.74	121	2.27	195	3.79	213	1.41	113	0.43	49	0.65	107	0.06	5
YEAR-TO-DATE PRECIP AND % OF AVERAGE	1.62	199	1.63	127	1.95	123	2.19	119	2.55	118	3.29	118	5.56	141	9.35	163	10.76	154	11.19	142	11.84	140	11.90	126
BULL LAKE																								
MONTHLY PRECIP AND % OF AVERAGE	1.10	158	0.01	2	0.16	70	0.21	107	0.25	91	0.52	112	2.59	238	3.65	209	1.25	98	0.36	37	0.94	135	0.10	9
YEAR-TO-DATE PRECIP AND % OF AVERAGE	1.10	158	1.11	102	1.27	96	1.48	97	1.73	97	2.25	100	4.84	145	8.49	167	9.74	153	10.10	138	11.04	137	11.14	122
MOUNTAIN PRECIPITATION [2]																								
BUFFALO BILL																								
MONTHLY PRECIP AND % OF AVERAGE	3.20	133	1.60	43	1.80	58	1.70	57	1.20	48	2.60	93	3.90	115	4.60	121	5.90	197	0.90	41	3.00	188	1.50	68
YEAR-TO-DATE PRECIP AND % OF AVERAGE	3.20	133	4.80	79	6.60	72	8.30	68	9.50	65	12.10	69	16.00	77	20.60	83	26.50	96	27.40	92	30.40	97	31.90	95
BOYSEN																								
MONTHLY PRECIP AND % OF AVERAGE	3.80	181	0.50	17	1.20	48	1.10	44	1.00	45	2.90	100	5.30	151	5.70	168	4.10	171	0.70	41	1.60	114	0.70	35
YEAR-TO-DATE PRECIP AND % OF AVERAGE	3.80	181	4.30	84	5.50	72	6.60	65	7.60	62	10.50	69	15.80	84	21.50	97	25.60	104	26.30	100	27.90	101	28.60	97
BULL LAKE																								
MONTHLY PRECIP AND % OF AVERAGE	3.70	185	0.30	14	0.90	53	0.90	56	0.80	50	2.90	121	5.00	156	5.80	171	3.20	139	0.50	33	1.90	136	0.40	21
YEAR-TO-DATE PRECIP AND % OF AVERAGE	3.70	185	4.00	95	4.90	83	5.80	77	6.60	73	9.50	83	14.50	99	20.30	112	23.50	115	24.00	110	25.90	111	26.30	104

[1] A composite of the following National Weather Service stations was used to determine monthly valley precipitation and percent of average for the drainage basins:
Bull Lake.....Burris, Diversion Dam, and Dubois;
Boysen.....Boysen Dam, Burris, Diversion Dam, Dubois, Lander, and Riverton;
Buffalo Bill.....Buffalo Bill Dam, Lake Yellowstone, and Tower Falls

[2] A composite of the following Natural Resources Conservation Service SNOTEL sites was used to determine monthly mountain precipitation and percent of average for the drainage basins:
Bull Lake.....Cold Springs, Elkhart Park, Hobbs Park, and St. Lawrence Alt;
Boysen.....Burroughs Creek, Cold Springs, Deer Park, Hobbs Park, Little Warm, St. Lawrence Alt, South Pass, Togwotee Pass, and Townsend Creek;
Buffalo Bill.....Blackwater, Evening Star, Kirwin, Marquette, Sylvan Lake, Sylvan Road, and Younts Peak

FLOOD BENEFITS

Flood Damage Prevented in the Wind/Bighorn and Shoshone River Systems[1]					
Reservoir	**Local**	**Main Stem**	**2010 Total**	**Previous Accumulation[3]**	**1950 - 2010 Accumulation Total**
Bull Lake[2]	$ 349,600	$ 0	$ 349,600	$ 2,690,700	$ 3,040,300
Boysen	$ 1,156,000	$ 6,231,100	$ 7,387,100	$ 98,992,700	$106,379,800
Buffalo Bill[2]	$ 1,751,200	$ 0	$ 1,751,200	$ 12,450,800	$14,202,000

1/ This data is received from the Army Corps of Engineers Omaha District Office and is revised every October. The period of assessment is 1950 through 2010.
2/ No space is allocated to flood control, but some flood protection is provided by operation for other purposes.
3/ Adjusted in 2006 by 0.1 to 0.5 to account for previous rounding of cumulative total to nearest 1.0.

Riverton Unit

The Riverton Project was reauthorized as the Riverton Unit Pick-Sloan Missouri Basin Program (P-S MBP) on September 25, 1970. Major facilities of this unit are Bull Lake Reservoir, Wind River Diversion Dam, Wyoming Canal, Pilot Butte Powerplant, Pilot Butte Reservoir, and Pilot Butte Canal. The major facilities provide water for irrigation of about 76,000 acres on the Midvale Irrigation District (Midvale). The water supply comes partly from the natural flow of the Wind River and partly from water stored in Bull Lake and Pilot Butte Reservoirs.

Bull Lake Reservoir is located on Bull Lake Creek, a tributary of the Wind River near Crowheart, Wyoming. Bull Lake has an active capacity of 151,737 acre-feet (AF), and is above all unit land. It is the principal storage facility for the unit and is operated by Midvale under contract with Reclamation. A small amount of incidental flood control benefit is provided by normal operation for other purposes. Bull Lake also provides a water resource for enhancing fish, wildlife, and recreation.

Bull Lake held 79,758 AF of water at the start of water year 2010, which was 105 percent of the normal end of September content and 52 percent of capacity. Irrigation on the Riverton Unit ended on October 5 and the release from Bull Lake was reduced at that time to conserve the remaining storage in Bull Lake.

During water year 2009, Midvale entered into an agreement with Reclamation that allowed the storage of Boysen water in Bull Lake by exchange. Because of this agreement, Bull Lake ended the water year at a higher content. Once the irrigation season ended, the Boysen water in Bull Lake was transferred back to Boysen at a rate of approximately 20 cfs to provide a winter flow in Bull Lake Creek. Inflow during October, November, and December was slightly greater than the release and the content of Bull Lake began to increase as soon as irrigation releases ended. By the end of December, storage in Bull Lake had increased to 81,538 AF, which was 108 percent of average.

On January 1, snowpack in the basin above Bull Lake was 72 percent of average. Water supply forecasts of the April-July snowmelt runoff were prepared each month, beginning in January and continuing through June. The January forecast indicated the April-July snowmelt runoff would be approximately 125,000 AF, which was 89 percent of average.

Precipitation in the mountains above Bull Lake was below average during January and the snowpack decreased to 69 percent of average on February 1. The February 1 snowmelt runoff forecast was reduced to 115,000 AF. Inflow during January, February, and March was slightly less than the outflow and at the end of March. The reservoir held 81,236 AF. February precipitation was below average, especially in the mountains, and the snowpack dropped 5 percent compared to average during the month. The March 1 forecast was reduced by 5,000 AF to 110,000 AF.

Conditions began to improve during March as a series of storms brought substantial snowfall to the Bull Lake watershed. Precipitation in the mountains was only 120 percent of average, but the snowpack increased 16 percent, to 80 percent of average on April 1.

While improvements were noted, the April 1 forecast remained at 110,000 AF of runoff expected during the April through July period, which was 78 percent of average. Rain and snow continued to fall during April. Midvale began diverting water into the Wyoming Canal on April 17 to fill the remaining space in Pilot Butte Reservoir and flush the canal system. Above average snowfall in the mountains and rain on the district lands delayed the need for irrigation water and irrigation deliveries weren't required until April 26. Precipitation during April was over 150 percent of average and snowpack in the Bull Lake drainage climbed to 96 percent of average on May 1. The May 1 forecast of April-July snowmelt runoff was increased to 135,000 AF, with about 4,600 AF of the expected runoff coming in to Bull Lake during April. Rainfall on district lands and natural flow in the Wind River satisfied crop requirements during May and except for a few days early in the month, releases from Bull Lake were maintained at 20 cfs. By the end of May, storage in Bull Lake had risen to 96,950 AF at 5786.00 feet. Precipitation during May was about twice what normally occurs, with temperatures that were well below average.

The snowpack continued to build well into the month and was 165 percent of average on June 1. With vastly improved conditions, the June 1 forecast increased to 160,000 AF of runoff during the April-July period, 114 percent of average. Due to the colder than normal temperatures during May, little snowmelt occurred and inflow to Bull Lake was only about 50 percent of average. As warmer weather moved into the basin during the first week of June, the snowmelt began and inflows rose rapidly. On June 7, inflows peaked at over 3,400 cfs, with the reservoir rising over 2 feet for the day. Releases were increased to slow the rate of rise and the maximum release for the year of 2,025 cfs was on June 9. Bull Lake inflow remained fairly high during June and the first part of July.

Reservoir inflow was closely monitored during the runoff and releases were adjusted as necessary to slowly fill Bull Lake. By the end of June, Bull Lake was within 5 feet of being full and held 138,189 AF of water. Near average inflow to Bull Lake occurred during July and releases were adjusted to continue filling the lake. Once inflows to Bull Lake began to recede, the release from the dam was also reduced and the reservoir level rose to its maximum elevation for the year of 5804.15 feet on July 13. At its maximum, Bull Lake was 0.85 feet below the top of the active conservation pool and 98 percent full with 149,785 AF of water stored behind the dam. Irrigation demands increased in August and as flows in the Wind River diminished, Bull Lake storage was called on to supplement the natural flow. The release from Bull Lake averaged about 970 cfs during August and at the end of the month, Bull Lake storage had been drawn down to 107,891 AF. Precipitation in the mountains above Bull Lake was about 20 percent of average during September and rainfall on the irrigated lands of the Riverton Unit was less than 10 percent of normal. To meet the irrigation demands on the project, the Bull Lake release averaged 815 cfs for September, which was 133 percent of average and the reservoir level fell to 5773.61 feet with 65,846 AF of water in storage on September 30.

Actual April-July inflows totaled 150,939 AF, 108 percent of average. Total inflow to Bull Lake for the water year was 194,231 AF, which was 104 percent of average. The flow of the Wind River above the mouth of Bull Lake Creek during the April-July period was estimated to be 100 percent of average, totaling 402,630 AF. The total diversion into the Wyoming Canal for the April-September period was 307,970 AF, 91 percent of average.

Additional hydrologic and statistical information pertaining to Bull Lake operations during 2010 can be found in Table WYT4 and Figure WYG1.

Pilot Butte Reservoir, an off-stream reservoir near Kinnear, Wyoming, receives its water supply from the Wind River through the Wyoming Canal. Pilot Butte Reservoir has a total capacity of 33,721 AF. Of this amount, 3,803 AF is allocated for inactive and dead storage and 29,918 AF for active conservation storage. Pilot Butte Dam and the Wyoming Canal which supplies the reservoir are operated by Midvale under contract with Reclamation.

Pilot Butte Reservoir began water year 2010 with a total storage content of approximately 19,101 AF at elevation 5441.73 feet. Releases from Pilot Canal for the 2009 irrigation season ended on October 5, 2009, but Midvale continued diverting water into the Wyoming Canal in order to refill Pilot Butte. Diversions continued until October 15 when Pilot Butte reached 29,580 AF of water at elevation 5455.27 feet. Once diversions into Pilot Butte were discontinued, the reservoir level began to slowly fall through the winter due to evaporation. By the end of March, evaporation had reduced the content of the reservoir to 28,971 AF. Diversion into Wyoming Canal resumed on April 17 to continue filling Pilot Butte and flush the canal system. Irrigation deliveries began on April 26. Storage in Pilot Butte at the end of April was 30,867 AF at 5456.77 feet. Flows in the Wind River were adequate to meet the needs of Riverton Unit irrigators and Pilot Butte remained essentially full well into July. As demand in August and September exceeded the natural flow available to Midvale, Pilot Butte storage was used to help meet the demand on Pilot Canal through the remainder of the irrigation season. Storage in Pilot Butte on September 30 was 17,441 AF at 5439.28 feet. Irrigation deliveries on the Riverton Unit ended on October 1, 2010.

Pilot Butte Powerplant was unavailable for service during water year 2010 and did not generate any electricity. In June of 2009, both units at Pilot Butte Powerplant were placed in "Mothballed" status and a determination of whether the units will be returned to service is pending.

Additional hydrologic and statistical information pertaining to Pilot Butte Reservoir during 2010 can be found in Table WYT5 and Figure WYG2.

TABLE WYT4
HYDROLOGIC DATA FOR WATER YEAR 2010
BULL LAKE RESERVOIR

RESERVOIR ALLOCATIONS	ELEVATION (FEET)	TOTAL RESERVOIR STORAGE (AF)	STORAGE ALLOCATION (AF)
TOP OF INACTIVE AND DEAD	5739.00	722	722
TOP OF ACTIVE CONSERVATION	5805.00	152,459	151,737

STORAGE-ELEVATION DATA	ELEVATION (FEET)	STORAGE (AF)	DATE
BEGINNING OF YEAR	5779.36	79,758	OCT 01, 2009
END OF YEAR	5773.61	65,846	SEP 30, 2010
ANNUAL LOW	5773.61	65,846	SEP 30, 2010
HISTORIC LOW*	5743.03	6,228	MAR 31, 1950
ANNUAL HIGH	5804.15	149,785	JUL 13, 2010
HISTORIC HIGH	5805.70	154,677	AUG 10, 1965

* Prior to 1952 daily records are not available. End of month data was used to determine the historic low.

INFLOW-OUTFLOW DATA	INFLOW	DATE	OUTFLOW	DATE
ANNUAL TOTAL (AF)	194,231	OCT 09-SEP 10	208,144	OCT 09-SEP 10
DAILY PEAK (cfs)	3,416	JUN 7, 2010	2,025	JUN 9, 2010
DAILY MINIMUM (cfs)	6	DEC 4, 2009	21	MAY 19, 2010
PEAK SPILLWAY FLOW (cfs)			0	
TOTAL SPILLWAY FLOW (AF)			0	

	INFLOW		OUTFLOW		CONTENT	
MONTH	KAF	% of Avg*	KAF	% of Avg*	KAF	% of Avg*
OCTOBER	6.1	111	5.6	85	80.3	108
NOVEMBER	3.1	100	1.8	75	81.5	108
DECEMBER	1.9	76	1.9	95	81.5	108
JANUARY	1.6	73	1.9	100	81.2	107
FEBRUARY	1.5	94	1.7	106	81.0	107
MARCH	2.2	122	1.9	112	81.2	107
APRIL	4.6	124	1.4	38	84.4	112
MAY	14.5	51	2.0	13	97.0	108
JUNE	87.9	144	46.7	191	138.2	109
JULY	43.9	94	35.1	79	147.0	114
AUGUST	20.5	99	59.6	128	107.9	105
SEPTEMBER	6.4	68	48.5	133	65.8	87
ANNUAL	194.2	104	208.1	111		

APRIL - JULY INFLOW (AF)	
ACTUAL	AVERAGE
150,939	140,400

* Average for the 1980-2009 period

FIGURE WYG1

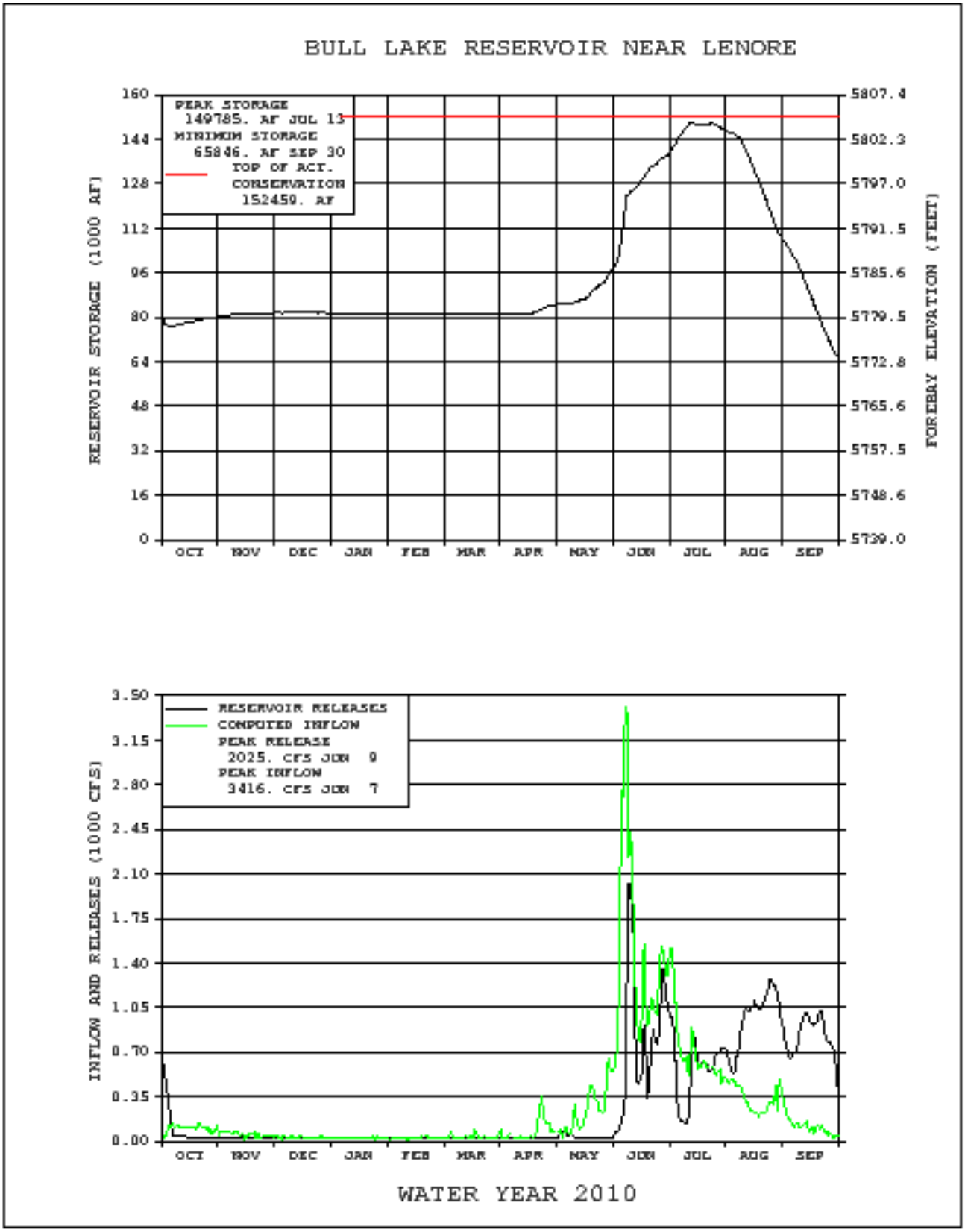

BULL LAKE RESERVOIR NEAR LENORE
PEAK STORAGE
149785. AF JUL 13
MINIMUM STORAGE
65846. AF SEP 30
TOP OF ACT.
CONSERVATION
152459. AF
RESERVOIR STORAGE (1000 AF)
FOREBAY ELEVATION (FEET)
160
144
128
112
96
80
64
48
32
16
0
5807.4
5802.3
5797.0
5791.5
5785.6
5779.5
5772.8
5765.6
5757.5
5748.6
5739.0
OCT
NOV
DEC
JAN
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP
RESERVOIR RELEASES
COMPUTED INFLOW
PEAK RELEASE
2025. CFS JUN 9
PEAK INFLOW
3416. CFS JUN 7
INFLOW AND RELEASES (1000 CFS)
3.50
3.15
2.80
2.45
2.10
1.75
1.40
1.05
0.70
0.35
0.00
OCT
NOV
DEC
JAN
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP
WATER YEAR 2010

TABLE WYT5
HYDROLOGIC DATA FOR WATER YEAR 2010
PILOT BUTTE RESERVOIR

RESERVOIR ALLOCATIONS	ELEVATION (FEET)	TOTAL RESERVOIR STORAGE (AF)	STORAGE ALLOCATION (AF)
TOP OF INACTIVE AND DEAD	5410.00	3,803	3,803
TOP OF ACTIVE CONSERVATION	5460.00	33,721	29,918

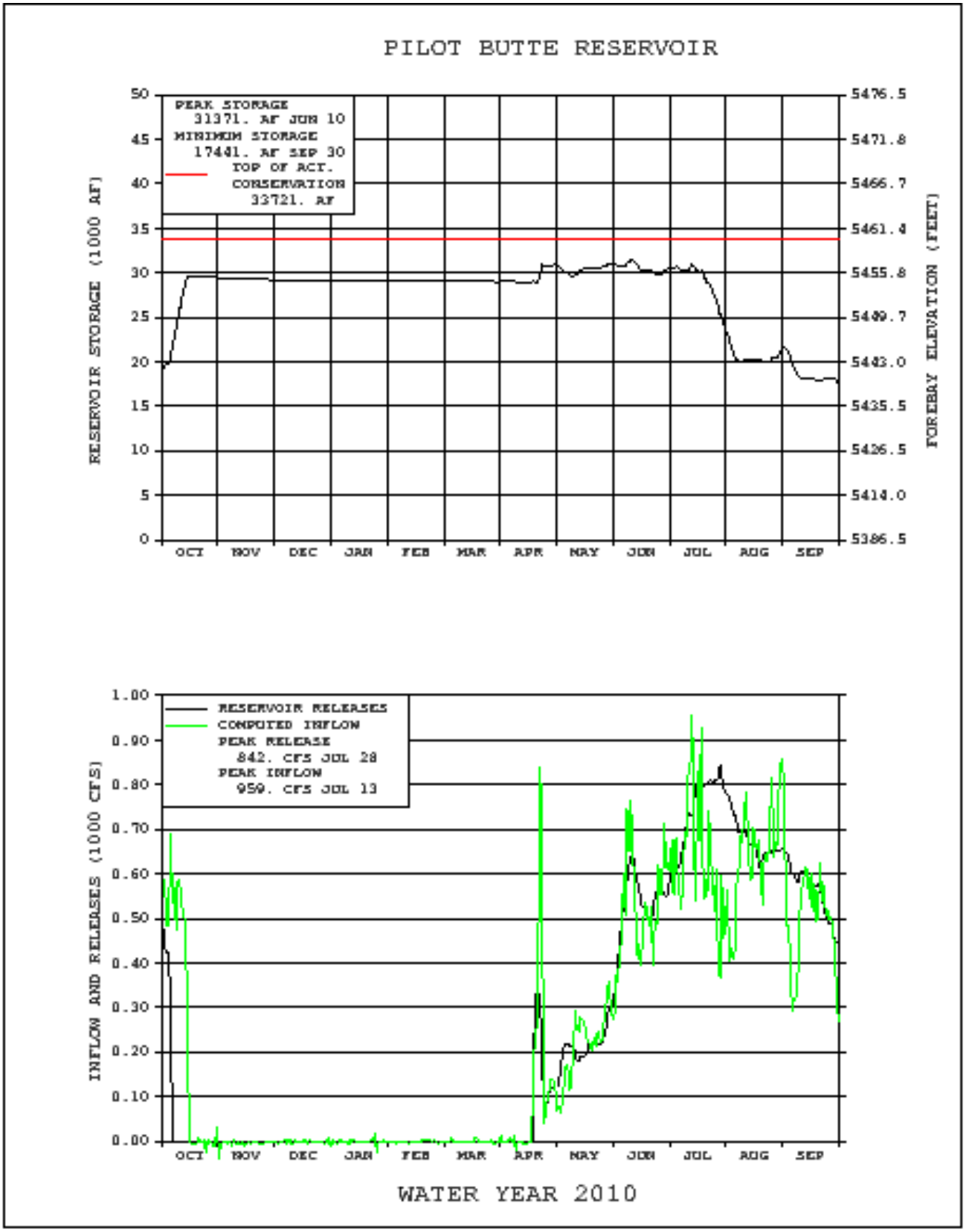
STORAGE-ELEVATION DATA	ELEVATION (FEET)	STORAGE (AF)	DATE
BEGINNING OF YEAR	5441.73	19,101	OCT 01, 2009
END OF YEAR	5439.28	17,441	SEP 30, 2010
ANNUAL LOW	5439.28	17,441	SEP 30, 2010
HISTORIC LOW	5409.80	3,748	DEC 01, 2006
ANNUAL HIGH	5457.35	31,371	JUN 10, 2010
HISTORIC HIGH	5460.60	37,465	APR 20, 1988

INFLOW-OUTFLOW DATA	INFLOW	DATE	OUTFLOW	DATE
ANNUAL TOTAL (AF)	171,867	OCT 09-SEP 10	173,527	OCT 09-SEP 10
DAILY PEAK (cfs)	959	JUL 13, 2010	842	JUL 28, 2010
DAILY MINIMUM (cfs)	0	WINTER MONTHS	0	WINTER MONTHS
PEAK SPILLWAY FLOW (cfs)			0	
TOTAL SPILLWAY FLOW (AF)			0	

	INFLOW*		OUTFLOW		CONTENT	
MONTH	KAF	% of Avg**	KAF	% of Avg**	KAF	% of Avg**
OCTOBER	14.4	134	4.1	193	29.4	113
NOVEMBER	-0.2	N/A	0.0	N/A	29.2	108
DECEMBER	-0.1	N/A	0.0	N/A	29.1	107
JANUARY	-0.1	N/A	0.0	N/A	29.0	106
FEBRUARY	-0.0	N/A	0.0	N/A	29.0	106
MARCH	-0.0	N/A	0.0	N/A	29.0	100
APRIL	6.3	85	4.4	75	30.9	101
MAY	13.2	55	13.1	47	31.0	115
JUNE	31.1	82	31.6	91	30.5	102
JULY	38.7	93	45.6	99	23.6	92
AUGUST	39.6	123	41.6	114	21.6	101
SEPTEMBER	29.1	124	33.3	125	17.4	96
ANNUAL	171.9	95	173.5	97		

* Negative values are the result of calculated inflow based on reservoir release and change in reservoir content.
** Average for the 1980-2009 period.

FIGURE WYG2


PILOT BUTTE RESERVOIR
PEAK STORAGE
31371. AF JUN 10
MINIMUM STORAGE
17441. AF SEP 30
TOP OF ACT.
CONSERVATION
33721. AF
RESERVOIR STORAGE (1000 AF)
FOREBAY ELEVATION (FEET)
50
45
40
35
30
25
20
15
10
5
0
5476.5
5471.8
5466.7
5461.4
5455.8
5449.7
5443.0
5435.5
5426.5
5414.0
5386.5
OCT
NOV
DEC
JAN
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP
RESERVOIR RELEASES
COMPUTED INFLOW
PEAK RELEASE
842. CFS JUL 28
PEAK INFLOW
959. CFS JUL 13
INFLOW AND RELEASES (1000 CFS)
1.00
0.90
0.80
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
OCT
NOV
DEC
JAN
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP
WATER YEAR 2010

Boysen Reservoir and Powerplant

Boysen Reservoir (P-S MBP) is located on the Wind River above Thermopolis, Wyoming. The dam and reservoir were built for flood control, power generation, irrigation, recreation, and fish and wildlife. Boysen Reservoir has a total capacity of 892,226 AF. Of this amount, 219,181 AF is allocated for inactive and dead storage, 522,413 AF for active conservation storage, and 150,632 AF for exclusive flood control storage. Of the amount allocated for active conservation, 144,229 AF is specifically allocated for joint-use flood control storage. All of the joint-use space is located between elevation 4717.00 feet and elevation 4725.00 feet, which is the top of the spillway gates when closed. The exclusive flood control space is located between elevation 4725.00 feet and elevation 4732.20 feet. When the reservoir rises above elevation 4724.50 feet, the spillway gates must be partially opened to maintain one half (½) foot of the gates above the water to prevent over-topping of the gates. When all flood control space is filled, releases cannot be controlled to less than 14,000 cfs.

Irrigation water is provided from the reservoir for several units, both upstream and downstream of Boysen Dam. Water is furnished downstream to about 7,500 acres in the Hanover-Bluff Unit (P-S MBP) and 3,400 acres on the Lucerne Canal in the Owl Creek Unit (P-S MBP). Supplemental water is also furnished to other irrigation districts and to a number of individual water users below the Dam. The Bighorn Canal Irrigation District and Hanover Irrigation District receive water under long term contracts with Reclamation. Depending on availability, water is also provided to Bluff Irrigation District, Kirby Ditch Company, Lower Hanover Canal Association, Bighorn Canal Irrigation District, and Hanover Irrigation District utilizing temporary water service contracts.

Water year 2010 began with 659,577 AF of water stored in Boysen Reservoir, which was 110 percent of the 30 year average. The corresponding reservoir elevation of 4720.63 feet was 4.37 feet below the top of the joint use pool. The winter release was set on September 25, 2009, when the release from the dam was reduced to 900 cfs. Precipitation in the Boysen watershed was above the 30 year average during the October through December period while inflow to the reservoir was right at the 30 year average in October and November and 81 percent of average in December. Releases were maintained at 900 cfs and the reservoir level dropped 1.45 feet to 4719.18 feet at the end of December, with corresponding reservoir storage of 634,008 AF.

Forecasts of April-July snowmelt runoff were prepared at the beginning of each month beginning in January and continuing through June. On January 1 the snowpack in the mountains above Boysen was 78 percent of average and the forecast indicated approximately 450,000 AF of water, 81 percent of average, would enter Boysen Reservoir during the April-July snowmelt runoff period. January inflow averaged about 500 cfs and with 900 cfs being released, reservoir storage fell to 609,056 AF on January 31.

Precipitation during January was close to average at lower elevations but the mountains received less than half of normal January precipitation and the snowpack decreased eight percent during the month to 70 percent of average on February 1. As a result of the declining conditions, the February 1 snowmelt runoff forecast was reduced by 50,000 AF to 400,000 AF, which was 72 percent of average.

During February the snowpack continued to fall further from average and the reservoir level dropped steadily, prompting a reduction in the release from 900 cfs to 800 cfs to conserve storage in the reservoir. The release was further reduced to 700 cfs on February 24 at the request of the Wyoming Game and Fish Department, conserving that water for use later in the spring to provide a flushing flow below Boysen Dam. At the end of February, Boysen Reservoir held 590,717 AF of water at elevation 4716.59 feet.

February precipitation was about 110 percent of average at low elevation weather stations but once again, precipitation in the mountains was less than half of average with temperatures in the Wind River basin averaging about three degrees colder than normal. The snowpack lost another five percent during February, when compared to average and the March 1 forecast of April-July snowmelt runoff was reduced to 350,000 AF. Based on the March forecast, Boysen Reservoir was projected to reach a maximum elevation of about 4722 feet at the end of June. This was about three feet below the top of the joint use pool. Frequent storms moved through the Wind River basin in March and the snowpack gradually increased during the month. March precipitation was above average, with slightly above average inflow.

The release from Boysen remained at 700 cfs until March 30 when releases were increased to provide the flushing flow requested by the Wyoming Game and Fish Department. Flushing flows are designed to simulate high runoff events that occurred in the river prior to flows being controlled by the dam. The rapidly increasing flows flush the fine sediment from the spawning gravels in the river, improving the spawning habitat for trout. The flushing flow began early on the morning of March 30 when releases were increased from 700 cfs to 3,000 cfs, with another increase to 5,000 cfs occurring five hours later. The 5,000 cfs release was maintained for ten hours and then gradually reduced back to 700 cfs. During the flushing flow, approximately 6,500 AF of water was released above the 700 cfs winter release. At the end of March, Boysen reservoir held 594,760 AF of water at elevation 4716.84 feet. The snowpack increased 12 percent through the month to 77 percent of average on April 1. With improving snow conditions going into April, the forecast prepared on April 1 was increased to 400,000 AF, which was 72 percent of average. April precipitation was well above average in the Wind River basin and temperatures were right at average. Releases above the 700 cfs winter release were required to meet irrigation demands beginning on April 19 and additional increases brought the release to 935 cfs by the end of the month. April inflow averaged about 1,125 cfs and the reservoir level rose 1.28 feet over the month to elevation 4718.12 feet.

The snowpack on May 1 was 91 percent of average, a 14 percent gain during April, and the May forecast of April-July snowmelt runoff increased to 570,000 AF. With conditions improving rapidly, releases from the dam were increased above irrigation demand on May 3 and reached powerplant capacity on May 6. Storms continued to bring moisture to the basin and temperatures that were well below normal held the snowpack in the mountains. The snowpack continued to build into mid May with a storm on May 11 and 12 dropping over three feet of snow in the Little Wind River drainage. The snowpack peaked almost a month later than normal and on May 15 releases in excess of powerplant capacity were initiated through the outlet works at the dam. Additional releases beginning on May 17 required opening the spillway gates and by the end of May, Boysen outflow was above 5,000 cfs. Inflow was about 130 percent of average during May, averaging about 2,540 cfs and the reservoir level fell to 4715.83 feet on May 31.

Mountain snowpack, especially in the Little Wind River drainage, remained high through May due to well below normal temperatures and above average precipitation. As high pressure entered the Wind River Basin in early June, temperatures at elevations above 9,000 feet rose into the 50's with nighttime temperatures remaining well above freezing. This resulted in a rapid snowmelt at higher elevations and a rapid rise in tributaries to the Wind River. The Little Wind River rose above flood stage on June 6 and peaked in the early morning of June 9 at 11.91 feet, which was almost 4 feet above flood stage and 1.06 feet higher than the highest crest of record. Inflow to Boysen peaked on June 9 at 16,001 cfs, with inflows above 11,000 cfs from June 7 through June 13. The total inflow for June of 502,767 AF was 201 percent of average. Spillway releases were increased to control the rate of fill of the reservoir and the outflow from the dam reached a maximum of 7,309 cfs on June 13. Reservoir inflow remained above 5,000 cfs through the Fourth of July while releases were gradually reduced beginning in mid-June to allow the reservoir to fill. Boysen Reservoir reached a maximum elevation of 4724.70 feet on July 4 as runoff was ending and inflows were in decline. Releases were reduced accordingly and the spillway gates were closed on July 15. Further reductions were made through the month, with the outflow cut to 1,500 cfs on July 20. Releases were gradually reduced during August and September, reaching the planned winter release of 800 cfs on September 21.

Actual inflow for the April-July period totaled 860,845 AF, which was 156 percent of average. Total inflow to Boysen during water year 2009 was 1,193,189 AF, 128 percent of average. The reservoir ended the water year at 4719.48 feet with a content of 639,219 AF. This was 107 percent of the average end of September content and 1.15 feet lower than at the end of September of 2009. The peak inflow for the year of 16,001 cfs occurred on June 9 with the maximum release of 7,309 cfs being made on June 13. During water year 2010, Boysen Powerplant generated 74,982,000 kWh of electricity, about 113 percent of average and 7,574,000 kWh more than was generated in 2009. Of the 1,213,547 AF of water released from Boysen in water year 2010, 852,982 AF was discharged through the powerplant and 360,565 AF bypassed the powerplant.

Important Events - 2010

September 25, 2009: Release was set at 900 cfs as irrigation demand fell below the planned winter release of 900 cfs.

November 13, 2009: Boysen Reservoir fall water information meeting was held in Worland to discuss water year 2009 operations, expected 2010 operation, and the winter release.

March 25, 2010: Boysen Reservoir spring water information meeting was held in Worland to discuss the water supply and proposed operation of Boysen Reservoir in 2010.

March 30 – March 31, 2010: Reservoir releases were adjusted as requested by Wyoming Game and Fish to provide a flushing flow in the river below Boysen Dam.

April 19, 2010: The release from the Dam was increased above the winter release to meet irrigation demands.

May 3, 2010: The release from the Dam was increased above irrigation demand to begin evacuating storage in anticipation of spring runoff.

May 12 – July 15, 2010: Releases through the spillway were made to control the reservoir level.

July 4, 2010: Boysen Reservoir reached a maximum elevation for the water year of 4724.70 feet.

September 21, 2010: Release was set at 800 cfs as irrigation demand fell below the planned winter release of 800 cfs.

Additional hydrologic and statistical information pertaining to the operation of Boysen Reservoir can be found in Table WYT6 and Figure WYG3.

TABLE WYT6
HYDROLOGIC DATA FOR WATER YEAR 2010
BOYSEN RESERVOIR

RESERVOIR ALLOCATIONS	ELEVATION (FEET)	TOTAL RESERVOIR STORAGE (AF)	STORAGE ALLOCATION (AF)
TOP OF INACTIVE AND DEAD	4685.00	219,181	219,181
TOP OF ACTIVE CONSERVATION	4717.00	597,365	378,184
TOP OF JOINT USE	4725.00	741,594	144,229
TOP OF EXCLUSIVE FLOOD CONTROL	4732.20	892,226	150,632

STORAGE-ELEVATION DATA	ELEVATION (FEET)	STORAGE (AF)	DATE
BEGINNING OF YEAR	4720.63	659,577	OCT 01, 2009
END OF YEAR	4719.48	639,219	SEP 30, 2010
ANNUAL LOW	4715.34	570,938	JUN 04, 2010
HISTORIC LOW ELEVATION *	4684.18		MAR 18, 1956
HISTORIC LOW CONTENT *		235,737	SEP 24, 2002
ANNUAL HIGH	4724.70	735,735	JUL 04, 2010
HISTORIC HIGH	4730.83	922,406	JUL 06, 1967

*Because storage space in a reservoir is lost as sediment is trapped behind the dam, reservoirs are resurveyed periodically to determine actual capacity. Based on the 1994 resurvey of Boysen Reservoir, the historic low content of 235,737 AF occurred at an elevation that was 2.69 feet higher than the historic low elevation.

INFLOW-OUTFLOW DATA	INFLOW	DATE	OUTFLOW	DATE
ANNUAL TOTAL (AF)	1,193,189	OCT 09-SEP 10	1,213,547*	OCT 09-SEP 10
DAILY PEAK (cfs)	16,001	JUN 09, 2010	7,309	JUN 13, 2010
DAILY MINIMUM (cfs)	23	DEC 26, 2009	698	APR 12, 2010
PEAK SPILLWAY FLOW (cfs)				
TOTAL SPILLWAY FLOW (AF)				

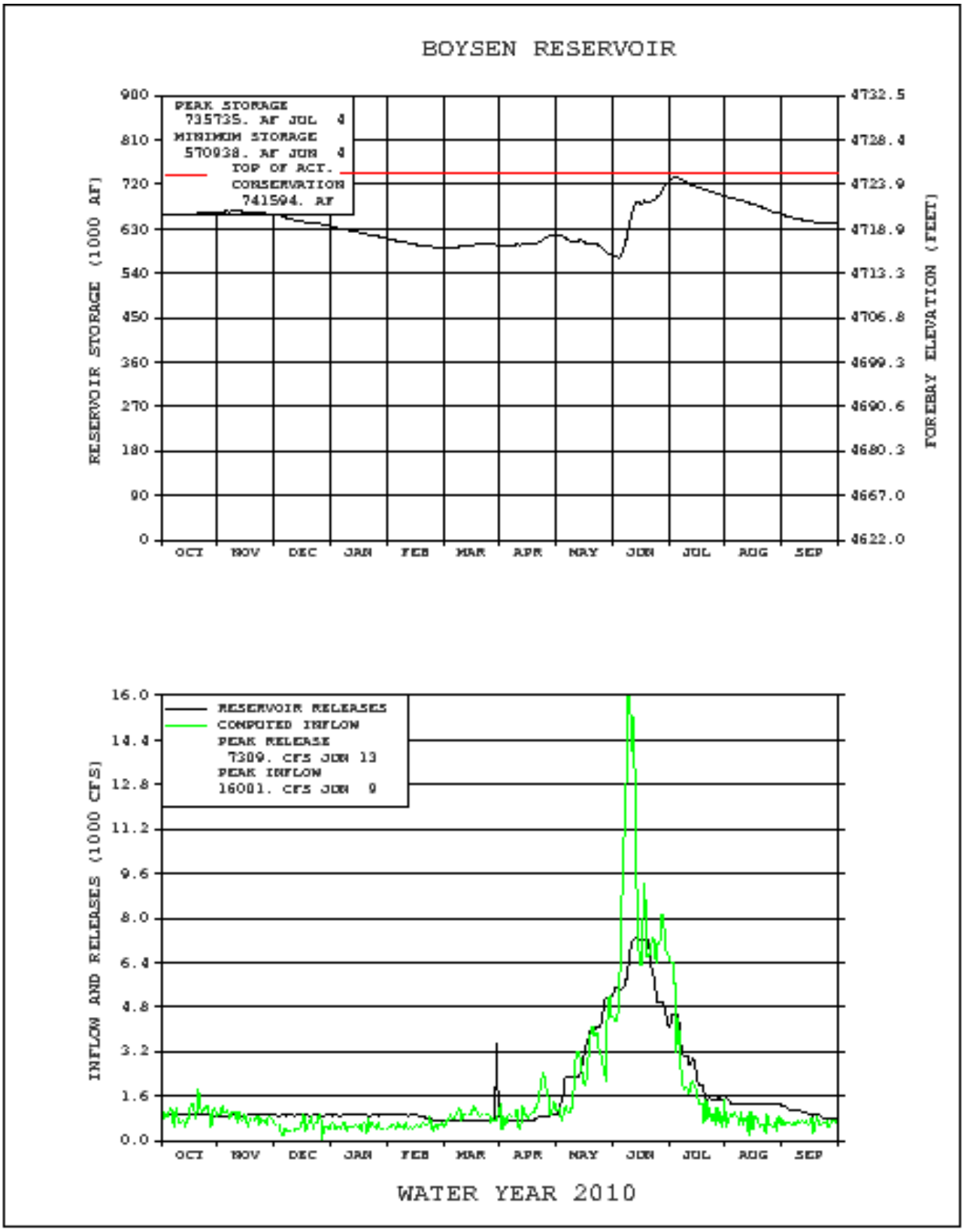
* Of the 1,213,547 AF of water released from Boysen Reservoir, 360,565 AF bypassed the powerplant.

	INFLOW		OUTFLOW		CONTENT	
MONTH	KAF	% of Avg*	KAF	% of Avg*	KAF	% of Avg*
OCTOBER	59.6	101	55.7	91	663.5	112
NOVEMBER	49.0	101	53.6	99	658.9	112
DECEMBER	30.7	81	55.6	100	634.0	111
JANUARY	30.7	84	55.7	106	609.1	110
FEBRUARY	29.1	78	47.4	99	590.7	108
MARCH	53.9	104	49.9	84	594.8	111
APRIL	66.9	139	45.8	72	615.9	118
MAY	156.1	127	193.4	208	578.6	105
JUNE	502.8	201	360.9	252	720.5	109
JULY	135.1	102	158.6	113	697.0	107
AUGUST	42.0	73	80.6	90	658.3	106
SEPTEMBER	37.3	71	56.5	79	639.2	106
ANNUAL	1,193.2	128	1,213.5	130		

APRIL - JULY INFLOW (AF)	
ACTUAL	AVERAGE
860,845	553,400

*Average for the 1980-2009 period

FIGURE WYG3


BOYSEN RESERVOIR
PEAK STORAGE
735735. AF JUL 4
MINIMUM STORAGE
570938. AF JUN 4
TOP OF ACT.
CONSERVATION
741594. AF
RESERVOIR STORAGE (1000 AF)
FOREBAY ELEVATION (FEET)
900
810
720
630
540
450
360
270
180
90
0
4732.5
4728.4
4723.9
4718.9
4713.3
4706.8
4699.3
4690.6
4680.3
4667.0
4622.0
OCT NOV DEC JAN FEB MAR APR MAY JUN JUL AUG SEP
RESERVOIR RELEASES
COMPUTED INFLOW
PEAK RELEASE
7309. CFS JUN 13
PEAK INFLOW
16001. CFS JUN 9
INFLOW AND RELEASES (1000 CFS)
16.0
14.4
12.8
11.2
9.6
8.0
6.4
4.8
3.2
1.6
0.0
OCT NOV DEC JAN FEB MAR APR MAY JUN JUL AUG SEP
WATER YEAR 2010

Anchor Reservoir

Anchor Reservoir (P-S MBP) is located on the South Fork of Owl Creek, a tributary of the Bighorn River near Thermopolis, Wyoming. It has a total storage capacity of 17,228 AF, of which 17,160 AF is active storage. It was constructed to furnish a supplemental irrigation supply for the Owl Creek Unit (P-S MBP). The dam was completed in November 1960. However, several major sinkholes developed in the lower portion of the reservoir after it began to fill, and corrective work to plug the sinkholes has not been successful. Two dikes, in service since 1979, partition off the portions of the reservoir with high seepage losses. The top of the dikes are at elevation 6415.00 feet, however, when the reservoir rises above elevation 6412.80 feet, water flows through a notch in one of the dikes into the sinkhole area. The reservoir is operated not to exceed elevation 6412.80 feet. Operation and maintenance of Anchor Dam is performed by contract with Owl Creek Irrigation District. Reclamation requires notification from the irrigation district any time the reservoir level is expected to exceed elevation 6400.00 feet. Operation above 6400.00 feet will be directed by Wyoming Area Office (WYAO) staff to avoid overtopping of the dikes.

Storage in Anchor Reservoir at the beginning of water year 2010 was 325 AF at elevation 6357.34 feet. The reservoir level remained fairly stable through the winter, gradually falling to 263 AF at elevation 6355.30 feet at the end of March. Inflows began to increase for a period in the last half of April but colder weather slowed things down until mid-May when some snowmelt began to enter the reservoir. May was colder than normal and inflow was below average as well, but storage increased to 2,345 AF by the end of May. As more seasonable temperatures returned in early June, inflow to Anchor rose quickly and the peak for the year of 536 cfs occurred on June 7. Inflow remained near or above 100 cfs for all of June and with the reservoir elevation rising above 6400.00 feet on June 6 releases were increased on June 8 to slow the rate at which the reservoir was filling. As the reservoir filled, Bureau of Reclamation and Owl Creek Irrigation District staff closely monitored the inflow and was in communication to discuss releases from the dam in order to store as much water as possible without exceeding elevation 6412.80 feet. The reservoir reached its maximum content for the year of 6,970 AF on June 30 at elevation 6411.39 feet. This was 1.41 feet below the elevation where water would begin to flow into the sinkhole area. Inflow dropped off quickly in July and with increasing demands, storage in the reservoir fell to 2,633 AF by the end of the month. Releases for irrigation drafted Anchor steadily during August and September and by the end of the water year the reservoir had been lowered to 6357.80 feet with 339 AF of storage. The maximum daily release for the year of 270 cfs was on June 12.

Hydrologic and statistical data pertaining to Anchor Reservoir operations during 2010 can be found in Table WYT7 and Figure WYG4. The negative inflows displayed in Figure WYG4 are the result of calculated inflow based on reservoir release and change in reservoir content. During some periods, evaporation and seepage from the reservoir could exceed inflow.

TABLE WYT7
HYDROLOGIC DATA FOR WATER YEAR 2010
ANCHOR RESERVOIR

RESERVOIR ALLOCATIONS	ELEVATION (FEET)	TOTAL RESERVOIR STORAGE (AF)	STORAGE ALLOCATION (AF)
TOP OF INACTIVE AND DEAD	6343.75	68	68
TOP OF ACTIVE CONSERVATION*	6441.00	17,228	17,160

* District operation has been restricted to elevation 6400.00 feet or less to prevent damage to the dikes and to minimize the chance of creating new sinkholes. Operations above elevation 6400.00 feet are directed by Reclamation.

STORAGE-ELEVATION DATA	ELEVATION (FEET)	STORAGE (AF)	DATE
BEGINNING OF YEAR	6357.34	325	OCT 01,2009
END OF YEAR	6357.80	339	SEP 30, 2010
ANNUAL LOW	6355.20	260	DEC 16, 2009
HISTORIC LOW			
ANNUAL HIGH	6411.39	6,970	JUN 30, 2010
HISTORIC HIGH	6418.52	9,252	JUL 03, 1967

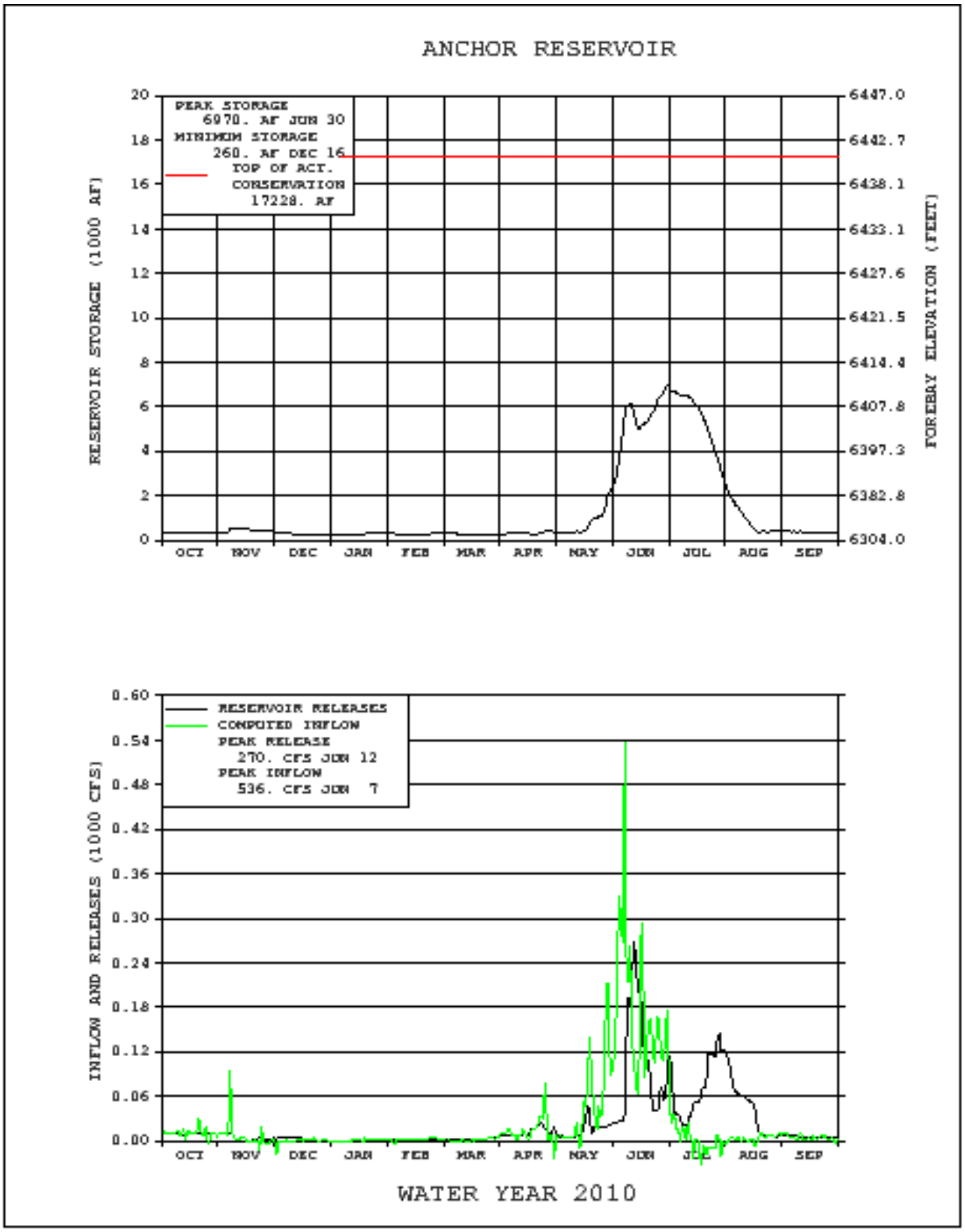
INFLOW-OUTFLOW DATA	INFLOW	DATE	OUTFLOW *	DATE
ANNUAL TOTAL (AF)	16,171	OCT 09-SEP 10	16,157	OCT 09-SEP 10
DAILY PEAK (cfs)	536	JUN 7, 2010	270	JUN 12, 2010
DAILY MINIMUM (cfs)	0	WINTER MONTHS	0	WINTER MONTHS
PEAK SPILLWAY FLOW (cfs)			0	
TOTAL SPILLWAY FLOW (AF)			0	

* Outflow is water released from the Dam to Owl Creek. When the reservoir level rises above approximately 6412.80 feet, water flows through a notch in one of the dikes into the sinkhole area. This water is neither measured nor accounted for. In 2010, no water flowed over the notch in the dike.

	INFLOW		OUTFLOW*		CONTENT	
MONTH	KAF	% of Avg*	KAF	% of Avg*	KAF	% of Avg*
OCTOBER	0.6	100	0.6	94	0.3	122
NOVEMBER	0.3	99	0.2	75	0.4	186
DECEMBER	0.0	0	0.1	60	0.3	128
JANUARY	0.1	83	0.1	34	0.3	154
FEBRUARY	0.1	73	0.1	89	0.3	103
MARCH	0.1	23	0.1	53	0.3	83
APRIL	0.8	116	0.7	145	0.3	68
MAY	2.9	72	0.9	29	2.3	147
JUNE	10.7	162	6.1	124	7.0	211
JULY	0.2	10	4.6	138	2.6	125
AUGUST	0.2	35	2.5	144	0.4	64
SEPTEMBER	0.2	42	0.3	37	0.4	105
ANNUAL	16.2	100	16.2	103		

*Average is for the 1991-2009 period. This period was used because of the availability of data at Anchor Reservoir.

FIGURE WYG4


ANCHOR RESERVOIR
PEAK STORAGE
6970. AF JUN 30
MINIMUM STORAGE
260. AF DEC 16
TOP OF ACT.
CONSERVATION
17228. AF
RESERVOIR STORAGE (1000 AF)
FOREBAY ELEVATION (FEET)
20
18
16
14
12
10
8
6
4
2
0
6447.0
6442.7
6438.1
6433.1
6427.6
6421.5
6414.4
6407.8
6397.3
6382.8
6304.0
OCT
NOV
DEC
JAN
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP
RESERVOIR RELEASES
COMPUTED INFLOW
PEAK RELEASE
270. CFS JUN 12
PEAK INFLOW
536. CFS JUN 7
INFLOW AND RELEASES (1000 CFS)
0.60
0.54
0.48
0.42
0.36
0.30
0.24
0.18
0.12
0.06
0.00
OCT
NOV
DEC
JAN
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP
WATER YEAR 2010

Shoshone Project & Buffalo Bill Unit

The primary features of the original Shoshone Project included Buffalo Bill Dam and Reservoir, Shoshone and Heart Mountain Powerplants, and the canal and lateral systems for the Willwood, Frannie, Garland, and Heart Mountain Divisions. In 1982, The Buffalo Bill Dam and Reservoir Modifications, Shoshone Project, Wyoming, was authorized as the Buffalo Bill Unit (P-S MBP). The principal modifications to Buffalo Bill Dam included raising the height of the Dam by 25 feet, reconstructing the Shoshone Powerplant, construction of the Buffalo Bill Powerplant, construction of the Spirit Mountain Energy Dissipation Structure, pressurizing a portion of the Shoshone Canyon Conduit, enlarging and gating the spillway, constructing a visitor's center, and constructing the North Fork, South Fork, and Diamond Creek Dikes. The North and South Fork dust abatement dikes were designed to impound water in areas of the enlarged reservoir that would be dry during periods when the reservoir elevation is low, thereby reducing the dust producing area of the reservoir. The Diamond Creek protective dike prevents the enlarged reservoir from inundating Irma Flats.

Controlled releases are made from Buffalo Bill Reservoir at four points: (1) Shoshone Canyon Conduit, (2) Shoshone Powerplant, (3) the gated spillway, and (4) two river outlets (jetflow valve and 4X5 high pressure gates). Water for the Willwood, Frannie, and Garland Divisions of the Shoshone Project is diverted from the Shoshone River below Buffalo Bill Reservoir. The Heart Mountain Division is irrigated by water released at the dam through a high-level outlet to the Shoshone Canyon Conduit and Heart Mountain Canal. Irrigation releases for the project land along the Shoshone River are made through the Shoshone Powerplant, the river outlets, or through the Shoshone Canyon Conduit and Buffalo Bill or Heart Mountain Powerplants. Project works presently serve about 93,000 acres in the four divisions.

The Heart Mountain Powerplant, Shoshone Project, with a nameplate capability of 6,000 kilowatts (kW) and maximum discharge capacity of 360 cfs, is located at the end of the Shoshone Canyon Conduit, which obtains its water from a high-level outlet, elevation 5233.00 feet, at Buffalo Bill Dam. The powerplant is located 3.5 miles below the dam and discharges into the Shoshone River. During the summer months, the water released through the powerplant is used to satisfy a portion of the irrigation demand of lands diverting directly from the river.

The Shoshone Powerplant, reconstructed as part of the Buffalo Bill Unit (P-S MBP), is located on the left bank of the Shoshone River at the toe of Buffalo Bill Dam and releases water directly into the Shoshone River. After 56 years of continuous use, the Shoshone Powerplant became obsolete because of safety problems beyond economical repair. On March 21, 1980, the original plant was taken out of service. In 1992 one of the three generating units was replaced with a new unit having a nameplate capability of 3,000 kW. In accordance with the Buffalo Bill Reservoir Enlargement Winter Release Operation Agreement, a flow of at least 100 cfs is released to the Shoshone River at the base of the dam at all times. This is normally achieved by the use of the Shoshone Powerplant. A maximum release of approximately 200 cfs can be made through the Shoshone Powerplant.

The Buffalo Bill Powerplant, Buffalo Bill Unit (P-S MBP), with a nameplate capability of 18,000 kW, is located about one mile downstream of Buffalo Bill Dam on the right bank of the Shoshone River. Water for generation at this powerplant is supplied through a portion of the Shoshone Canyon Conduit, which was pressurized as part of the Buffalo Bill modification. The maximum discharge capacity of the three units at the Buffalo Bill Powerplant is 930 cfs. The powerplant first generated power on July 15, 1992.

Spirit Mountain Powerplant, Buffalo Bill Unit (P-S MBP), with a nameplate capability of 4,500 kW and discharge capacity of 560 cfs, is a newly constructed energy dissipator powerplant located about one mile downstream of Buffalo Bill Dam on the right side of the Shoshone River. Water released through the Shoshone Canyon Conduit for Heart Mountain Canal or Heart Mountain Powerplant must be routed through the Spirit Mountain Powerplant or through associated sleeve valves to dissipate energy in the transition from the pressurized portion of the Shoshone Canyon Conduit to the free flow portion of the conduit. The discharge from the powerplant must be carried away from the plant by use of the free-flow conduit and operation of the powerplant depends on the availability of the conduit to carry discharged water.

Buffalo Bill Dam and Reservoir, located on the Shoshone River above Cody, Wyoming, is a multipurpose facility that provides water for domestic, irrigation, municipal, fish and wildlife, power, and recreational use. It also provides a small amount of incidental flood control, although no storage space is specifically reserved for this purpose. The total storage capacity of the reservoir is 646,565 AF at elevation 5393.50 feet, the top of the active conservation pool.

Storage in Buffalo Bill Reservoir at the beginning of water year 2010 was 486,016 AF of water at elevation 5372.51 feet. Irrigation releases to the Heart Mountain Canal continued until October 7, 2009. The need for irrigation releases to the Shoshone River also ended in early October, however, releases to the river were maintained at 725 cfs into early November as the reservoir was lowered to facilitate work in the North Fork of the Shoshone River in the area of the North Fork Dike inlet structure and to provide a lower reservoir level going into the winter. By maintaining the reservoir elevation below 5370 feet during the winter months, problems associated with ice jams on the South Fork during the winter are reduced significantly. On November 12 the release to the Shoshone River was reduced to 350 cfs in accordance with the Buffalo Bill Reservoir Enlargement Winter Release Operation Agreement. Inflows during the October through December period were near average but by the end of December storage in the reservoir had decreased to 448,252 AF. Precipitation was 92 percent of average during the period and the snowpack in the Buffalo Bill watershed stood at 69 percent of average on January 1.

Forecasts of the April-July snowmelt runoff are made each month beginning in January and continuing through June for Buffalo Bill Reservoir. Conditions on January 1 indicated that 550,000 AF of runoff could be expected to flow into Buffalo Bill Reservoir during the April through July period, which was 83 percent of the 30 year average. January inflow to Buffalo Bill was slightly below average and at the end of the month storage in the reservoir stood at 440,800 AF of water. Precipitation in the mountains of the Buffalo Bill watershed was below average and the snowpack dropped to 63 percent of average on February 1, resulting in the February 1 snowmelt runoff forecast being reduced to 475,000 AF.

The snowpack remained near 60 percent of average during February, March, and April, and forecasts prepared on March 1, April 1, and May 1 all indicated the April through July inflow would be 450,000 AF, which was 68 percent of average. Inflow during the February through April period was about 85 percent of average while the outflow was maintained at 350 cfs until April 14 when increased releases for irrigation began. Storage in Buffalo Bill at the end of April was 413,497 AF at elevation 5362.06 feet. May was much colder than normal with above average precipitation, allowing the snowpack to build during the first half of the month. Little snow melt runoff occurred during the first half of May and the inflow to Buffalo Bill was only 46 percent of average, which resulted in the reservoir being drawn down to 387,276 AF at the end of May. The snowpack made a substantial gain during May as it built at a time it would normally be declining, and stood at 90 percent of average on June 1. With the improved snowpack conditions, the June 1 forecast was increased to 580,000 AF, 88 percent of average.

With night time temperatures in the mountains remaining above 32 degrees, rain, and rain on the snowpack, the runoff got into high gear during the first week of June as inflow to Buffalo Bill rose from about 2,100 cfs on June 1 to over 10,600 cfs on June 5 and peaked at 13,419 cfs on June 7. Releases in excess of demand and powerplant capacity were initiated on June 14 when the 4X5 gates were opened to control the rate at which the reservoir filled. Precipitation during June was 150 percent of average and reservoir inflow was 130 percent of normal. Releases through the 4X5 gates were adjusted as needed during the month to control the reservoir level and on June 30 Buffalo Bill Reservoir held 603,139 AF of water at elevation 5388.06 feet. Provisional data from the U S Geological Survey shows that the inflow on the North Fork of the Shoshone River peaked at 8,540 cfs on June 7 and the peak on the South Fork of 4,770 cfs also occurred on June 7. Additional releases, beginning on July 1, were made by initiating a release through the Buffalo Bill spillway and the maximum average daily release to the Shoshone River of 5,450 cfs occurred on July 2. Releases were rapidly reduced beginning on July 3 and the spillway gates were closed on July 6. By July 14, the release to the river was down to 1,300 cfs and the 4X5 gates were closed. Control of the release from the dam was turned over to the Shoshone Irrigation District on July 16 and the release to the Shoshone River was limited to meeting irrigation demand for the remainder of the summer.

Storage in Buffalo Bill peaked for the year on July 20 at 619,351 AF, which was 27,214 AF below the top of the conservation pool. The maximum water surface elevation of 5390.12 feet was 3.38 feet below the full level. Inflow during August fell to 95 percent of average and September inflow was 79 percent of average. Releases began to exceed inflow on July 21 and the reservoir level fell almost 18 feet by the end of September. At the end of the water year Buffalo Bill Reservoir held 485,526 AF of water at elevation 5372.44 feet. The end of September content was 110 percent of the 1994-2009 average for the enlarged reservoir. The total inflow to Buffalo Bill during the April through July runoff period was 674,195 AF, which was 102 percent of average. The total water year inflow of 845,177 AF was 101 percent of average.

Total energy generated at all powerplants that directly receive water out of Buffalo Bill Reservoir totaled 124,412,000 kWh in 2010. Of this total amount, Heart Mountain Powerplant generated 18,925,000 kWh, Buffalo Bill Powerplant generated 66,709,000 kWh, Shoshone Powerplant generated 22,845,000 kWh and Spirit Mountain Powerplant generated 15,933,000 kWh.

The powerplants used 652,024 AF of water to generate this amount of energy and 77 percent of the total water released from Buffalo Bill Reservoir during water year 2010 was used for generation. About 27 percent, or 226,512 AF of the total water released from Buffalo Bill Reservoir, was released to the Heart Mountain Canal for irrigation purposes.

Important Events - 2010

October 7, 2009: Irrigation diversions to the Heart Mountain Canal were discontinued for the 2009 irrigation season.

November 12, 2009: Releases to the Shoshone River were reduced to the winter release of 350 cfs.

March 26, 2010: Buffalo Bill Reservoir Public Information Meeting was held in Powell to discuss water year 2009 operation and expected 2010 operation.

April 14, 2010: Irrigation releases to the Heart Mountain Canal were initiated for the 2010 irrigation season.

April 18, 2010: Releases from Buffalo Bill Reservoir were increased to meet downstream irrigation demand.

July 1, 2010 – July 6, 2010: Releases were made through the Buffalo Bill spillway to control the reservoir level.

July 20, 2010: Buffalo Bill Reservoir reached a m aximum elevation for the water year of 5390.12 feet.

Additional hydrologic and statistical information pertaining to the operations of Buffalo Bill Reservoir during water year 2010 can be found in Table WYT8 and Figure WYG5.

TABLE WYT8
HYDROLOGIC DATA FOR WATER YEAR 2010
BUFFALO BILL RESERVOIR

RESERVOIR ALLOCATIONS	ELEVATION (FEET)	TOTAL RESERVOIR STORAGE (AF)	STORAGE ALLOCATION (AF)
TOP OF INACTIVE AND DEAD	5259.60	41,748	41,748
TOP OF ACTIVE CONSERVATION	5393.50	646,565	604,817

STORAGE-ELEVATION DATA	ELEVATION (FEET)	STORAGE (AF)	DATE
BEGINNING OF YEAR	5372.51	486,016	OCT 01,2009
END OF YEAR	5372.44	485,526	SEP 30, 2010
ANNUAL LOW	5356.37	376,661	MAY 16, 2010
HISTORIC LOW*		19,080	JAN 31, 1941
ANNUAL HIGH	5390.12	619,351	JUL 20, 2010
HISTORIC HIGH	5393.51	646,647	JUL 30, 1996

* Prior to 1952 daily records are not available. End of month data was used to determine the historic low.

INFLOW-OUTFLOW DATA	INFLOW	DATE	OUTFLOW*	DATE
ANNUAL TOTAL (AF)	845,177	OCT 09-SEP 10	846,031	OCT 09-SEP 10
DAILY PEAK (cfs)	13,419	JUN 7, 2010	5,445	JUL 2, 2010
DAILY MINIMUM (cfs)	9	MAR 13, 2010	330	NOV 18, 2009
PEAK SPILLWAY FLOW (cfs)			3,173	JUL 2, 2010
TOTAL SPILLWAY FLOW (AF)			29,893	JUL 1-JUL 6, 2010

*Daily peak and minimum are releases to the river

	INFLOW		OUTFLOW		CONTENT	
MONTH	KAF	% of Avg*	KAF	% of Avg*	KAF	% of Avg*
OCTOBER	30.5	121	56.1	161	460.5	110
NOVEMBER	23.1	109	26.7	151	456.8	109
DECEMBER	13.5	86	22.0	129	448.3	107
JANUARY	14.3	97	21.8	135	440.8	105
FEBRUARY	11.1	85	19.6	123	432.3	104
MARCH	15.4	82	21.8	107	425.9	104
APRIL	34.9	84	47.4	89	413.5	106
MAY	73.8	46	100.0	89	387.3	87
JUNE	387.1	130	171.2	96	603.1	106
JULY	178.4	112	173.0	100	608.6	107
AUGUST	42.4	95	113.7	102	537.6	107
SEPTEMBER	20.7	79	72.8	91	485.5	110
ANNUAL	845.2	101	846.0	102		

APRIL - JULY INFLOW (AF)	
ACTUAL	AVERAGE
674,195	659,700

*Average for inflow and outflow is the 1980-2009 period. Because of the enlargement of Buffalo Bill Reservoir in 1992, the period of record on which average content is based is 1993-2009.

FIGURE WYG5

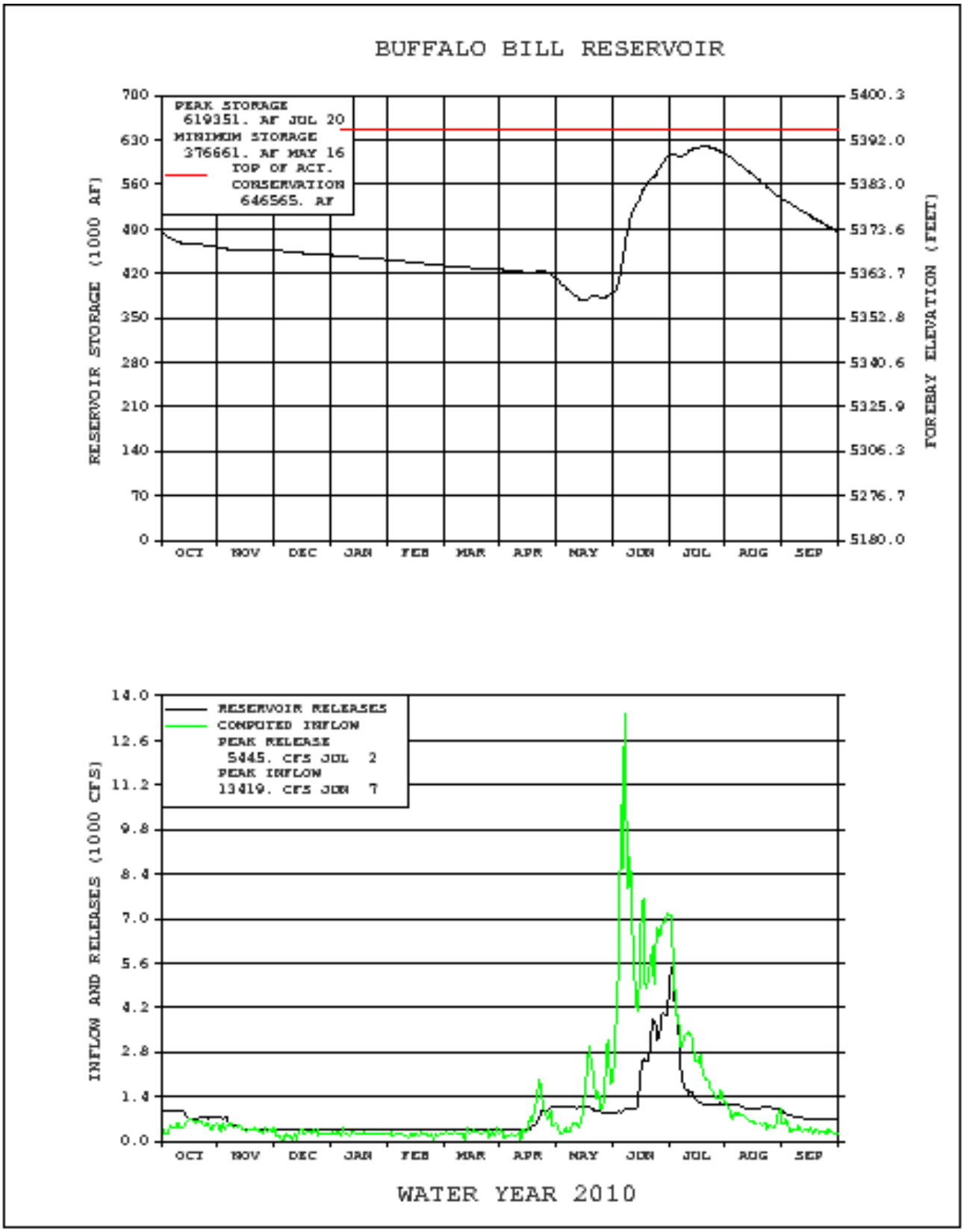

BUFFALO BILL RESERVOIR
PEAK STORAGE
619351. AF JUL 20
MINIMUM STORAGE
376661. AF MAY 16
TOP OF ACT.
CONSERVATION
646565. AF
RESERVOIR STORAGE (1000 AF)
FOREBAY ELEVATION (FEET)
700
630
560
490
420
350
280
210
140
70
0
5400.3
5392.0
5383.0
5373.6
5363.7
5352.8
5340.6
5325.9
5306.3
5276.7
5180.0
OCT
NOV
DEC
JAN
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP
RESERVOIR RELEASES
COMPUTED INFLOW
PEAK RELEASE
5445. CFS JUL 2
PEAK INFLOW
13419. CFS JUN 7
INFLOW AND RELEASES (1000 CFS)
14.0
12.6
11.2
9.8
8.4
7.0
5.6
4.2
2.8
1.4
0.0
WATER YEAR 2010

Table WYT9
WATER YEAR 2010 ACTUAL OUTAGES FOR WYOMING POWERPLANTS

Facilities	Description of Work	Outage Dates
BOYSEN		
Unit 1	Annual Maintenance	11/02/09 - 12/03/09
Unit 1	Hi-Pot Cables	01/20/10 - 01/25/10
Unit 2	Annual Maintenance	12/08/09 - 01/14/10
Unit 2	Hi-Pot Cables	01/19/10 - 01/20/10
PILOT BUTTE		
Unit 1	Unit in "Mothballed" status	06/01/09 - 09/30/10
Unit 2	Unit in "Mothballed" status	06/01/09 - 09/30/10
BUFFALO BILL		
Buffalo Bill Powerplant		
Unit 1	Annual Maintenance / Bad Unit Breaker	10/02/09 - 12/16/09
Unit 2	Bad Unit Breaker	10/01/09 - 10/02/09
Unit 2	Annual Maintenance	12/21/09 - 01/07/10
Unit 3	Annual Maintenance	01/19/10 - 01/29/10
Shoshone Powerplant		
Unit 3	Annual Maintenance	02/08/10 - 02/26/10
Heart Mountain Powerplant		
Unit 1	Transformer Maintenance	10/19/09 - 10/22/09
Unit 1	Annual Maintenance	03/01/10 - 03/25/10
Unit 1	Battery Ground Exciter	04/22/10 - 04/26/10
Unit 1	Switching KZ1A Clearance	09/27/10 - 09/29/10
Spirit Mountain Powerplant		
Unit 1	Annual Maintenance	10/19/09 - 10/29/09
Unit 1	Hi-Pot Test and Shoshone Canyon Conduit Repair	03/15/10 - 03/24/10
Unit 1	86 Relay Burned	04/08/10 - 04/13/10

SUMMARY OF RESERVOIR OPERATIONS FOR BENEFIT OF FISH AND WILDLIFE, ENVIRONMENT AND RECREATION

Bull Lake Reservoir

During the past several years, Midvale and Reclamation have entered into an annual agreement whereby Reclamation could store Boysen water in Bull Lake under any combination of four conditions set forth in the agreement. A similar agreement was approved for 2010. The Boysen water stored in Bull Lake allows Bull Lake to be maintained at a higher content and also provides a flow of 20 to 25 cfs in Bull Lake Creek below the dam as the Boysen water is released from Bull Lake through the winter months. On October 1, 2009, Bull Lake Reservoir held 79,758 AF of water. Of the 79,758 AF held in Bull Lake, 10,915 AF was Boysen water in Bull Lake. Inflow to Bull Lake was slightly greater than the release and the reservoir slowly rose through the winter. Inflow from snowmelt runoff began in mid-May and during the April-July period the inflow to Bull Lake was 107 percent of average. The reservoir reached a maximum elevation for the year of 5804.15 feet on July 13, which was 30.5 feet higher than the minimum elevation for the year of 5773.61 feet that occurred on September 30. At the end of water year 2010, the content of Bull Lake was 65,846 AF. At the beginning of water year 2011, there was 9,941 AF of Boysen storage water in Bull Lake. This water will be transferred back to Boysen during the winter months of water year 2011 to provide a winter flow in Bull Lake Creek.

Boysen Reservoir

Boysen Reservoir storage at the beginning of water year 2010 was 110 percent of average and 89 percent of capacity. Following the 2009 irrigation season, the release from Boysen Dam was set at approximately 900 cfs, where it remained until late February when releases were decreased to 800 cfs due to below average snowpack in the Boysen watershed. At the request of the Wyoming Game and Fish Department, another 100 cfs reduction was made in order to conserve water for use during a flushing flow. Flushing flows are designed to simulate high runoff events that occurred in the river prior to flows being controlled by the dam. The rapidly increasing flows flush the fine sediment from the spawning gravels in the river, improving the spawning habitat for trout. The flushing flow began early on the morning of March 30 when releases were increased from 700 cfs to 3,000 cfs, with another increase to 5,000 cfs occurring 5 hours later. The 5,000 cfs release was maintained for 10 hours and then gradually reduced back to 700 cfs. During the flushing flow, approximately 6,500 AF of water was released above the 700 cfs winter release. The month of April is normally when many species of fish spawn in the upper few feet of the reservoir. To insure a successful spawn, it is important to limit the amount of drawdown on the reservoir during April. In April of 2010, the inflow to Boysen exceeded the outflow by about 21,000 AF and the reservoir rose 1.28 feet during the month. The reservoir continued to rise during the first few days of May but as releases were made to make room for the expected runoff the lake level dropped 2.34 feet by the end of the month. The reservoir level was at 4715.95 feet going into the Memorial Day weekend, which was the same as at the beginning of the holiday weekend in 2009.

Buffalo Bill Reservoir

Following the 2009 irrigation season the release from Buffalo Bill Reservoir was set at approximately 350 cfs, based on winter release criteria contained in the Buffalo Bill Reservoir Enlargement Winter Release Operation Agreement. A winter release of 100 cfs, 150 cfs, 200 cfs, or 350 cfs, will be provided below Buffalo Bill Powerplant based on the total inflow to Buffalo Bill Reservoir during the previous water year and the amount of storage in the reservoir and in the State account on September 30. A release of 100 cfs will be maintained in the river below the dam at all times.

Reclamation continues to support the WGF Reservoir Research Branch in its efforts to assess fish population and species distribution in the enlarged reservoir through the use of hydro-acoustic technology and by providing WGF river access and an aluminum tube for planting fish in the Shoshone River off the deck of Buffalo Bill Powerplant.

At Buffalo Bill Reservoir, as the reservoir is drawn down, the lake bed is exposed to wind erosion which creates dust in the reservoir area and in the town of Cody, Wyoming. As a part of the enlargement of Buffalo Bill Reservoir, dust abatement dikes were built on the upper ends of the North and South Fork arms of the reservoir to hold water in areas that would become dry as the reservoir level decreased, thus reducing the area of dry lake bed. During the period from October 11, 2009, through June 7, 2010, the water surface elevation of Buffalo Bill Reservoir was below the top of the North Fork Dike (elevation 5370.00 feet). The minimum elevation of the pool behind the South Fork Dike of 5391.71 feet occurred on March 28, 2010, and the maximum elevation of 5394.76 feet occurred on May 4, 2010. At the maximum elevation, the pool behind the South Fork Dike covered 215 surface acres. On May 16, 2010, when the water surface elevation of Buffalo Bill Reservoir was at its low for the year of 5356.37 feet, the water surface elevation of the pool behind the North Fork Dike was approximately the same as the main reservoir and the water surface elevation of the pool behind the South Fork Dike was 5392.71 feet. At the minimum reported elevation of Buffalo Bill Reservoir, 193 more acres of land would have been exposed without the ability to store water behind the South Fork Dike.

The number of stoplogs at the outlet control structure on the South Fork Dike has been set to maintain the static water level of the pond behind the dike at approximately 5392.00 feet at the end of the water year. The increased elevation provides a larger impoundment behind the dike, benefiting waterfowl as well as the fishery.

The Diamond Creek Dike was constructed to prevent Diamond Creek and the Irma Flats area from being inundated by the enlarged reservoir. Inflows from the Diamond Creek drainage enter Diamond Creek Reservoir which lies at the base of the dike. This water is then pumped into Buffalo Bill Reservoir in order to maintain the elevation of Diamond Creek Reservoir between a maximum of 5340.40 feet and a minimum of 5339.50 feet with the normal water surface elevation being 5340.00 feet. In water year 2010, 8,815 AF of water was pumped from Diamond Creek Reservoir into Buffalo Bill Reservoir.

Reservoir levels during all of water year 2010 were adequate for recreational activities on Buffalo Bill Reservoir.

WEATHER SUMMARY FOR NORTH AND SOUTH DAKOTA

October precipitation was normal at Deerfield and Dickinson Reservoirs, above normal at Belle Fourche and Keyhole Reservoirs, much above to very much above normal at the remaining reservoirs.

November precipitation was much below normal at Angostura Reservoir, and very much below normal at the remaining reservoirs.

December precipitation was normal at Keyhole Reservoir, much below to very much below normal at Deerfield, Dickinson, and Jamestown Reservoirs, and was much above to very much above normal at the remaining reservoirs.

January precipitation was very much above normal at Heart Butte Reservoir, normal at Belle Fourche and Shadehill Reservoirs and much below to very much below normal at the remaining reservoirs.

February precipitation was much above normal at Heart Butte Reservoir, very much below normal at Deerfield and Dickinson reservoirs, and normal to below normal at the remaining reservoirs.

March precipitation was very much above normal at Jamestown Reservoir, and was below normal to very much below normal at the remaining reservoirs.

April precipitation was very much above normal at Angostura and Pactola Reservoirs, above normal at Heart Butte Reservoir, normal at Belle Fourche, Keyhole, and Shadehill Reservoirs, and below normal at the remaining reservoirs.

May precipitation was very much above normal at Angostura and Jamestown Reservoirs, much above normal at Keyhole, Pactola, and Shadehill Reservoirs, above normal at Belle Fourche and Heart Butte Reservoirs, and normal to below normal at the remaining reservoirs.

June precipitation was much above normal at Angostura, Keyhole, and Shadehill Reservoirs, above normal at Pactola Reservoir, normal at Belle Fourche, Dickinson, and Heart Butte Reservoirs and below normal to much below normal at the remaining reservoirs.

July precipitation was much above to very much above normal at Jamestown and Shadehill Reservoirs, above normal at Angostura and Heart Butte Reservoirs, normal at Deerfield and Keyhole Reservoirs, and below to very much below normal at the remaining reservoirs.

August precipitation was much above to very much above normal at Belle Fourche, Heart Butte, Keyhole, and Shadehill Reservoirs, above normal at Pactola Reservoir, and below to very much below normal at the remaining reservoirs.

September precipitation was very much above normal at Dickinson, Heart Butte, Jamestown, and Shadehill Reservoirs, normal at Belle Fourche and Pactola Reservoirs, much below to very much below normal at the remaining reservoirs.

Total annual precipitation for Reclamation facilities in North Dakota, South Dakota, and northeastern Wyoming is shown on Table DKT1.

TABLE DKT1 Total Annual Precipitation for Reclamation Reservoirs in North Dakota, South Dakota, and Northeastern Wyoming in Inches			
Reservoir	**2010 Total**	**Average Total**	**Percent**
Angostura 1/	82.46	66.46	124
Belle Fourche 2/	58.76	55.92	105
Deerfield	13.97	21.11	66
Keyhole 3/	38.56	35.92	107
Pactola	23.18	21.10	110
Shadehill 4/	48.90	32.61	150
Dickinson	14.88	16.35	91
Heart Butte	23.08	15.75	147
Jamestown	25.29	18.49	137

1/ Angostura Reservoir's annual precipitation includes data from Oelrichs, SD, Hot Springs, SD, Newcastle, WY, and Red Bird, WY climate stations.

2/ Belle Fourche Reservoir's annual precipitation includes data from Newell, SD, Spearfish, SD, and Sundance, WY climate stations.

3/ Keyhole Reservoir's annual precipitation includes data from Gillette and Sundance, WY climate stations.

4/ Shadehill Reservoir's annual precipitation includes data from Camp Crook and Lemmon, SD climate stations.

Table DKT2 displays the changes in storage content between September 30, 2009, and September 30, 2010, at reservoirs in North and South Dakota and eastern Wyoming.

TABLE DKT2 Comparison of End-of-Month Storage Content for Reservoirs in North Dakota, South Dakota, and Northeastern Wyoming in Acre-Feet			
Reservoir	**Storage September 30, 2009**	**Storage September 30, 2010**	**Change in Storage**
Angostura	74,443	97,886	23,443
Belle Fourche	117,891	102,248	-15,643
Deerfield	14,845	14,734	-111
Keyhole	100,679	109,315	8,636
Pactola	54,651	53,878	-773
Shadehill	104,205	105,860	1,655
Dickinson	1,751	7,769	6,018
Heart Butte	59,752	62,831	3,614
Jamestown	29,217	29,319	102

FLOOD BENEFITS FOR RESERVOIRS IN NORTH AND SOUTH DAKOTA AND NORTHEASTERN WYOMING

Several Bureau of Reclamation reservoirs in northeastern Wyoming, South Dakota, and North Dakota provided flood relief during water year (WY) 2010. They are: Heart Butte Reservoir on the Heart River near Glen Ullin, North Dakota; Shadehill Reservoir on the Grand River near Shadehill, South Dakota; Angostura Reservoir on the Cheyenne River near Hot Springs, South Dakota; Pactola Reservoir on Rapid Creek near Rapid City, South Dakota; Keyhole Reservoir on the Belle Fourche River near Moorcroft, Wyoming; and Jamestown Reservoir on the James River near Jamestown, North Dakota.

The information on the distribution of flood damages prevented is provided by the Corps. The distributions of flood damages prevented for each reservoir are as follows:

FLOOD DAMAGE PREVENTED IN 2010
ACCUMULATED TOTAL 1950-2010

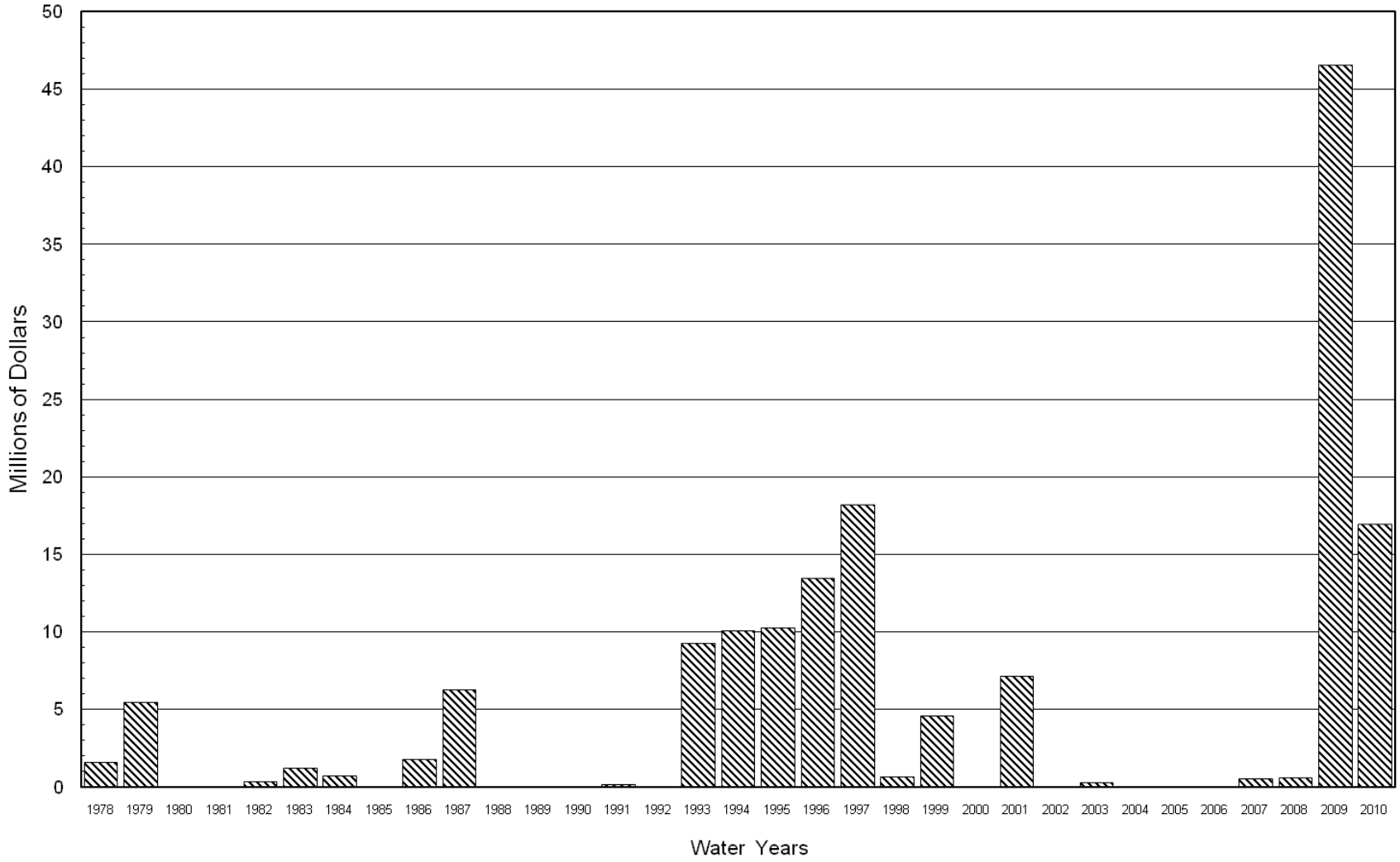
	Local	Main-Stem	2010 Total	Previous Accumulations	1950-2010 Accum Totals
Heart Butte	$72,000	$800	$72,800	$15,091,100	$15,163,900
Shadehill	$201,500	$800	$202,300	$11,003,800	$11,206,100
Angostura	$200	$0	$200	$22,600	$22,800
Pactola	$60,300	$0	$60,300	$3,317,900	$3,432,200
Keyhole	$200	$0	$200	$4,155,400	$4,155,600
Jamestown	$16,619,500	$0	$16,619,500	$130,086,700	$146,706,200
Total	**$16,953,700**	**$1,600**	**$16,955,300**	**$163,731,500**	**$180,686,800**

Flood damages prevented by Dakotas Area Office reservoirs between Garrison and Gavins Point Dams are shown on Figure DKG1.

FIGURE DKG1

FLOOD DAMAGES PREVENTED

By Dakota Area Projects Between Garrison and Gavins Point Dams



UNIT OPERATIONAL SUMMERIES FOR WATER YEAR 2010

Dickinson Reservoir

Background

Dickinson Dam and Edward Arthur Patterson Lake (also known as Dickinson Reservoir) is located on the Heart River near Dickinson, North Dakota. The reservoir has a dead capacity of 356 acre-feet, an inactive capacity of 100 acre-feet and an active conservation capacity of 8,156 acre-feet (for a total storage capacity of 8,612 acre-feet at the top of conservation elevation 2420.00 feet). Reservoir water is utilized for irrigating approximately 230 acres along the Heart River downstream of the dam and for municipal use by the Dickinson Parks and Recreation District.

Water Year 2010 Operations Summary

Dickinson Reservoir started WY 2010 at elevation 2410.87 feet and storage of 1,751 acre-feet, which is 9.13 feet, and 6,861 acre-feet below the top of the conservation pool (elevation 2420.00 feet and storage 8,612 acre-feet). Dickinson Reservoir peaked at elevation 2420.63 feet on March 31 with 9,386 acre-feet of storage. The reservoir elevation on September 30, 2010, was 2419.27 feet with storage of 7,769 acre-feet, which is 0.73 feet, and 843 acre-feet below the top of conservation pool.

The maximum discharge of 833 cubic feet per second (cfs) occurred on March 31. Reservoir net inflows for water year 2010 totaled 21,253 acre-feet, 112 percent of average. The maximum daily inflow occurred on March 30 with 1,272 cfs. Precipitation for the water year totaled 14.88 inches, which is 91 percent of average.

No water was specifically released for irrigation purposes.

An Emergency Management/Security orientation was conducted on January 28 and a tabletop exercise was held on June 23.

The Annual Site Inspection (ASI) was done on August 19, 2010, by personnel from the Dakotas Area Office.

Monthly Statistics For WY 2010

Record and near record monthly inflows in 59 years of record keeping were recorded in the following months: October had its 8th highest inflow, November had its 10th highest inflow, August had its 4th lowest inflow, and September had its 10th highest inflow.

Record or near record monthly end of month content in 59 years of record keeping were recorded in the following months: October, November, December, January, and February had its lowest ever storage, March had its 8th highest storage, May had its 9th highest storage, July and August had its 10th highest storage, and September had its 6th highest storage. Additional statistical information on Dickinson Reservoir and its operations during 2010 can be found on Table DKT3 and Figure DKG2.

TABLE DKT3
HYDROLOGIC DATA FOR 2010
DICKINSON RESERVOIR (ALSO KNOWN AS E. A. PATTERSON LAKE)

RESERVOIR ALLOCATIONS	ELEVATION (FEET)	TOTAL RESERVOIR STORAGE (AF)	STORAGE ALLOCATION (AF)
TOP OF INACTIVE	2,405.00	456	456
TOP OF ACTIVE CONSERVATION	2,420.00	8,612	8,156
TOP OF JOINT USE			
TOP OF EXCLUSIVE FLOOD CONTROL			

STORAGE-ELEVATION DATA	ELEVATION (FT)	STORAGE (AF)	DATE
BEGINNING OF YEAR	2,410.87	1,751	OCT 01, 2009
END OF YEAR	2,419.27	7,769	SEP 30, 2010
ANNUAL LOW	2,408.25	982	NOV 03, 2009
ANNUAL HIGH	2,420.63	9,386	MAR 31, 2010
HISTORIC HIGH	2,422.19	**9,348	MAR 21, 1997

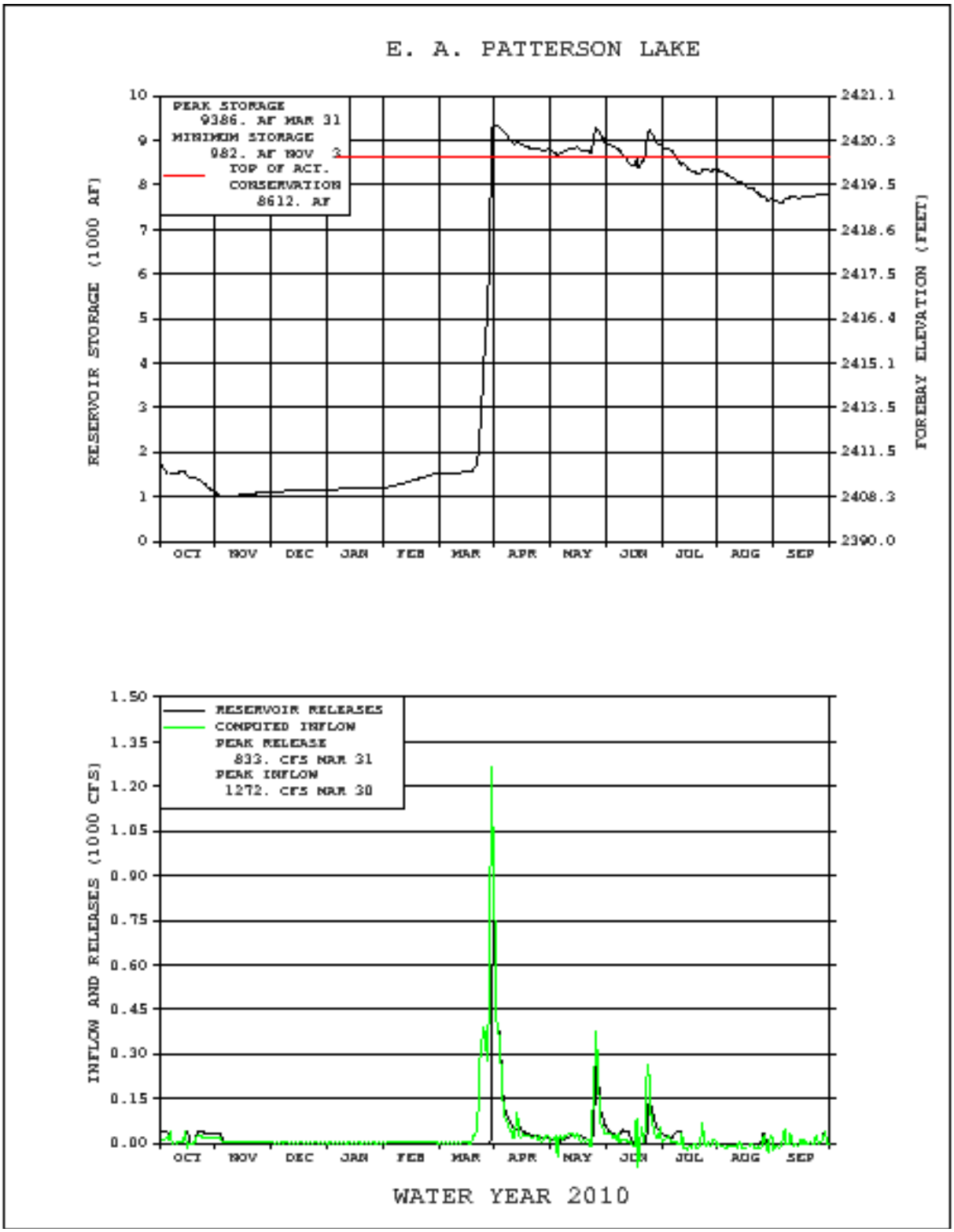
INFLOW-OUTFLOW DATA	INFLOW	DATE	OUTFLOW	DATE
ANNUAL TOTAL (AF)	21,253	OCT 09-SEP 10	15,235	OCT 09-SEP 10
DAILY PEAK (CFS)	1,272	MAR 30, 2010	833	MAR 31,2010
DAILY MINIMUM (CFS)	0	*	0	*

MONTH	INFLOW		OUTFLOW		CONTENT	
	AF	% OF AVG	AF	% OF AVG	AF	% OF AVG
OCTOBER	745	291	1,421	395	1,075	20
NOVEMBER	208	151	165	82	1,118	21
DECEMBER	49	42	0	NA	1,167	22
JANUARY	41	23	0	NA	1,208	22
FEBRUARY	316	30	0	NA	1,524	26
MARCH	9,543	135	1,681	28	9,386	138
APRIL	5,473	127	6,067	147	8,792	126
MAY	2,954	136	2,783	121	8,963	129
JUNE	2,194	91	2,231	93	8,926	128
JULY	35	4	632	44	8,329	129
AUGUST	-552	-192	119	15	7,658	129
SEPTEMBER	247	466	136	37	7,769	138
ANNUAL	21,253	112	15,235	80		
APRIL-JULY	10,656	108				

*Frequently observed during fall and winter months

**Due to new area-capacity table, the capacity that corresponds to the new historic high elevation is less than a previous historic high capacity amount (11,520 AF @ Elevation 2421.08 ft on June 9, 1982)

DKG2


E. A. PATTERSON LAKE
PEAK STORAGE
9386. AF MAR 31
MINIMUM STORAGE
982. AF NOV 3
TOP OF ACT.
CONSERVATION
8612. AF
RESERVOIR STORAGE (1000 AF)
FOREBAY ELEVATION (FEET)
10
9
8
7
6
5
4
3
2
1
0
2421.1
2420.3
2419.5
2418.6
2417.5
2416.4
2415.1
2413.5
2411.5
2408.3
2390.0
OCT NOV DEC JAN FEB MAR APR MAY JUN JUL AUG SEP
RESERVOIR RELEASES
COMPUTED INFLOW
PEAK RELEASE
833. CFS MAR 31
PEAK INFLOW
1272. CFS MAR 30
INFLOW AND RELEASES (1000 CFS)
1.50
1.35
1.20
1.05
0.90
0.75
0.60
0.45
0.30
0.15
0.00
OCT NOV DEC JAN FEB MAR APR MAY JUN JUL AUG SEP
WATER YEAR 2010

Heart Butte Reservoir

Background

Heart Butte Dam and Lake Tschida (also known as Heart Butte Reservoir) is located on the Heart River near Glen Ullin, North Dakota. The reservoir has a dead storage capacity of 5,227 acre-feet, an active conservation capacity of 61,915 acre-feet (for a total storage capacity of 67,142 acre-feet at the top of active conservation elevation 2064.50 feet), and an exclusive flood control space of 147,027 acre-feet. Flood control storage is located above the crest of an un-gated glory-hole spillway. Heart Butte Reservoir is primarily used for flood control and the authorized irrigation of up to 13,100 acres of which about 7,320 acres are now being irrigated.

Water Year 2010 Operation Summary

Heart Butte Reservoir started WY 2010 at elevation 2062.19 feet and storage of 59,752 acre-feet, which is 2.31 feet, and 7,390 acre-feet below the top of conservation pool (elevation 2064.50 feet and storage 67,142 acre-feet). Heart Butte Reservoir peaked at elevation 2068.90 feet on April 2 with 82,493 acre-feet of storage. The reservoir elevation on September 30, 2010, was 2063.17 feet with storage of 62,831 acre-feet, which is 1.33 feet and 4,311 acre-feet below the top of conservation pool.

The maximum discharge of 2,252 cfs occurred on April 3. Reservoir net inflows for water year 2010 totaled 82,753 acre-feet, 97 percent of average. The maximum daily inflow occurred on March 31 with 3,859 cfs. Precipitation for the water year totaled 23.08 inches, which is 147 percent of average.

70,396 acre-feet of water was specifically released for irrigation purposes.

An Emergency Management/Security orientation was conducted on January 26, 2010.

The Annual Site Inspection (ASI) was done on August 18, 2010, by personnel from the Dakotas Area Office.

Monthly Statistics For WY 2010

Record and near record monthly inflows in 61 years of record keeping were recorded in the following months: October had its 8th highest inflow, December had its 6th highest inflow, January had its 8th highest inflow, and September has its 6th highest inflow.

There were no record and near record monthly end of month content in the 61 years of record keeping for WY2010.

Additional statistical information on Heart Butte Reservoir and its operations during 2010 can be found on Table DKT4 and Figure DKG3.

TABLE DKT4
HYDROLOGIC DATA FOR 2010
HEART BUTTE RESERVOIR (ALSO KNOWN AS LAKE TSCHIDA)

RESERVOIR ALLOCATIONS	ELEVATION (FEET)	TOTAL RESERVOIR STORAGE (AF)	STORAGE ALLOCATION (AF)
TOP OF INACTIVE AND DEAD	2,030.00	5,227	5,227
TOP OF ACTIVE CONSERVATION	2,064.50	67,142	61,915
TOP OF JOINT USE			
TOP OF EXCLUSIVE FLOOD CONTROL	2,094.50	214,169	147,027

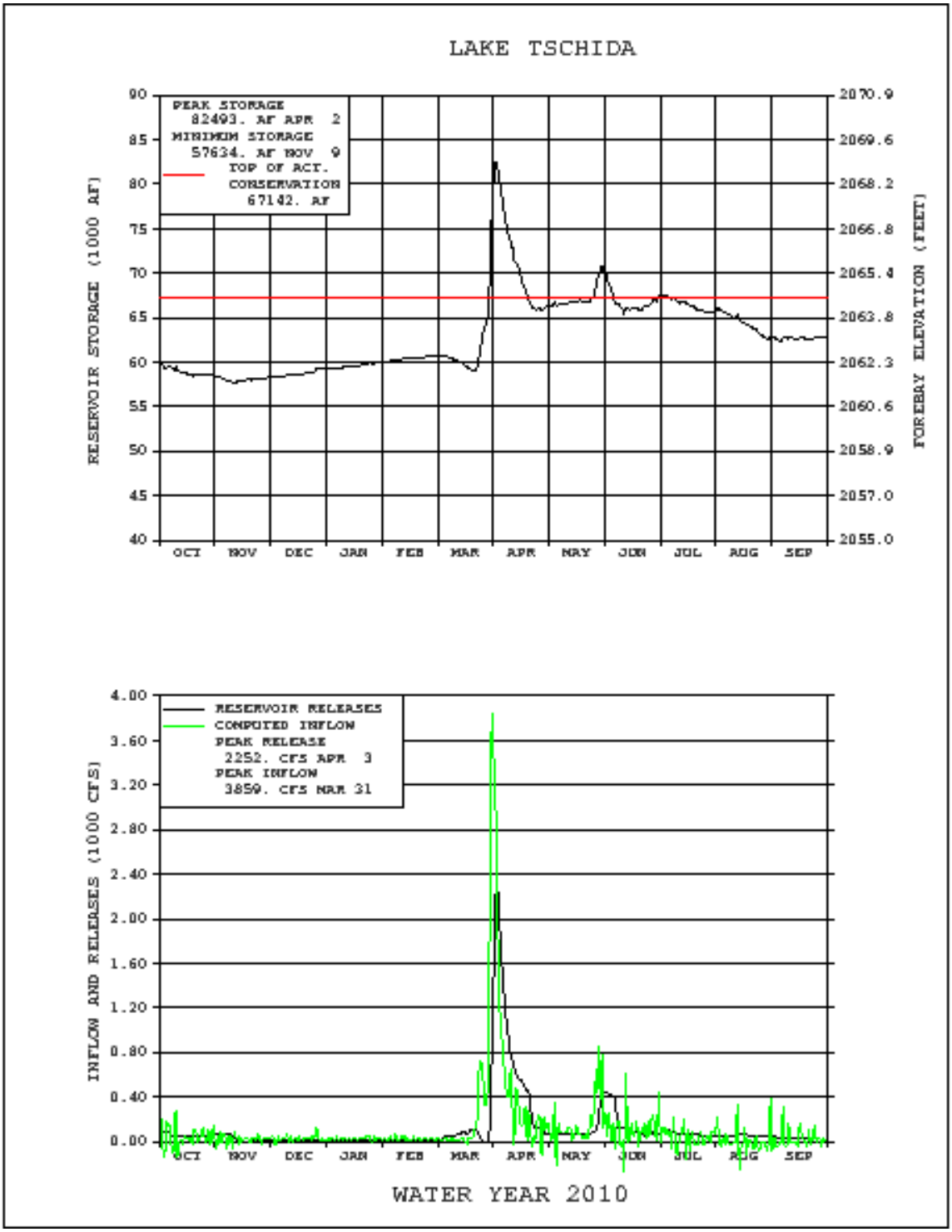
STORAGE-ELEVATION DATA	ELEVATION (FT)	STORAGE (AF)	DATE
BEGINNING OF YEAR	2,062.19	59,752	OCT 01, 2009
END OF YEAR	2,063.17	62,831	SEP 30, 2010
ANNUAL LOW	2,061.50	57,634	NOV 09, 2009
ANNUAL HIGH	2,068.90	82,493	APR 02, 2010
HISTORIC HIGH	2,086.23	173,203	APR 09, 1952

INFLOW-OUTFLOW DATA	INFLOW	DATE	OUTFLOW	DATE
ANNUAL TOTAL (AF)	82,753	OCT 09-SEP 10	79,674	OCT 09-SEP 10
DAILY PEAK (CFS)	3,859	MAR 31, 2010	2,252	APR 03, 2010
DAILY MINIMUM (CFS)	0	*	0	*

MONTH	INFLOW		OUTFLOW		CONTENT	
	AF	% OF AVG	AF	% OF AVG	AF	% OF AVG
OCTOBER	2,120	220	3,475	199	58,397	101
NOVEMBER	1,299	112	1,360	100	58,336	101
DECEMBER	1,407	176	516	41	59,227	103
JANUARY	1,347	156	511	46	60,063	105
FEBRUARY	1,123	32	469	26	60,717	103
MARCH	22,038	75	5,114	28	77,641	111
APRIL	32,147	135	43,501	185	66,287	94
MAY	10,437	112	6,443	60	70,281	102
JUNE	6,621	68	9,396	110	67,506	96
JULY	2,391	55	4,198	52	65,699	99
AUGUST	210	20	3,110	61	62,799	101
SEPTEMBER	1,613	686	1,581	62	62,831	105
ANNUAL	82,753	97	79,674	95		
APRIL-JULY	51,596	109				

* Frequently observed during fall and winter months

DKG3


LAKE TSCHIDA
PEAK STORAGE
82493. AF APR 2
MINIMUM STORAGE
57634. AF NOV 9
TOP OF ACT.
CONSERVATION
67142. AF
RESERVOIR STORAGE (1000 AF)
FOREBAY ELEVATION (FEET)
90
85
80
75
70
65
60
55
50
45
40
2070.9
2069.6
2068.2
2066.8
2065.4
2063.8
2062.3
2060.6
2058.9
2057.0
2055.0
OCT NOV DEC JAN FEB MAR APR MAY JUN JUL AUG SEP
RESERVOIR RELEASES
COMPUTED INFLOW
PEAK RELEASE
2252. CFS APR 3
PEAK INFLOW
3859. CFS MAR 31
INFLOW AND RELEASES (1000 CFS)
4.00
3.60
3.20
2.80
2.40
2.00
1.60
1.20
0.80
0.40
0.00
OCT NOV DEC JAN FEB MAR APR MAY JUN JUL AUG SEP
WATER YEAR 2010

Jamestown Reservoir

Background

Jamestown Reservoir is located on the James River above Jamestown, North Dakota. The reservoir has a dead capacity of 822 acre-feet, an active conservation capacity of 24,535 acre-feet (for a total top of active conservation capacity of 25,357 acre-feet at elevation 1428.00 feet), a joint-use capacity of 6,153 acre-feet, and an exclusive flood control space of 189,468 acre-feet. The exclusive flood control storage is below the crest of an ungated glory-hole spillway, and flood control releases are controlled by the gated outlets. The joint-use space is available for flood control at the beginning of spring runoff and is used for conservation purposes during the summer months.

Water Year 2010 Operations Summary

Jamestown Reservoir started WY 2010 at elevation 1429.95 feet and storage of 29,217 acre-feet, which is 1.95 feet, and 3,860 acre-feet above the top of the conservation pool (elevation 1428.00 feet and storage 25,357 acre-feet). Jamestown Reservoir peaked at elevation 1445.77 feet on April 15 with 124,638 acre-feet of storage. The reservoir elevation on September 30, 2010, was 1430.00 feet with storage of 29,319 acre-feet, which is 2.00 feet, and 3,962 acre-feet above the top of active conservation pool.

The maximum discharge of 1,220 cfs occurred on April 16. Reservoir net inflows for water year 2010 totaled 223,849 acre-feet, 481 percent of average. The maximum daily inflow occurred on April 5 with 4,773 cfs. Precipitation for the water year totaled 25.29 inches at 137 percent of average.

No water was specifically released for irrigation purposes.

An Emergency Management/Security orientation was conducted on January 27, 2010.

The Annual Site Inspection (ASI) was done on August 11, 2010, by personnel from the Dakotas Area Office.

Monthly Statistics For WY 2010

Record and near record monthly inflows in 57 years of record keeping were recorded in the following months: October had its 2nd highest inflow, November had its 4th highest inflow, December had its 7th highest inflow, January had its 5th highest inflow, March and April had its 3rd highest inflow, May had its 7th highest inflow, July had its 6th highest inflow, and September had its 2nd highest inflow.

Record and near record monthly end of month content in 57 years of record keeping were recorded in the following months: March had its 3rd highest storage, April had its 4th highest storage, May had its 5th highest storage, and June had its 4th highest storage.

Additional statistical information on Jamestown Reservoir and its operations during 2010 can be found on Table DKT5 and Figure DKG4.

TABLE DKT5
HYDROLOGIC DATA FOR 2010
JAMESTOWN RESERVOIR

RESERVOIR ALLOCATIONS	ELEVATION (FEET)	TOTAL RESERVOIR STORAGE (AF)	STORAGE ALLOCATION (AF)
TOP OF INACTIVE AND DEAD	1,400.00	822	822
TOP OF ACTIVE CONSERVATION	1,428.00	25,357	24,535
TOP OF JOINT USE	1,431.00	31,510	6,153
TOP OF EXCLUSIVE FLOOD CONTROL	1,454.00	220,978	189,468

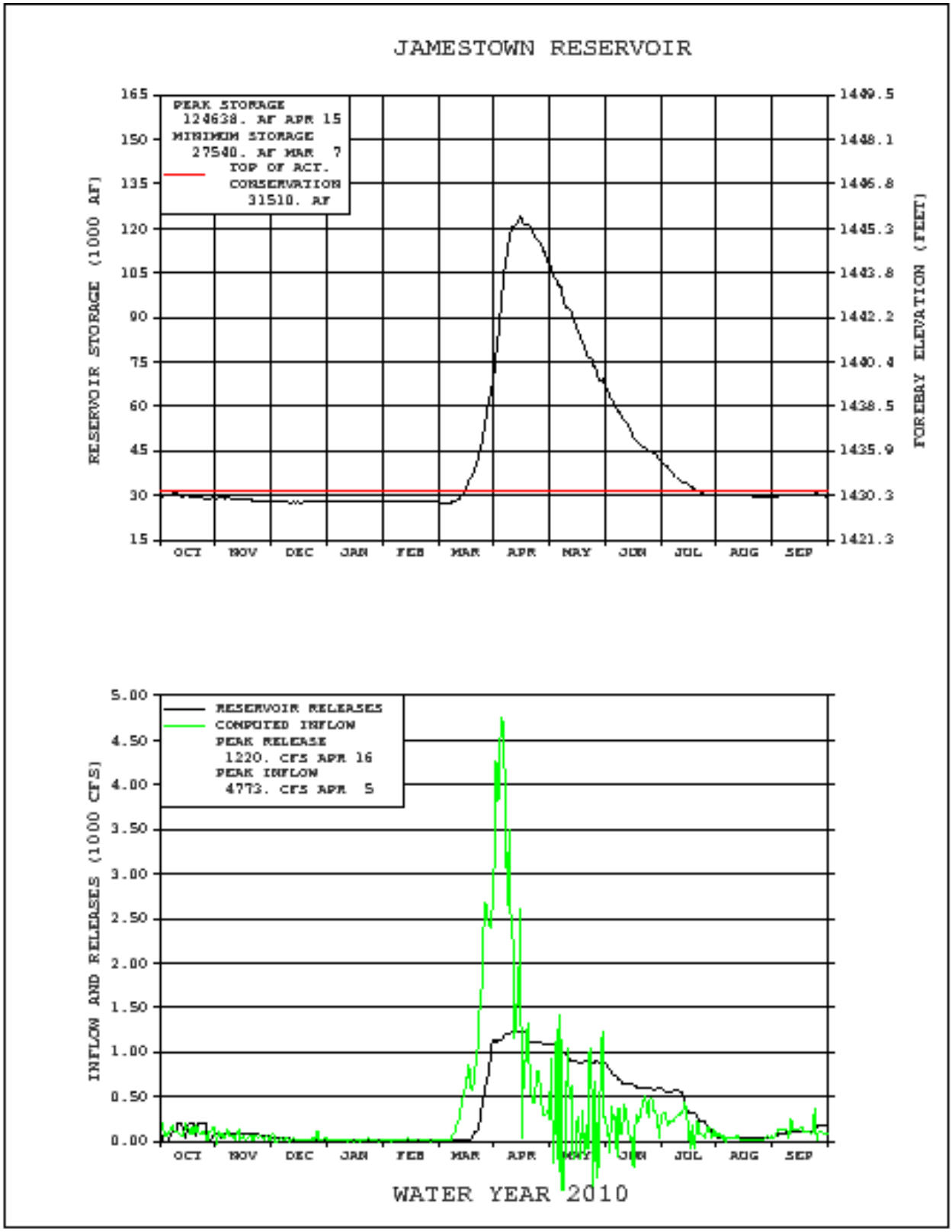
STORAGE-ELEVATION DATA	ELEVATION (FT)	STORAGE (AF)	DATE
BEGINNING OF YEAR	1,429.95	29,217	OCT 01, 2009
END OF YEAR	1,430.00	29,319	SEP 30, 2010
ANNUAL LOW	1,429.13	27,540	MAR 07, 2010
ANNUAL HIGH	1,445.77	124,638	APR 15, 2010
HISTORIC HIGH	1,454.10	222,318	APR 26, 2009

INFLOW-OUTFLOW DATA	INFLOW	DATE	OUTFLOW	DATE
ANNUAL TOTAL (AF)	223,849	OCT 09-SEP 10	223,746	OCT 09-SEP 10
DAILY PEAK (CFS)	4,773	APR 05, 2010	1,220	APR 16, 2010
DAILY MINIMUM (CFS)	0	*	0	*

MONTH	INFLOW		OUTFLOW		CONTENT	
	AF	% OF AVG	AF	% OF AVG	AF	% OF AVG
OCTOBER	6,431	713	6,615	309	29,033	116
NOVEMBER	3,164	460	4,269	446	27,928	113
DECEMBER	1,303	426	1,283	463	27,948	113
JANUARY	761	614	781	806	27,928	112
FEBRUARY	439	194	704	819	27,662	111
MARCH	51,924	844	11,859	1,913	67,727	222
APRIL	109,894	512	68,723	862	108,898	247
MAY	16,893	236	57,909	481	67,882	173
JUNE	13,291	454	39,235	479	41,938	124
JULY	10,813	365	22,709	413	30,042	96
AUGUST	1,979	76	2,549	58	29,472	100
SEPTEMBER	6,957	675	7,110	190	29,319	109
ANNUAL	223,849	481	223,746	486		
APRIL-JULY	150,891	437				

*Frequently observed during fall and winter months

DKG4


JAMESTOWN RESERVOIR
PEAK STORAGE
124638. AF APR 15
MINIMUM STORAGE
27540. AF MAR 7
TOP OF ACT.
CONSERVATION
31510. AF
RESERVOIR STORAGE (1000 AF)
FOREBAY ELEVATION (FEET)
165
150
135
120
105
90
75
60
45
30
15
1449.5
1448.1
1446.8
1445.3
1443.8
1442.2
1440.4
1438.5
1435.9
1430.3
1421.3
OCT NOV DEC JAN FEB MAR APR MAY JUN JUL AUG SEP
RESERVOIR RELEASES
COMPUTED INFLOW
PEAK RELEASE
1220. CFS APR 16
PEAK INFLOW
4773. CFS APR 5
INFLOW AND RELEASES (1000 CFS)
5.00
4.50
4.00
3.50
3.00
2.50
2.00
1.50
1.00
0.50
0.00
OCT NOV DEC JAN FEB MAR APR MAY JUN JUL AUG SEP
WATER YEAR 2010

Deerfield Reservoir

Background

Deerfield Reservoir is located on Castle Creek, a tributary of Rapid Creek above Rapid City. Deerfield Reservoir (Rapid Valley Project) and Pactola Reservoir (Rapid Valley Unit, P-S MBP), furnish a supplemental irrigation supply to about 8,900 acres in the Rapid Valley Water Conservancy District and furnish replacement water for a portion of the water used from Rapid Creek by Rapid City. The majority of prior rights to the flows of Rapid Creek during the irrigation season is held by individuals and ditch companies in the Rapid Valley Water Conservancy District.

In 1985, Deerfield Dam was modified to accommodate a larger flood as determined from the results of the Probable Maximum Flood Analysis. These modifications consisted of raising the crest of the dam 38 feet, excavating an unlined auxiliary spillway, removing and filling in the old spillway, and extending the existing emergency gate passageway to the new control house at the higher crest elevation. The reservoir has a total capacity of 15,655 acre-feet with an additional 26,655 acre-feet of surcharge capacity.

During the winter of 1995-96 the hollow jet valves were removed to allow the installation of the jet flow valves as part of the outlet works modification contract. The work was done to improve fish habitat in 1.5 miles of the creek immediately downstream of the dam. The stream improvement project was a cooperative effort accomplished by the city of Rapid City, Rapid Valley Water Conservancy District, Black Hills Fly Fishers, Bureau of Reclamation, US Forest Service, and South Dakota Game Fish and Parks. The project modified the outlet works of Deerfield Dam by installing Jet Flow Gates to allow greater minimum winter releases than the 6-inch bypass is capable of providing.

WY 2010 Operations Summary

Deerfield Reservoir started WY 2010 at elevation 5906.04 feet and storage of 14,845 acre-feet, which is 1.96 feet and 810 acre-feet below the top of the conservation pool. Inflows for WY 2010 totaled 13,712 acre-feet (142 percent of the average). The peak reservoir elevation for WY 2010 was 5908.25 feet, storage of 15,771 acre-feet, and occurred on May 27, 2010. The minimum elevation for WY 2010 was 5904.77 feet, storage of 14,328 acre-feet, and occurred on March 1, 2010. WY 2010 ended at elevation 5905.77 feet and storage of 14,734 acre-feet, which is 2.23 feet and 921 acre-feet below the top of the conservation pool. Precipitation for the water year was 66 percent of average.

Rapid Valley Water Conservancy District did not order any water from Deerfield for the 2010 irrigation season.

An Emergency Management Tabletop Exercise was held February 25, 2010.

The Annual Facility Review was done on May 5, 2010, by personnel from the Rapid City Field Office.

Monthly Statistics For WY 2010

October end-of-month (EOM) elevation, at Deerfield Reservoir, was much above average. October inflow was above average. Release is 11 cfs. Deerfield finished the month 2.1 feet from full.

November EOM elevation, at Deerfield Reservoir, was much above average. November inflow was below average. Release is 11 cfs. Deerfield finished the month 2.3 feet from full.

December EOM elevation, at Deerfield Reservoir, was above average. December inflow was below average. Release is 11 cfs. Deerfield finished the month 2.8 feet from full.

January EOM elevation, at Deerfield Reservoir, was above average. January inflow was below average. Release is 9 cfs. Deerfield finished the month 3.0 feet from full.

February EOM elevation, at Deerfield Reservoir, was above average. February inflow was below average. Emergency Management Tabletop Exercise done on February 25. Release is 9 cfs. Deerfield finished the month 3.2 feet from full.

March EOM elevation, at Deerfield Reservoir, was above average. March inflow was below average. Release is 9 cfs. Deerfield finished the month 2.8 feet from full.

April EOM elevation, at Deerfield Reservoir, was above average. April inflow was above average. Release is 18 cfs. Deerfield finished the month 0.8 feet from full.

May EOM elevation, at Deerfield Reservoir, was 2nd highest and May inflows were 5th highest in 57 years of record. Deerfield Reservoir annual inspection was done on May 5. Internal alert declared on May 17 when elevation reached 5908.0 feet. Release at 70 cfs. Deerfield finished the month 0.04 feet into the flood pool.

June EOM elevation, at Deerfield Reservoir, was above average. June inflows were much above average. Internal alert canceled on June 2 when elevation dropped below 5908.0 feet. Release at 32 cfs. Deerfield finished the month 0.4 feet from full.

July EOM elevation, at Deerfield Reservoir, was above average. July inflows were much above average. Release at 30 cfs. Deerfield finished the month 0.9 feet from full.

August EOM elevation, at Deerfield Reservoir, was above average. August inflow was above average. Release at 15 cfs. Deerfield finished the month 1.9 feet from full.

September EOM elevation, at Deerfield Reservoir, was much above average. September inflow was above average. Release at 12 cfs. Deerfield finished the month 2.2 feet from full.

Additional statistical information on Deerfield Reservoir and its operations during 2010 can be found on Table DKT6 and Figure DKG5.

TABLE DKT6
HYDROLOGIC DATA FOR 2010
DEERFIELD RESERVOIR

RESERVOIR ALLOCATIONS	ELEVATION (FEET)	TOTAL RESERVOIR STORAGE (AF)	STORAGE ALLOCATION (AF)
TOP OF INACTIVE AND DEAD	5,839.00	151	151
TOP OF ACTIVE CONSERVATION	5,908.00	15,654	15,503
TOP OF JOINT USE			
TOP OF EXCLUSIVE FLOOD CONTROL			

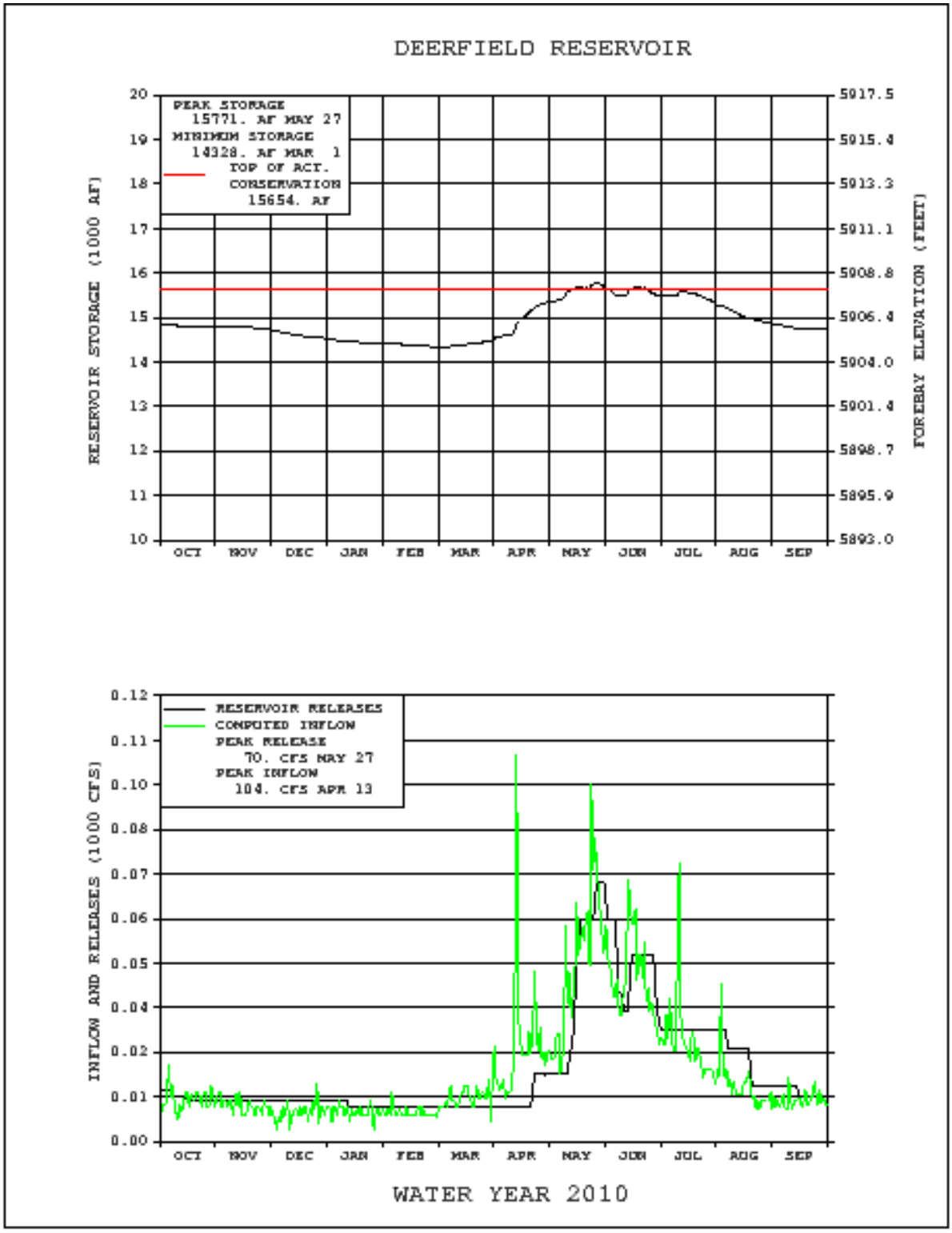
STORAGE-ELEVATION DATA	ELEVATION (FT)	STORAGE (AF)	DATE
BEGINNING OF YEAR	5,906.04	14,845	OCT 01, 2009
END OF YEAR	5,905.77	14,734	SEP 30, 2010
ANNUAL LOW	5904.77	14,328	MAR 1, 2010
ANNUAL HIGH	5,908.25	15,771	MAY 27, 2010
HISTORIC HIGH	5,909.05	16,157	FEB 25, 1985

INFLOW-OUTFLOW DATA	INFLOW	DATE	OUTFLOW	DATE
ANNUAL TOTAL (AF)	13,712	OCT 09-SEP 10	13, 823	OCT 09-SEP10
DAILY PEAK (CFS)	104	APR 13, 2010	70	MAY 27, 2010
DAILY MINIMUM (CFS)	0	*	9	MAR 30, 2010

MONTH	INFLOW		OUTFLOW		CONTENT	
	AF	% OF AVG	AF	% OF AVG	AF	% OF AVG
OCTOBER	692	108	729	98	14,808	120
NOVEMBER	565	97	655	187	14,718	117
DECEMBER	480	79	676	219	14,522	112
JANUARY	477	79	595	194	14,404	109
FEBRUARY	427	76	500	159	14,331	106
MARCH	711	83	553	96	14,489	105
APRIL	1,530	129	688	67	15,331	110
MAY	2,940	217	2,590	202	15,681	112
JUNE	2,667	224	2,857	235	15,491	111
JULY	1,656	196	1,845	167	15,302	112
AUGUST	903	136	1,343	111	14,862	113
SEPTEMBER	666	112	794	68	14,734	118
ANNUAL	13,712	142	13,823	145		
APRIL-JULY	8,793	192				

*Frequently observed during fall and winter months

DKG5


DEERFIELD RESERVOIR
PEAK STORAGE
15771. AF MAY 27
MINIMUM STORAGE
14328. AF MAR 1
TOP OF ACT.
CONSERVATION
15654. AF
RESERVOIR STORAGE (1000 AF)
FOREBAY ELEVATION (FEET)
20
19
18
17
16
15
14
13
12
11
10
5917.5
5915.4
5913.3
5911.1
5908.8
5906.4
5904.0
5901.4
5898.7
5895.9
5893.0
OCT
NOV
DEC
JAN
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP
RESERVOIR RELEASES
COMPUTED INFLOW
PEAK RELEASE
70. CFS MAY 27
PEAK INFLOW
104. CFS APR 13
INFLOW AND RELEASES (1000 CFS)
0.12
0.11
0.10
0.08
0.07
0.06
0.05
0.04
0.02
0.01
0.00
WATER YEAR 2010

Pactola Reservoir

Background

Pactola Reservoir, Rapid Valley Unit (P-S MBP), located on Rapid Creek above Rapid City, South Dakota, acts in conjunction with Deerfield Reservoir, Rapid Valley Project, to furnish a supplemental irrigation supply to about 8,900 acres in the Rapid Valley Water Conservancy District, replacement water for Rapid City, and a supply of domestic water for private water systems both above and below the city. The reservoir is also operated to provide flood control. It has a conservation capacity of 55,972 acre-feet, (54,955 acre-feet active) and 43,057 acre-feet of exclusive flood control space. The flood control space is all below the ungated spillway crest, and releases in this pool are controlled by the river outlet works. Rapid City has contracts for Pactola and Deerfield Reservoir water. The Rapid Valley Sanitation District and C&J Sanders Water Company also have contracts for water service from Pactola Reservoir. Operation of the two reservoirs is integrated to maintain as much water as possible in the upstream facility, Deerfield Reservoir, and at the same time maintain a uniform outflow from Deerfield to maximize fishery benefits in the stream between the reservoirs. Since no inflow forecasts are available, the reservoir is normally operated as full as possible. Two Snowtel (North Rapid Creek and Blind Park) sites were installed in the Pactola and Deerfield drainage basin in May of 1990.

As part of the Safety Examination of Existing Structures (Safety of Dams) Program, a study was made in the early 1980's to determine the adequacy of Pactola Dam, Spillway, and Reservoir to safely pass the new Inflow Design Flood (IDF) determined on the basis of present day hydrologic technology. The studies showed that the facility was not able to safely handle the new IDF. Modification work was completed in 1987 and provided sufficient surcharge storage and spillway capacity to pass the IDF. Modification work consisted of raising the crest of the dam 15 feet, widening the existing rock-cut spillway chute and stilling basin from 240 feet to 425 feet, relocating Highway 385 to the new dam crest, extending the existing gate access shaft to the higher crest elevation, and reconstructing a new two-level gate control house at the higher crest elevation.

WY 2010 Operations Summary

Pactola Reservoir started WY 2010 at elevation 4578.65 feet and storage of 54,651 acre-feet, which is 1.55 feet and 1,321 acre-feet below the top of the conservation pool. Inflows for WY 2010 totaled 56,808 acre-feet (162 percent of average). The peak reservoir elevation for WY 2010 was 4582.66 feet, storage of 58,117 acre-feet, and occurred on May 30, 2010. The minimum elevation for WY 2010 was 4577.25 feet, storage of 53,478 acre-feet, and occurred on September 19, 2010. WY 2010 ended at elevation 4577.33 feet and storage of 53,878 acre-feet, which is 2.87 feet and 2,094 acre-feet below the top of the conservation pool. Precipitation for the water year was 110 percent of average.

The city of Rapid City did not order any water from City storage at Pactola to meet needs over and above natural flow releases required to meet prior rights in Rapid Creek during the summer of 2010.

The operation of Pactola Reservoir provided minimal local and mainstream flood relief during WY 2010. The flood plain through Rapid City is designed to pass 6,500 cfs without major property damage, but some areas of the bicycle path near Canyon Lake will inundate at 350 to 400 cfs. Spring releases from Pactola Dam peaked at 302 cfs on June 14, 2010.

An Emergency Management Tabletop exercise was held on February 25, 2010.

The Annual Facility Review was done on August 23, 2010, by personnel from the Rapid City Field Office.

Cavitation damage, downstream of the regulating gates, was repaired in September 2010.

A new long term storage contract was signed on July 31, 2007, between Reclamation and the city of Rapid City. The contract provides storage space of 49,000 acre-feet for the city and 6,000 acre-feet was retained by Reclamation.

Monthly Statistics For WY 2010

October EOM elevation, at Pactola Reservoir, was much above average. October inflow was above average. Release is 33 cfs. Pactola ended the month 1.1 feet from full.

November EOM elevation, at Pactola Reservoir, was much above average. November inflow was much above average. Release is 33 cfs. Pactola ended the month 0.9 feet from full.

December EOM elevation, at Pactola Reservoir, was much above average. December inflow was much above average. Release is 33 cfs. Pactola ended the month 1.2 feet from full.

January EOM elevation, at Pactola Reservoir, was much above average. January inflow was above average. Release is 33 cfs. Pactola ended the month 1.4 feet from full.

February EOM elevation, at Pactola Reservoir, was above average. February inflow was much above average. Emergency Management Tabletop Exercise done on February 25. Release is 37 cfs. Pactola ended the month 1.9 feet from full.

March EOM elevation and March inflow, at Pactola Reservoir, were above average. Release is 37 cfs. Pactola ended the month 1.5 feet from full.

April EOM elevation, at Pactola Reservoir, was 4th highest in 54 years on record. April inflow was above average. Release is 73 cfs. Pactola ended the month 0.1 feet from full.

May EOM elevation, at Pactola Reservoir, was 4th highest and May inflow was 5th highest in 54 years on record. Internal Alert declared on May 10, when Forebay reached 4580.2 feet. Release is 300 cfs. Pactola ended the month 2.4 feet into the flood pool.

June EOM elevation and June inflow, at Pactola Reservoir, were above average. Internal Alert canceled on June 17, when elevation dropped below 4580.2 feet. Release is 148 cfs. Pactola ended the month 0.3 feet from full.

July EOM elevation, at Pactola Reservoir, was average. July inflows were much above average. Release is 93 cfs. Pactola ended the month 0.8 feet from full.

August EOM elevation, at Pactola Reservoir, was much above average. August inflow was much above average. Release is 58 cfs. Pactola ended the month 1.6 feet from full.

September EOM elevation, at Pactola Reservoir, was above average. September inflow was above average. Release is 30 cfs. Pactola ended the month 2.5 feet from full.

Additional statistical information on Pactola Reservoir and its operations during 2010 can be found on Table DKT7 and Figure DKG6.

TABLE DKT7
HYDROLOGIC DATA FOR 2010
PACTOLA RESERVOIR

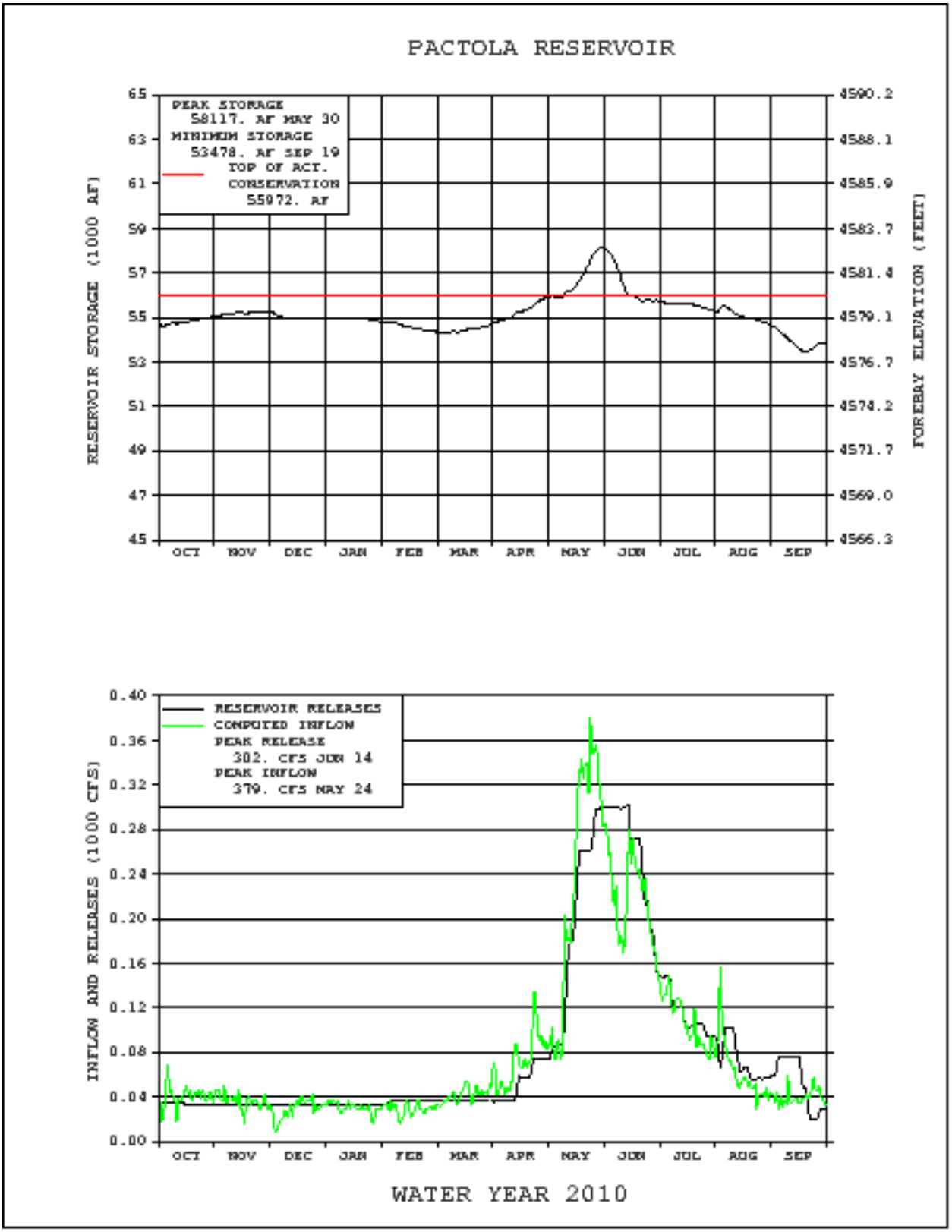
RESERVOIR ALLOCATIONS	ELEVATION (FEET)	TOTAL RESERVOIR STORAGE (AF)	STORAGE ALLOCATION (AF)
TOP OF INACTIVE AND DEAD	4,456.10	1,017	1,017
TOP OF ACTIVE CONSERVATION	4,580.20	55,972	54,955
TOP OF JOINT USE			
TOP OF EXCLUSIVE FLOOD CONTROL	4,621.50	99,029	43,057

STORAGE-ELEVATION DATA	ELEVATION (FT)	STORAGE (AF)	DATE
BEGINNING OF YEAR	4,578.65	54,651	OCT 01, 2009
END OF YEAR	4,577.73	53,878	SEP 30, 2010
ANNUAL LOW	4,577.25	53,478	SEP 19, 2010
ANNUAL HIGH	4,582.66	58,117	MAY 30, 2010
HISTORIC HIGH	4,585.87	61,105	MAY 19, 1965

INFLOW-OUTFLOW DATA	INFLOW	DATE	OUTFLOW	DATE
ANNUAL TOTAL (AF)	56,808	OCT 09-SEP 10	57,581	OCT 09-SEP 10
DAILY PEAK (CFS)	379	MAY 24, 2010	302	JUN 14, 2010
DAILY MINIMUM (CFS)	8	DEC 03, 2009	20	SEP 21, 2010

MONTH	INFLOW		OUTFLOW		CONTENT	
	AF	% OF AVG	AF	% OF AVG	AF	% OF AVG
OCTOBER	2,473	123	2,082	128	55,042	124
NOVEMBER	2,151	145	1,964	146	55,229	124
DECEMBER	1,774	140	2,029	146	54,974	124
JANUARY	1,850	141	2,029	155	54,795	123
FEBRUARY	1,588	119	2,027	170	54,356	122
MARCH	2,558	108	2,254	133	54,660	121
APRIL	4,337	103	3,134	110	55,863	120
MAY	14,199	219	11,980	224	58,082	122
JUNE	13,121	198	15,460	261	55,743	115
JULY	6,603	180	7,091	137	55,255	118
AUGUST	3,786	142	4,406	111	54,635	123
SEPTEMBER	2369	108	3,126	120	53,878	122
ANNUAL	56,808	162	57,581	170		
APRIL-JULY	38,260	182				

DKG6


PACTOLA RESERVOIR
PEAK STORAGE
58117. AF MAY 30
MINIMUM STORAGE
53478. AF SEP 19
TOP OF ACT.
CONSERVATION
55972. AF
RESERVOIR STORAGE (1000 AF)
FOREBAY ELEVATION (FEET)
65
63
61
59
57
55
53
51
49
47
45
4590.2
4588.1
4585.9
4583.7
4581.4
4579.1
4576.7
4574.2
4571.7
4569.0
4566.3
OCT
NOV
DEC
JAN
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP
RESERVOIR RELEASES
COMPUTED INFLOW
PEAK RELEASE
302. CFS JUN 14
PEAK INFLOW
379. CFS MAY 24
INFLOW AND RELEASES (1000 CFS)
0.40
0.36
0.32
0.28
0.24
0.20
0.16
0.12
0.08
0.04
0.00
OCT
NOV
DEC
JAN
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP
WATER YEAR 2010

Angostura Reservoir

Background

Angostura Reservoir (P-S MBP), located on the Cheyenne River above Hot Springs, South Dakota, was built to service about 12,200 acres in the Angostura Unit (P-S MBP) and for power generation. It has a total capacity of 123,048 acre-feet with an additional surcharge capacity of 57,308 acre-feet. Its principle use is for irrigation of the Angostura Unit, which diverts its water from a high-level outlet at the dam. In the early years, water surplus to irrigation needs was released to the river through a small power plant with a nameplate capacity of 1,200 kilowatts. Because of the low runoff, and because actual irrigation diversions were higher than previously anticipated, it was concluded that continued operation of the power plant was economically infeasible. Except for a few operations of less than 24 hours each, the plant was last operated in February 1959. In 1966, the plant was officially closed and the equipment was declared surplus in March 1968. Disposal of this equipment was completed in 1971. Releases for irrigation are made through the canal outlet works into the Angostura Main Canal having a design capacity of 290 cfs. Releases to the Cheyenne River are only made when the reservoir is assured of filling.

WY 2010 Operations Summary

Angostura Reservoir started WY 2010 at elevation 3174.79 feet and storage of 74,443 acre-feet, which is 12.41 feet and 48,605 acre-feet below the top of the conservation pool. Inflows for WY 2010 totaled 111,087 acre-feet (143 percent of the average). Peak inflows occurred in May, totaling 44,356 acre-feet for the month. On May 25, 2010, Angostura Reservoir reached elevation 3186.91 feet and began to spill. Peak spill (5210 cfs) occurred on May 26, 2010. The reservoir continued to spill through the radial gates until June 27, 2010. This was the first spill since April of 2000. The peak reservoir elevation for WY 2010 was 3187.27 feet and storage of 123,371 acre-feet and occurred on May 25, 2010. The minimum elevation for WY 2010 was 3174.72 feet and storage of 74,216 acre-feet and occurred on October 1, 2009. WY 2010 ended at elevation 3181.32 feet and storage of 97,886 acre-feet, which is 5.88 feet and 25,162 acre-feet below the top of the conservation pool. Precipitation for the water year was 124 percent of average.

The Angostura Irrigation District had a full water allotment for its irrigators. Releases for irrigation began June 21 and reached a peak of 263 cfs on July 21. The irrigation release was terminated on September 24 with 97,847 acre-feet in total storage and 55,642 acre-feet in active storage. Total irrigation releases were 28,729 acre-feet.

Reclamation's Sedimentation and River Hydraulics Group of the Technical Service Center in Denver conducted a sedimentation survey of Angostura Reservoir in 2004 and provided a survey report and new area and capacity tables in August of 2005. The last survey was done in 1979. Angostura Reservoir accumulated 7,716 acre-feet of sediment since the last survey. Since construction in 1949, Angostura has accumulated 36,867 acre-feet of sediment. The sedimentation rate from 1949 through 2004 has averaged 670 acre-feet per year. The new area and capacity tables were first used in WY 2006.

An Emergency Management Tabletop Exercise was held on February 23, 2010.

The Annual Facility Review was done on September 10, 2010, by personnel from the Rapid City Field Office.

Monthly Statistics For Water Year 2010

October end-of-month (EOM) elevation, at Angostura Reservoir, was below average. October inflow was above average. Angostura ended the month 11.8 feet from full.

November end-of-month (EOM) elevation, at Angostura Reservoir, was below average. November inflow was above average. Angostura ended the month 11.2 feet from full.

December end-of-month (EOM) elevation, at Angostura Reservoir, was below average. December inflow was above average. Angostura ended the month 10.6 feet from full.

January end-of-month (EOM) elevation, at Angostura Reservoir, was below average. January inflow was below average. Angostura ended the month 10.2 feet from full.

February end-of-month (EOM) elevation and February inflow, at Angostura Reservoir, were below average. Emergency Management Tabletop Exercise done on February 23. Angostura ended the month 9.5 feet from full.

March end-of-month (EOM) elevation and March inflow, at Angostura Reservoir, were below average. Angostura ended the month 7.3 feet from full.

April end-of-month (EOM) elevation and April inflow, at Angostura Reservoir, were above average. Associate Facility Review done on April 19. Angostura ended the month 5.3 feet from full.

May end-of-month (EOM) elevation, at Angostura Reservoir, was above average. May inflow was much above average. Response Level 1 declared on May 26 when elevation reached 3186.9 feet. Peak release was 5900 cfs on May 26. Angostura ended the month 0.3 feet from full.

June end-of-month (EOM) elevation, at Angostura Reservoir, was above average. June inflow was much above average. Went from Response Level 1 to Internal Alert on June 20 when elevation dropped below 3186.9 feet. Began filling canal on June 21. Angostura ended the month 0.5 feet from full.

July end-of-month (EOM) elevation, at Angostura Reservoir, was above average. July inflow was below average. Angostura ended the month 2.1 feet from full.

August end-of-month (EOM) elevation, at Angostura Reservoir, was above average. August inflow was below average. Angostura ended the month 4.4 feet from full.

September end-of-month (EOM) elevation, at Angostura Reservoir, was above average. September inflow was below average. The annual inspection was done on September 10. Canal shut off on September 24. Angostura ended the month 5.9 feet from full.

Additional statistical information on Angostura Reservoir and its operations during 2010 can be found on Table DKT8 and Figure DKG7.

TABLE DKT8
HYDROLOGIC DATA FOR 2010
ANGOSTURA RESERVOIR

RESERVOIR ALLOCATIONS	ELEVATION (FEET)	TOTAL RESERVOIR STORAGE (AF)	STORAGE ALLOCATION (AF)
TOP OF INACTIVE AND DEAD	3,163.00	42,205	42,205
TOP OF ACTIVE CONSERVATION	3,187.20	123,048	80,843
TOP OF JOINT USE			
TOP OF EXCLUSIVE FLOOD CONTROL			

STORAGE-ELEVATION DATA	ELEVATION (FT)	STORAGE (AF)	DATE
BEGINNING OF YEAR	3,174.79	74,443	OCT 01, 2009
END OF YEAR	3,181.32	97,886	SEP 30, 2010
ANNUAL LOW	3,174.72	74,216	OCT 1, 2009
ANNUAL HIGH	3,187.27	123,371	MAY 25, 2010
HISTORIC HIGH	3,189.37	**152,228	MAY 20, 1978

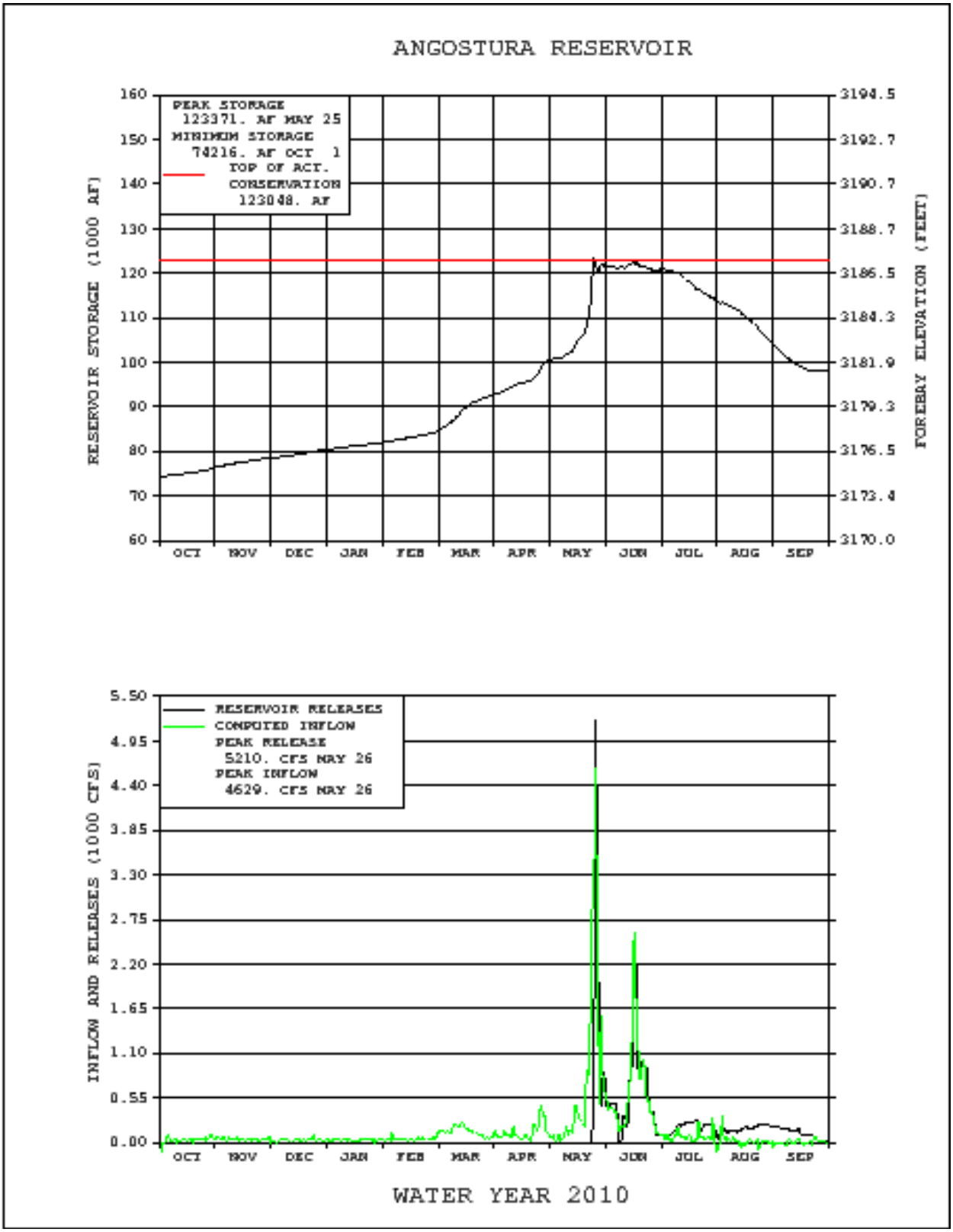
INFLOW-OUTFLOW DATA	INFLOW	DATE	OUTFLOW	DATE
ANNUAL TOTAL (AF)	111,087	OCT 09-SEP 10	88,634	OCT 09-SEP 10
DAILY PEAK (CFS)	4,629	MAY 26, 2010	5,210	MAY 26, 2010
DAILY MINIMUM (CFS)	0	*	0	*

MONTH	INFLOW		OUTFLOW		CONTENT	
	AF	% OF AVG	AF	% OF AVG	AF	% OF AVG
OCTOBER	1,897	118	0	0	76,340	78
NOVEMBER	2,237	102	0	0	78,577	80
DECEMBER	1,837	103	0	0	80,414	80
JANUARY	1,590	78	0	0	82,004	81
FEBRUARY	2,356	55	8	0	84,360	80
MARCH	8,149	74	0	0	92,509	82
APRIL	7,805	102	0	0	100,314	86
MAY	44,356	295	24,218	191	121,441	100
JUNE	35,907	186	36,547	189	120,801	100
JULY	4,139	99	11,197	71	113,743	101
AUGUST	707	23	10,476	81	103,974	102
SEPTEMBER	108	10	6,196	113	97,886	100
ANNUAL	111,087	143	88,634	114		
APRIL-JULY	92,207	180				

*Frequently observed during fall and winter months

**Due to new area-capacity table, the capacity that corresponds to the new historic high elevation is less than a previous high capacity amount (169,020 AF @ Elevation 3189.0 ft on June 18, 1962)

DKG7


ANGOSTURA RESERVOIR
PEAK STORAGE
123371. AF MAY 25
MINIMUM STORAGE
74216. AF OCT 1
TOP OF ACT.
CONSERVATION
123048. AF
RESERVOIR STORAGE (1000 AF)
FOREBAY ELEVATION (FEET)
160
150
140
130
120
110
100
90
80
70
60
3194.5
3192.7
3190.7
3188.7
3186.5
3184.3
3181.9
3179.3
3176.5
3173.4
3170.0
OCT
NOV
DEC
JAN
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP
RESERVOIR RELEASES
COMPUTED INFLOW
PEAK RELEASE
5210. CFS MAY 26
PEAK INFLOW
4629. CFS MAY 26
INFLOW AND RELEASES (1000 CFS)
5.50
4.95
4.40
3.85
3.30
2.75
2.20
1.65
1.10
0.55
0.00
WATER YEAR 2010

Keyhole Reservoir

Background

Keyhole Reservoir (P-S MBP) located on the Belle Fourche River below Moorcroft, Wyoming, has a conservation capacity of 188,671 acre-feet, (182,079 acre-feet active) and 140,463 acre-feet of exclusive flood control space. It was constructed to furnish a supplemental irrigation supply to 57,000 acres in the Belle Fourche Project and for flood control. Keyhole Reservoir is subject to the Belle Fourche River Compact, and the inflows and storage in the reservoir are allocated 10 percent to Wyoming users and 90 percent to South Dakota users, subject to prior rights. On January 3, 1963, the Belle Fourche Irrigation District executed a long-term contract for the use of 7.7 percent of active storage space in the reservoir. This space will be used to store water belonging to the irrigation district under its prior water right along with the District's pro rata share of storable inflows to Keyhole Reservoir. On January 1, 1985, the Crook County Irrigation District's Contract for 18,080 acre-feet of space in Keyhole Reservoir became effective. The allocated space is used by each organization to store its pro rata share of inflows to Keyhole Reservoir. The flood control space at Keyhole Reservoir is all located above an ungated spillway. The spillway capacity is 11,000 cfs at maximum water surface elevation. The downstream safe channel capacity is 3,000 cfs. Formulas for forecasting inflows have not been developed. Research by the Soil Conservation Service during water years 1992 through 1994 show that inflow forecasting to Keyhole Reservoir is not reliable since there is no consistent snow pack and precipitation is highly cyclical. No further efforts to develop forecast models are planned.

WY 2010 Operations Summary

Keyhole Reservoir started WY 2010 at elevation 4087.47 feet and storage of 100,679 acre-feet, which is 11.83 feet and 87,992 acre-feet below the top of the conservation pool. Inflows for WY 2010 totaled 8,636 acre-feet, (55 percent of the average). Peak inflows occurred in May totaling 5,714 acre-feet for the month. The peak reservoir elevation for WY 2010 was 4090.13 feet, storage of 116,508 acre-feet, and occurred on June 26, 2010. The minimum elevation for WY 2010 was 4087.42 feet, storage of 100,399 acre-feet, and occurred on December 6, 2009. WY 2010 ended at elevation 4088.96 feet and storage of 109,315 acre-feet, which is 10.34 feet and 79,356 acre-feet below the top of the conservation pool. Precipitation for the water year was 107 percent of average.

There were no irrigation releases for WY 2010.

Reclamation's Sedimentation and River Hydraulics Group of the Technical Service Center in Denver conducted a sedimentation survey of Keyhole Reservoir in 2003 and provided a survey report and new area and capacity tables in July of 2005. The last survey was done in 1978. Keyhole Reservoir accumulated 5,082 acre-feet of sediment since the last survey. Since construction in 1952, Keyhole has accumulated 12,495 acre-feet of sediment. The sedimentation rate from 1952 through 2003 has averaged 240 acre-feet per year. The new area and capacity tables were first used in WY 2006.

An Emergency Management/Security Orientation was held January 14, 2010.

A Comprehensive Facility Review (CFR) was conducted April 13 and May 11, 2010 by personnel from the Technical Services Center, Great Plains Regional Office, and Rapid City Field Office.

Monthly Statistics For Water Year 2010

October EOM elevation, at Keyhole Reservoir, was above average. October inflow was much above average. Keyhole ended the month 11.8 feet from full.

November EOM elevation, at Keyhole Reservoir, was above average. November inflow was slightly below average. Keyhole ended the month 11.9 feet from full.

December EOM elevation, at Keyhole Reservoir, was above average. December inflow was much above average. Keyhole ended the month 11.8 feet from full.

January EOM elevation, at Keyhole Reservoir, was above average. January inflow was below average. Keyhole ended the month 11.7 feet from full.

February EOM elevation, at Keyhole Reservoir, was above average. February inflow was below average. Keyhole ended the month 11.7 feet from full.

March EOM elevation, at Keyhole Reservoir, was above average. March inflow was below average. Keyhole ended the month 11.0 feet from full.

April EOM elevation, at Keyhole Reservoir, was above average. April inflow was below average. Mechanical CFR was done on April 13. Keyhole ended the month 10.7 feet from full.

May EOM elevation and May inflow, at Keyhole Reservoir, were above average. Civil CFR was done on May 11. Keyhole ended the month 9.8 feet from full.

June EOM elevation, at Keyhole Reservoir, was above average. June inflows were below average. Keyhole ended the month 9.2 feet from full.

July EOM elevation, at Keyhole Reservoir, was above average. July inflows were below average. Keyhole ended the month 9.5 feet from full.

August EOM elevation, at Keyhole Reservoir, was above average. August inflow was below average. Keyhole ended the month 10.0 feet from full.

September EOM elevation, at Keyhole Reservoir, was above average. September inflow was below average. Keyhole ended the month 10.3 feet from full.

Additional statistical information on Keyhole Reservoir and its operations during 2010 can be found on Table DKT9 and Figure DKG8.

TABLE DKT9
HYDROLOGIC DATA FOR 2010
KEYHOLE RESERVOIR

RESERVOIR ALLOCATIONS	ELEVATION (FEET)	TOTAL RESERVOIR STORAGE (AF)	STORAGE ALLOCATION (AF)
TOP OF INACTIVE AND DEAD	4,051.00	6,592	6,592
TOP OF ACTIVE CONSERVATION	4,099.30	188,671	182,079
TOP OF JOINT USE			
TOP OF EXCLUSIVE FLOOD CONTROL	4,111.50	329,134	140,463

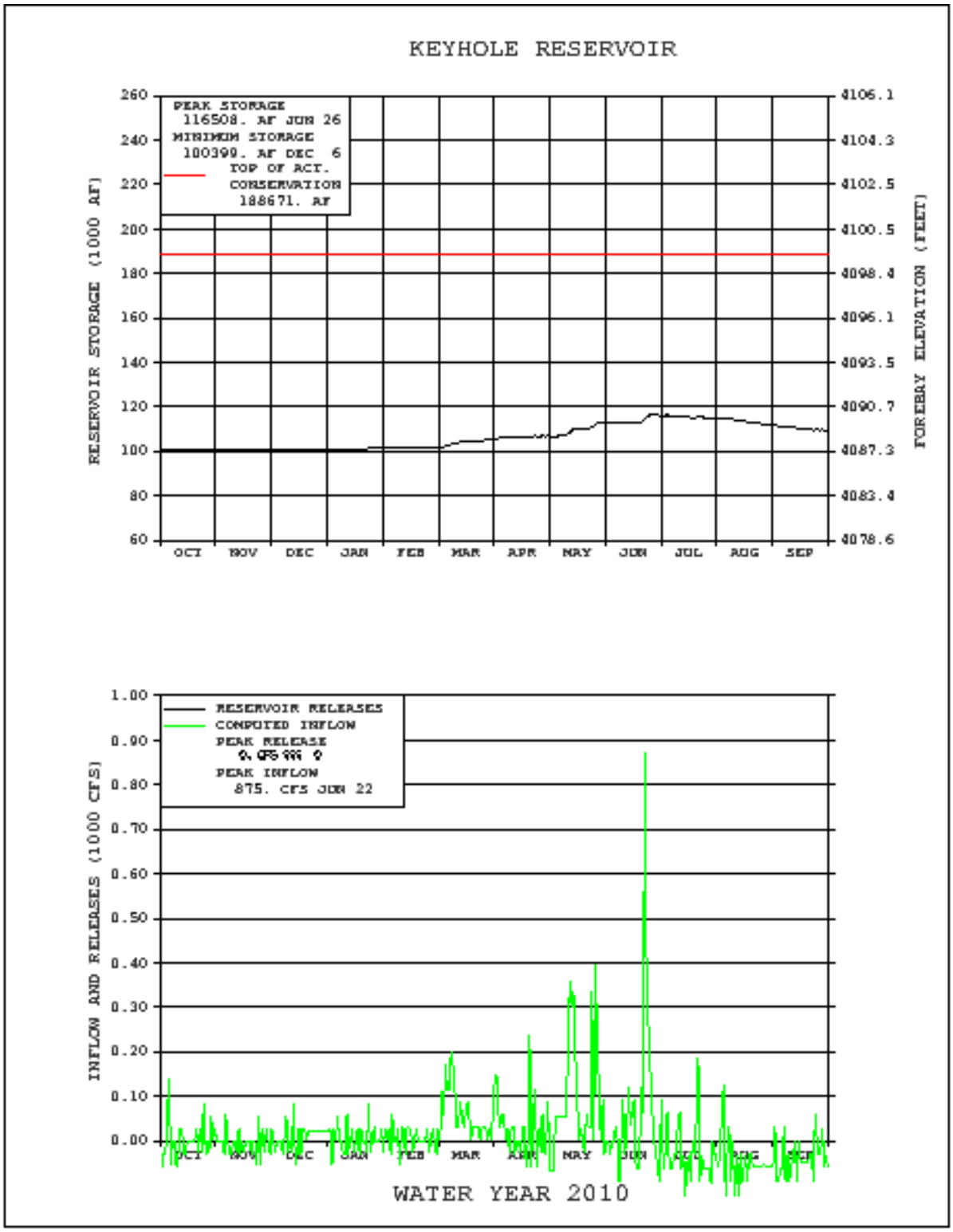
STORAGE-ELEVATION DATA	ELEVATION (FT)	STORAGE (AF)	DATE
BEGINNING OF YEAR	4,087.47	100,679	OCT 01, 2009
END OF YEAR	4,088.96	109,315	SEP 30, 2010
ANNUAL LOW	4,087.42	100,399	DEC 06, 2009
ANNUAL HIGH	4,090.13	116,508	JUN 26, 2010
HISTORIC HIGH	4,100.38	210,222	MAY 21, 1978

INFLOW-OUTFLOW DATA	INFLOW	DATE	OUTFLOW	DATE
ANNUAL TOTAL (AF)	8,636	OCT 09-SEP 10	0	OCT 09-SEP 10
DAILY PEAK (CFS)	875	JUN 22, 2010	0	
DAILY MINIMUM (CFS)	0	*	0	*

MONTH	INFLOW		OUTFLOW		CONTENT	
	AF	% OF AVG	AF	% OF AVG	AF	% OF AVG
OCTOBER	112	NA	0	NA	100,791	115
NOVEMBER	-280	NA	0	NA	100,511	115
DECEMBER	505	401	0	NA	101,016	116
JANUARY	281	63	0	NA	101,297	116
FEBRUARY	281	10	0	NA	101,578	113
MARCH	3,607	55	0	NA	105,185	109
APRIL	1,814	70	0	NA	106,999	111
MAY	5,714	121	0	NA	112,713	113
JUNE	3,418	97	0	NA	116,131	115
JULY	-1,626	NA	0	NA	114,505	119
AUGUST	-2,892	NA	0	NA	111,613	123
SEPTEMBER	-2,298	NA	0	NA	109,315	124
ANNUAL	8,636	54	0	NA		
APRIL-JULY	9,320	93				

*Frequently observed during fall and winter months

DKG8


KEYHOLE RESERVOIR
PEAK STORAGE
116508. AF JUN 26
MINIMUM STORAGE
100399. AF DEC 6
TOP OF ACT.
CONSERVATION
188671. AF
RESERVOIR STORAGE (1000 AF)
FOREBAY ELEVATION (FEET)
260
240
220
200
180
160
140
120
100
80
60
4106.1
4104.3
4102.5
4100.5
4098.4
4096.1
4093.5
4090.7
4087.3
4083.4
4078.6
OCT
NOV
DEC
JAN
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP
RESERVOIR RELEASES
COMPUTED INFLOW
PEAK RELEASE
PEAK INFLOW
875. CFS JUN 22
INFLOW AND RELEASES (1000 CFS)
1.00
0.90
0.80
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
WATER YEAR 2010

Shadehill Reservoir

Background

Shadehill Reservoir, a feature of the Shadehill Unit (P-S MBP), is located on the Grand River near Shadehill, South Dakota, and was constructed for irrigation of 9,700 acres, and for flood control, recreation, and fish and wildlife purposes. The reservoir has a dead and conservation capacity totaling 120,172 acre-feet with an additional exclusive flood control capacity of 230,004 acre-feet and a surcharge capacity of 119,560 acre-feet. Flood control space is all located above the crest of an un-gated glory-hole spillway. Because of the questionable quality of water, it was decided to postpone construction of distribution works for irrigation.

After further study, it was concluded that water from Shadehill Reservoir can be used for sustained irrigation if certain limitations of soils, leaching water, soil amendments, and drainage are met. A definite plan report covering 6,700 acres which meets these limitations has been completed, approved by the Commissioner, and released for distribution.

On December 17, 1963, landowners within the area voted 24 to 21 against formation of an irrigation district. Further action on development of the area was deferred until the attitude of the landowners was more favorable. Pending more extensive irrigation development, an additional 50,272 acre-feet of space between elevations 2260 feet and 2272 feet was allocated to flood control. Allocations and evacuation of this space was made possible by modification of the outlet works in 1969 to permit a discharge of 600 cfs to the river. In June of 1975, the West River Conservancy Sub-District was formed combining all but one of the old individual contracts for water supply from the reservoir into one. Acreage contracted for by the District was 5,000 acres; however, only 3,064 acres were developed. On March 18, 1986, the contract between Reclamation and the West River Conservancy Sub-District was assigned to the Shadehill Water User District, an organization, which succeeded the Sub-District under South Dakota Law. This contract has expired and presently conservation releases are meeting irrigation demands. Should irrigation releases be required a temporary water service contract will need to be executed with the Shadehill Water User District.

Because certain release criteria reduced the effectiveness of flood control operations in the zone between elevation 2260 feet and 2272 feet, and because the Corps of Engineers has constructed Bowman Haley Reservoir upstream from Shadehill Reservoir with 53,800 acre-feet of flood control space, the Corps requested that the interim flood control agreement be terminated and that responsibility for the operations of Shadehill Reservoir when the pool is between elevations 2260 feet and 2272 feet revert to Reclamation. By a revised field working agreement dated May 15, 1972, it was agreed that the space between elevation 2260 feet and 2272 feet (50,272 acre-feet) be reallocated to conservation use. However, space below elevation 2272 feet will continue to be evacuated before the start of the spring runoff, but to a lesser extent than in the past.

WY 2010 Operations Summary

Shadehill Reservoir started WY 2010 at elevation 2268.67 feet and storage of 104,205 acre-feet, which is 3.33 feet and 15,967 acre-feet below the top of the conservation pool. Inflows for WY 2010 totaled 89,270 acre-feet, (124 percent of the average). Peak inflows occurred in May totaling 20,877 acre-feet for the month. The peak reservoir elevation for WY 2010 was 2273.29 feet, storage of 126,777 acre-feet, and occurred on May 26, 2010. The minimum elevation for WY 2010 was 2265.79 feet, storage of 91,599 acre-feet, and occurred on March 17, 2010. WY 2010 ended at elevation 2269.03 feet and storage of 105,860 acre-feet, which is 2.97 feet and 14,312 acre-feet below the top of the conservation pool. Precipitation for the water year was 150 percent of average.

All project irrigation demands were met from river maintenance releases. There were no storage releases for irrigation needed during water year 2010.

An Emergency Management/Security orientation was conducted on March 30, 2010.

A Periodic Facility Review (PFR) was conducted August 7, 2010, by personnel from the Great Plains Regional Office and the Rapid City Field Office.

Contract R10PX60216 Shadehill Dam Service Spillway Rip-Rap Repair, was awarded to Miller Construction Company for $50,822.05. The contract was substantially complete in September 2010.

Monthly Statistics For Water Year 2010

October EOM elevation, at Shadehill Reservoir, was above average. October inflow was much above average. Controlled release at 71 cfs. Shadehill finished the month 3.9 feet from full.

November EOM elevation, at Shadehill Reservoir, was above average. November inflow was above average. Controlled release at 49 cfs. Shadehill finished the month 4.5 feet from full.

December EOM elevation, at Shadehill Reservoir, was above average. December inflow was below average. Controlled release at 49 cfs. Shadehill finished the month 5.0 feet from full.

January EOM elevation, at Shadehill Reservoir, was above average. January inflow was below average. Controlled release at 48 cfs. Shadehill finished the month 5.5 feet from full.

February EOM elevation, at Shadehill Reservoir, was above average. February inflow was below average. Controlled release at 48 cfs. Shadehill finished the month 6.0 feet from full.

March EOM elevation, at Shadehill Reservoir, was above average. March inflow was below average. Controlled release at 52 cfs. Emergency Management Security Orientation was done on March 30. Shadehill ended the month 2.4 feet from full.

April EOM elevation, at Shadehill Reservoir, was above average. April inflow was below average. Internal Alert declared on April 9, when Forebay reached 2272.0 feet. Combined (spillway and controlled) release at 125 cfs. Shadehill ended the month 0.3 feet into the flood pool.

May EOM elevation and May inflow, at Shadehill Reservoir, were much above average. Combined (spillway and controlled) release at 542 cfs. Shadehill ended the month 0.3 feet into the flood pool.

June EOM elevation and June inflow, at Shadehill Reservoir, were above average. Remain in Internal Alert. Combined (spillway and controlled) release at 192 cfs. Shadehill ended the month 0.1 feet into the flood pool.

July EOM elevation, at Shadehill Reservoir, was above average. July inflow was the 5th highest in 58 years on record. Cancel Internal Alert on July 3, then declared another Internal Alert for the period July 24 to July 31 because of high inflows. Controlled release at 150 cfs. Shadehill ended the month 0.0 feet into the flood pool.

August EOM elevation, at Shadehill Reservoir, was above average. August inflow was much above average. Controlled release at 75 cfs. Shadehill ended the month 2.0 feet from full.

September EOM elevation, at Shadehill Reservoir, was above average. September inflow was 4th highest in 58 years of record. Controlled release at 100 cfs. Shadehill ended the month 3.0 feet from full.

Additional statistical information on Shadehill Reservoir and its operations during 2010 can be found on Table DKT10 and Figure DKG9.

TABLE DKT10
HYDROLOGIC DATA FOR 2010
SHADEHILL RESERVOIR

RESERVOIR ALLOCATIONS	ELEVATION (FEET)	TOTAL RESERVOIR STORAGE (AF)	STORAGE ALLOCATION (AF)
TOP OF INACTIVE AND DEAD	2,250.80	43,869	43,869
TOP OF ACTIVE CONSERVATION	2,272.00	120,172	76,303
TOP OF JOINT USE			
TOP OF EXCLUSIVE FLOOD CONTROL	2,302.00	350,176	230,004

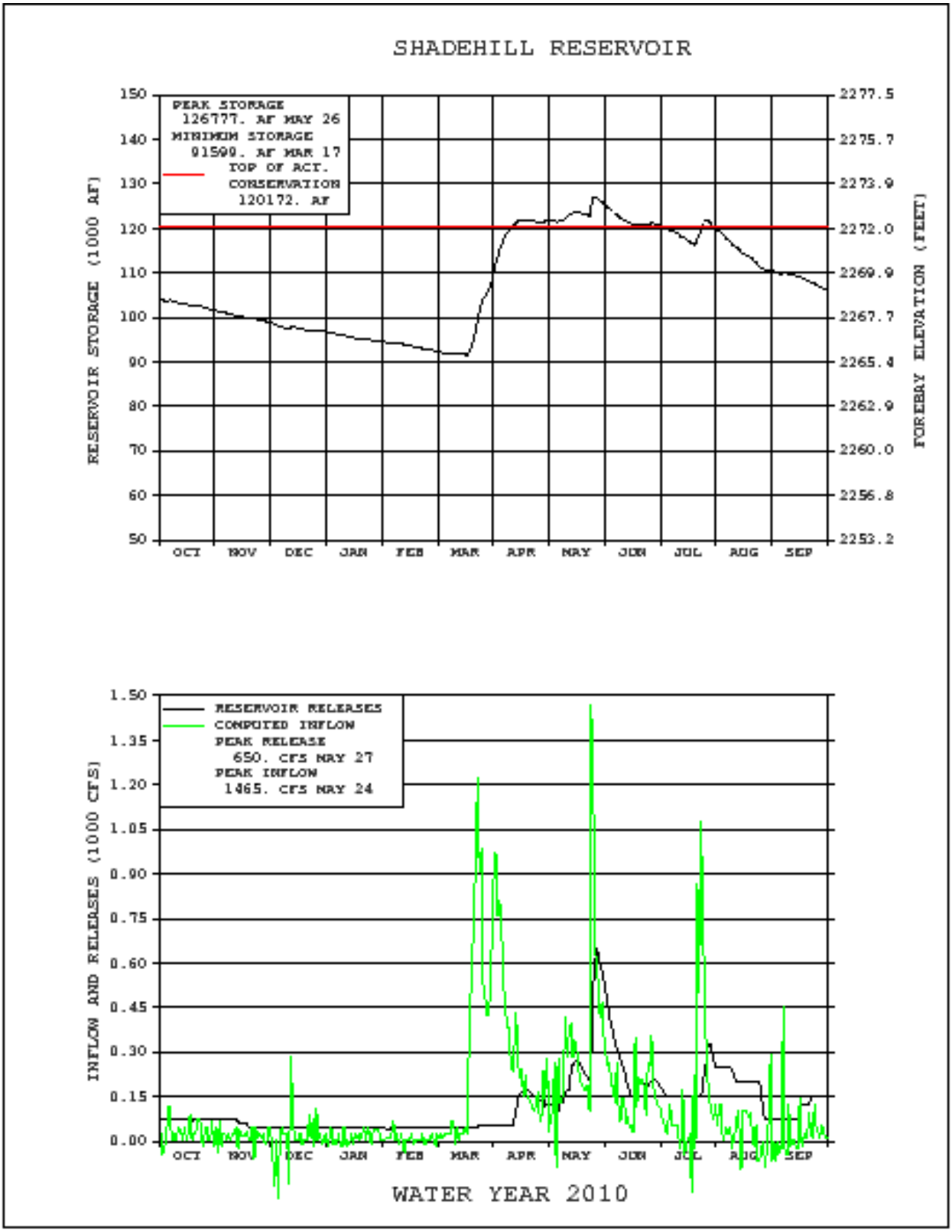
STORAGE-ELEVATION DATA	ELEVATION (FT)	STORAGE (AF)	DATE
BEGINNING OF YEAR	2,268.67	104,205	OCT 01, 2009
END OF YEAR	2,269.03	105,860	SEP 30, 2010
ANNUAL LOW	2,265.79	91,599	MAR17, 2010
ANNUAL HIGH	2,273.29	126,777	MAY 26, 2010
HISTORIC HIGH	2,297.90	318,438	APR 10, 1952

INFLOW-OUTFLOW DATA	INFLOW	DATE	OUTFLOW	DATE
ANNUAL TOTAL (AF)	89,270	OCT 09-SEP 10	87,615	OCT 09-SEP 10
DAILY PEAK (CFS)	1,465	MAY 24, 2010	650	MAY 27,2010,
DAILY MINIMUM (CFS)	0	*	38	FEB 01,2010

MONTH	INFLOW		OUTFLOW		CONTENT	
	AF	% OF AVG	AF	% OF AVG	AF	% OF AVG
OCTOBER	1,843	372	4,426	141	101,622	92
NOVEMBER	947	132	3,575	140	98,994	91
DECEMBER	637	90	3,002	124	96,629	91
JANUARY	811	89	2,965	128	94,475	90
FEBRUARY	425	14	2,588	126	92,312	87
MARCH	19,121	85	2,965	31	108,468	91
APRIL	19,937	95	6,618	37	121,787	99
MAY	20,877	194	17,187	171	125,477	102
JUNE	10,092	117	14,894	182	120,675	97
JULY	10,630	306	11,283	215	120,022	98
AUGUST	2,109	1,152	11,632,	266	110,499	94
SEPTEMBER	1,841	NA	6,480	182	105,860	93
ANNUAL	89,270	124	87,615	124		
APRIL-JULY	61,536	140				

*Frequently observed during fall and winter months

DKG9


SHADEHILL RESERVOIR
PEAK STORAGE
126777. AF MAY 26
MINIMUM STORAGE
91599. AF MAR 17
TOP OF ACT.
CONSERVATION
120172. AF
RESERVOIR STORAGE (1000 AF)
FOREBAY ELEVATION (FEET)
150
140
130
120
110
100
90
80
70
60
50
2277.5
2275.7
2273.9
2272.0
2269.9
2267.7
2265.4
2262.9
2260.0
2256.8
2253.2
OCT
NOV
DEC
JAN
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP
RESERVOIR RELEASES
COMPUTED INFLOW
PEAK RELEASE
650. CFS MAY 27
PEAK INFLOW
1465. CFS MAY 24
INFLOW AND RELEASES (1000 CFS)
1.50
1.35
1.20
1.05
0.90
0.75
0.60
0.45
0.30
0.15
0.00
WATER YEAR 2010

Belle Fourche Reservoir

Background

Belle Fourche Reservoir, located near Belle Fourche, South Dakota, is formed by Belle Fourche Dam on Owl Creek, a tributary of the Belle Fourche River. It has a total capacity of 172,873 acre-feet, (169,790 acre-feet active). The reservoir is filled by diverting water from the Belle Fourche River through the Inlet Canal, which has a capacity of 1,300 cfs. The reservoir is used for irrigation of 57,000 acres in the Belle Fourche Project, which also receives a supplemental supply from Keyhole Reservoir. From November 1965 through May 1977, the active capacity of the reservoir was temporarily limited to 160,300 acre-feet at elevation 2981.8 feet until the damaged spillway was replaced.

When the Belle Fourche Reservoir storage right is satisfied by the reservoir filling, the South Dakota Department of Environment and Natural Resources provide guidelines for complying with water rights on the Belle Fourche River. The District is required to continue to bypass 5 cfs for domestic use prior to diverting the Johnson Lateral Water Right for up to 40 cfs. If flows into the diversion dam are greater than 45 cfs, the District is required to bypass up to 60 cfs for downstream irrigation rights. Any flows in excess of these amounts can be diverted into the reservoir and stored. If all of these rights are not needed, the District can divert flows into the reservoir.

Water Year 2010 Operations Summary

Belle Fourche Reservoir started WY 2010 at elevation 2967.51 feet and storage of 117,891 acre-feet, which is 7.49 feet and 54,982 acre-feet below the top of the conservation pool. Inflows for WY 2010 totaled 73,693 acre-feet, which was 64 percent of the average. The inflows were low because the Inlet Canal was shut off from mid November 2009 to mid March 2010 and then again in parts of April and May 2010 due to high reservoir water levels. Peak inflows occurred in April totaling 16,009 acre-feet for the month, which was 115 percent of average. The peak reservoir elevation for WY 2010 was 2974.81 feet, storage of 171,349 acre-feet, and occurred on June 25, 2010. The minimum elevation for WY 2010 was 2964.98 feet, storage of 102,248 acre-feet, and occurred on September 30, 2010. WY 2010 ended at elevation 2964.98 feet and storage of 102,248 acre-feet, which is 10.02 feet and 70,625 acre-feet below the top of the conservation pool. Precipitation for the water year was 105 percent of average.

Water users were allocated 18 inches of water, a full allocation, for the 2010 irrigation season.

The Inlet Canal was turned on March 22, 2010. The North Canal and South Canals were turned on June 14, 2010. South Canal shut off on September 27 and North Canal was not shut off until October 1, 2010, in WY 2011. Irrigation releases for the 2010 season were North Canal 49,106 acre-feet, South Canal 37,961 acre-feet, and Inlet Canal-Johnson Lateral 4,406 acre-feet for a total of 91,473 acre-feet.

An Emergency Management Tabletop Exercise was held February 24, 2010.

The annual settlement survey was completed. This survey is done approximately 1 month after the peak elevation for the year has occurred in the reservoir. Inclinometer readings were taken quarterly as required by the periodic monitoring schedule.

A Periodic Facility Review (PFR) was conducted September 13, 2010, by personnel from the Great Plains Regional Office and the Rapid City Field Office.

Reclamation's Sedimentation and River Hydraulics Group (of the Technical Service Center in Denver) conducted a sedimentation survey of Belle Fourche Reservoir in 2006 and provided a survey report and new area and capacity tables in April 2007. The last survey was done in 1949. Belle Fourche Reservoir accumulated 19,204 acre-feet since the 1949 survey and 36,364 acre-feet since the original survey in 1910. The sedimentation rate from 1910 through 2006 averages 375 acre-feet per year. The new area and capacity tables were first used in WY 2008.

Monthly Statistics For Water Year 2010

October EOM elevation, at Belle Fourche Reservoir, was the 3rd highest in 58 years of record. October inflow was above average. North Canal shut off on October 9. Belle Fourche ended the month 5.9 feet from full.

November EOM elevation, at Belle Fourche Reservoir, was the 3rd highest in 58 years of record. November inflow was above average. Inlet Canal shut off on November 20. Belle Fourche ended the month 4.7 feet from full.

December EOM elevation, at Belle Fourche Reservoir, was the 5th highest in 58 years of record. December inflow was below average. (Inlet Canal shut off-only natural inflows.) Belle Fourche ended the month 4.7 feet from full.

January EOM elevation, at Belle Fourche Reservoir, was much above average. January inflow was below average. (Inlet Canal shut off-only natural inflows.) Belle Fourche ended the month 4.7 feet from full.

February EOM elevation, at Belle Fourche Reservoir, was above average. February inflow was below average. (Inlet Canal shut off-only natural inflows.) Emergency Management Tabletop Exercise done on February 24. Belle Fourche ended the month 4.7 feet from full.

March EOM elevation, at Belle Fourche Reservoir, was above average. March inflow was below average. Began 200 cfs release to Inlet Canal on March 22. Belle Fourche ended the month 3.0 feet from full.

April EOM elevation, at Belle Fourche Reservoir, was much above average. April inflow was above average. Internal Alert declared on April 24, when Forebay reached 2974.0 feet. Associated Facility Review done on April 27. Belle Fourche ended the month 0.9 feet from full.

May EOM elevation, at Belle Fourche Reservoir, was above average. May inflow was much below average (Inlet Canal shut off). Began filling canals on May 24. Belle Fourche ended the month 0.4 feet from full.

June EOM elevation, at Belle Fourche Reservoir, was much above average. No diversions to reservoir were made during June. Began filling canals on June 14. Remain in Internal Alert. Belle Fourche ended the month 0.3 feet from full.

July EOM elevation, at Belle Fourche Reservoir, was much above average. July inflow was above average. Cancel Internal Alert when elevation dropped below 2274.0 feet on July 12. Belle Fourche ended the month 3.6 feet from full.

August EOM elevation, at Belle Fourche Reservoir, was 4th highest in 58 years of record. August inflow was much above average. Belle Fourche ended the month 6.7 feet from full.

September EOM elevation, at Belle Fourche Reservoir, was much above average. Inlet Canal shut off on September 1 for lining installation. South Canal shut off on September 24. Belle Fourche ended the month 10.0 feet from full.

Additional statistical information on Belle Fourche Reservoir and its operations during 2010 can be found on Table DKT11 and Figure DKG10.

TABLE DKT11
HYDROLOGIC DATA FOR 2010
BELLE FOURCHE RESERVOIR

RESERVOIR ALLOCATIONS	ELEVATION (FEET)	TOTAL RESERVOIR STORAGE (AF)	STORAGE ALLOCATION (AF)
TOP OF INACTIVE AND DEAD	2,927.00	3,083	3,083
TOP OF ACTIVE CONSERVATION	2,975.00	172,873	169,790
TOP OF JOINT USE			
TOP OF EXCLUSIVE FLOOD CONTROL			

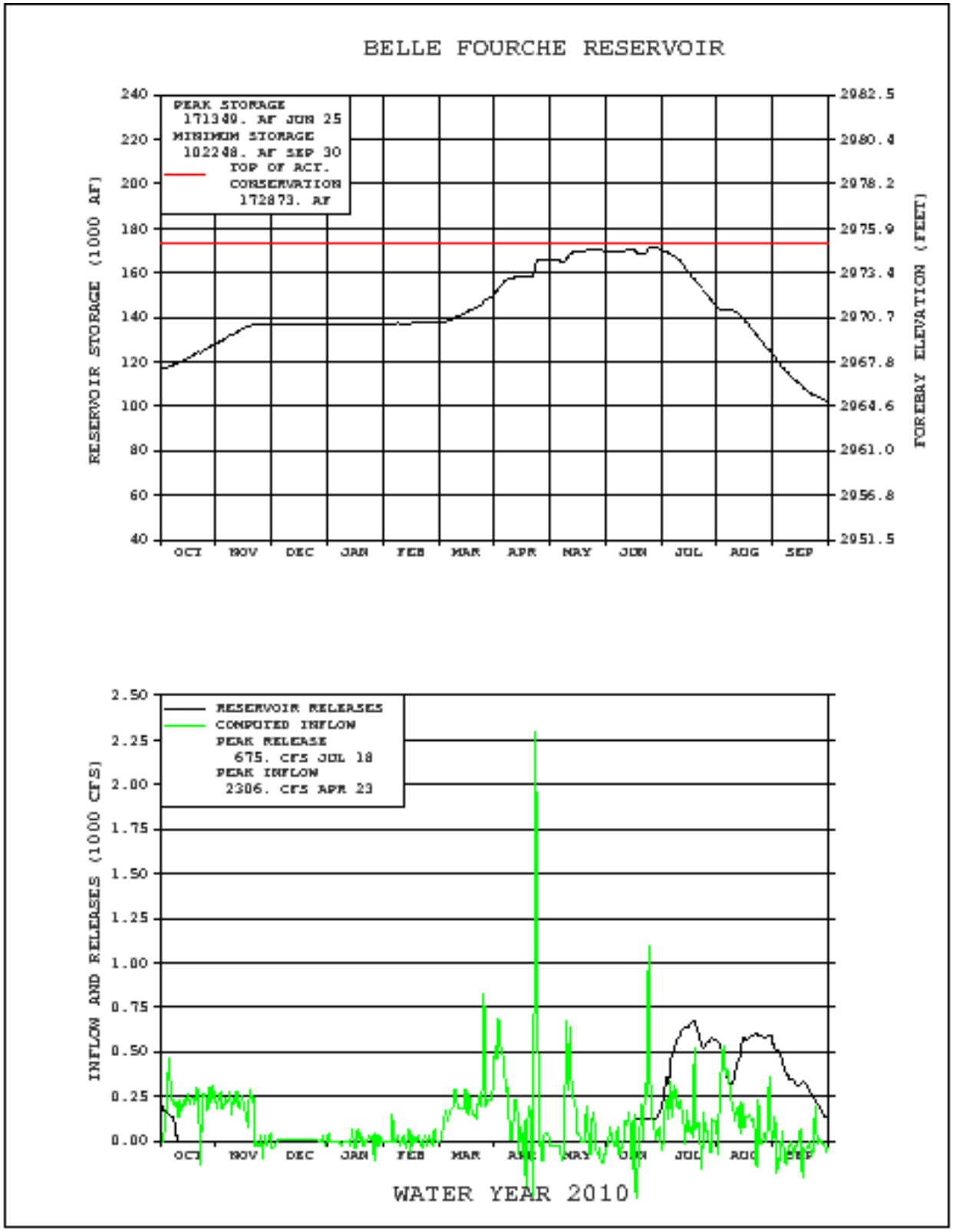
STORAGE-ELEVATION DATA	ELEVATION (FT)	STORAGE (AF)	DATE
BEGINNING OF YEAR	2,967.51	117,891	OCT 01, 2009
END OF YEAR	2,964.98	102,248	SEP 30, 2010
ANNUAL LOW	2,964.98	102,248	SEP 30, 2010
ANNUAL HIGH	2,974.81	171,349	JUN 25, 2010
HISTORIC HIGH	2,975.92	180,387	JUN 07, 2008

INFLOW-OUTFLOW DATA	INFLOW	DATE	OUTFLOW	DATE
ANNUAL TOTAL (AF)	73,693	OCT 09-SEP 10	89,336	OCT 09-SEP 10
DAILY PEAK (CFS)	2,306	APR 23, 2010	675	JUL 18, 2010
DAILY MINIMUM (CFS)	0	*	0	*

MONTH	INFLOW		OUTFLOW		CONTENT	
	AF	% OF AVG	AF	% OF AVG	AF	% OF AVG
OCTOBER	12,949	126	2,421	414	128,419	181
NOVEMBER	8,335	84	0	NA	136,754	171
DECEMBER	73	1	0	NA	136,827	153
JANUARY	0	NA	0	NA	136,827	139
FEBRUARY	505	5	0	NA	137,332	127
MARCH	12,369	76	0	NA	149,701	120
APRIL	16,009	115	0	NA	165,710	120
MAY	3,962	27	0	NA	169,672	117
JUNE	4,769	41	3,732	23	170,709	121
JULY	7,186	196	32,818	88	145,077	135
AUGUST	9,491	441	31,662	89	122,906	166
SEPTEMBER	-1,955	NA	18,703	110	102,248	166
ANNUAL	73,693	64	89,336	78		
APRIL-JULY	31,926	73				

*Frequently observed during fall and winter months

DKG10


BELLE FOURCHE RESERVOIR
PEAK STORAGE
171340. AF JUN 25
MINIMUM STORAGE
102248. AF SEP 30
TOP OF ACT.
CONSERVATION
172873. AF
RESERVOIR STORAGE (1000 AF)
FOREBAY ELEVATION (FEET)
240
220
200
180
160
140
120
100
80
60
40
2982.5
2980.4
2978.2
2975.9
2973.4
2970.7
2967.8
2964.6
2961.0
2956.8
2951.5
OCT
NOV
DEC
JAN
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP
RESERVOIR RELEASES
COMPUTED INFLOW
PEAK RELEASE
675. CFS JUL 18
PEAK INFLOW
2306. CFS APR 23
INFLOW AND RELEASES (1000 CFS)
2.50
2.25
2.00
1.75
1.50
1.25
1.00
0.75
0.50
0.25
0.00
WATER YEAR 2010

OPERATING PLANS FOR WATER YEAR 2011

Clark Canyon Reservoir

Three operating plans were prepared for 2011 to show the operations of Clark Canyon Reservoir which could occur under various runoff conditions. These operations for the three runoff conditions are shown in Table MTT12A-C and Figure MTG13. These plans are presented only to show the probable limits of operations; therefore, unpredictable conditions may cause the actual operations to vary widely from the plans presented here. Flood control operations will be coordinated with the U. S. Army Corps of Engineers (Corps) as specified by the Flood Control Regulations. The Corps will issue instructions on release rates when storage rises into or above the joint use space reserved for flood control.

The objectives of operations of Clark Canyon Reservoir are to meet all conservation commitments, to provide flood control in cooperation with the Corps, and meet fish, wildlife, and recreational needs. The reservoir is generally operated under the following criteria and limitations.

(1) During the fall and winter, releases are adjusted to allow storage to reach no higher than 154,195 acre-feet at elevation 5542.10 feet by March 1.

(2) From inflow forecasts prepared during January through the end of the spring runoff season, based on existing snow water content, releases are adjusted to allow storage to fill to 174,367 acre-feet at elevation 5546.10 feet during late May or early June.

(3) During May-September, reservoir releases are adjusted to meet downstream irrigation demands or to control storage in the flood pool if storage increases above the top of the joint use pool. If the Corps requests replacement storage, the reservoir is allowed to fill as high as 230,822 acre-feet at elevation 5556.50 feet.

(4) Whenever an adequate water supply is available, releases from Clark Canyon Dam will be maintained at rates to sustain flows in the Beaverhead River below Clark Canyon Dam between 100-200 cfs. During below normal runoff years, it may be necessary to reduce the releases to as low as 25-30 cfs in the Beaverhead River below Clark Canyon Dam, the absolute minimum flow required to protect the river fishery.

(5) Whenever possible, stable flows are maintained during October through the spring to enhance the fish spawning conditions. Large fluctuations in winter release changes will be avoided whenever possible to prevent any flooding from occurring as a result of ice jams.

The total annual inflow to Clark Canyon Reservoir during 2010 was 230,521 acre-feet, 87 percent of normal. Storage on September 30, 2010, was 142,912 acre-feet at elevation 5539.78 feet, 115 percent of average for the end of September.

Storage in Lima Reservoir, a private facility located upstream of Clark Canyon Reservoir, ended water year 2010 at 157 percent of average.

Depending on snowpack and storage conditions Lima Reservoir may store much of the early season runoff during 2011 from the Red Rock River drainage.

Clark Canyon Reservoir is expected to fill during 2011 under all probable runoff conditions. Water levels under the minimum runoff conditions are expected to peak in early May near or above the top of the joint-use pool. However, in the most probable and maximum probable runoff condition the water level in Clark Canyon is expected to peak in late May at or above the top of the joint-use pool. Under all three plans winter releases are expected to be reduced to approximately 210 cfs, upon close coordination with Montana Fish, Wildlife, and Parks. No irrigation shortages are expected to occur under any of the plans.

The most probable October through February inflows were estimated to transition from 40 percentile inflows or inflows that are historically exceeded 60 percent of the time to 45 percentile inflows of flows that would be exceeded 55 percent of the time. Inflows during March-June were estimated to transition from 45 percentile inflows, inflows that are historically exceeded 55 percent of the time to 60 percentile inflows or inflows that are historically exceeded 40 percent of the time. Inflows from July through September were estimated to transition from 45 percentile inflows that are historically exceeded 55 percent of the time to average inflows.

The minimum probable October through September inflows, with the exception of May, were estimated to equal approximately 25 to 30 percentile inflows or inflows that are historically exceeded 70 to75 percent of the time. Inflows during May were estimated to equal 50 percentile inflows or inflows that are historically exceeded 50 percent of the time.

The maximum probable October through November inflows were estimated to equal 74 percentile inflows or inflows that are historically exceeded 26 percent of the time. The December through September inflows were estimated to equal 84 percentile inflows or inflows that are historically exceeded 16 percent of the time.

TABLE MTT12A

CLARK CANYON RESERVOIR OPERATING PLAN
Based on October 1 2010 Inflow Estimates

2011 Minimum Probable Plan

	2010	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Clark Canyon Reservoir		Initial Cont:		142.9 kaf		Minimum Cont:		10.0 kaf		Maximum Cont:		310.1 kaf		
			Elev:	5539.78 ft			Elev: 5489.22 ft					Elev: 5569.57 ft		
Hydrology	2010	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Monthly Inflow	kaf	14.8	16.0	13.7	12.6	12.2	14.8	14.5	21.4	21.0	17.8	13.3	13.5	185.6
Evaporation Loss	kaf	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
River Release	kaf	16.9	9.4	9.6	9.6	8.7	7.4	7.1	24.7	36.0	48.7	33.6	8.8	220.5
River Release	cfs	275	158	156	156	157	120	119	402	605	792	546	148	
Min Release	cfs	275	100	100	100	100	120	120	28	28	28	28	28	
Excess Release	kaf	0.0	3.4	3.5	3.5	3.1	0.0	0.0	0.0	0.0	3.1	3.1	3.0	
Gordon Spring Gain	kaf	1.5	1.5	1.5	1.5	1.4	1.5	1.5	1.5	1.5	1.5	1.5	1.5	
End-Month Elevation	ft	5539.34	5540.71	5541.55	5542.16	5542.87	5544.34	5545.80	5545.15	5542.16	5535.57	5530.71	5531.88	
End-Month Content	kaf	140.8	147.4	151.5	154.5	158.0	165.4	172.8	169.5	154.5	123.6	103.3	108.0	
Net Change Content	kaf	-2.1	6.6	4.1	3.0	3.5	7.4	7.4	-3.3	-15.0	-30.9	-20.3	4.7	-34.9
Diversions	2010	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
East Bench Demand	kaf								8.1	10.2	13.8	5.8	0.8	38.7
East Bench Req Rels	kaf								14.7	18.6	25.1	10.5	1.4	70.3
East Bench Div	kaf								14.7	18.6	25.1	10.5	1.4	70.3
East Bench Short	kaf													
CCWSC Tot Demand	kaf								15.8	23.3	28.9	25.3	4.9	98.2
CCWSC Req Rels	kaf								10.0	14.7	18.2	15.9	3.1	61.9
CCWSC Div	kaf								10.0	14.7	18.2	15.9	3.1	61.9
CCWSC Shortage	kaf													
Non-proj Demand	kaf								2.4	6.7	6.0	8.9	4.4	28.4

TABLE MTT12B

CLARK CANYON RESERVOIR OPERATING PLAN
Based on October 1 2010 Inflow Estimates

2011 Most Probable Plan

	2010	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Clark Canyon Reservoir		Initial Cont:		142.9 kaf		Minimum Cont:		10.0 kaf		Maximum Cont:		310.1 kaf		
			Elev:	5539.78 ft			Elev: 5489.22 ft					Elev: 5569.57 ft		
Hydrology	2010	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Monthly Inflow	kaf	19.5	20.2	19.1	16.0	14.5	18.3	19.6	21.0	41.0	22.6	19.4	20.1	251.3
Evaporation Loss	kaf	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
River Release	kaf	17.8	12.5	12.9	15.2	13.8	14.1	13.6	16.8	41.4	53.7	38.5	21.2	271.5
River Release	cfs	289	210	210	247	248	229	229	273	696	873	626	356	
Min Release	cfs	290	210	210	210	210	200	200	50	50	50	50	50	
Excess Release	kaf	0.0	0.0	0.0	2.3	2.1	1.8	1.7	1.7	5.4	9.4	9.3	9.0	
Gordon Spring Gain	kaf	1.5	1.5	1.5	1.5	1.4	1.5	1.5	1.5	1.5	1.5	1.5	1.5	
End-Month Elevation	ft	5540.13	5541.72	5542.97	5543.13	5543.27	5544.11	5545.29	5546.11	5546.03	5539.78	5535.62	5535.37	
End-Month Content	kaf	144.6	152.3	158.5	159.3	160.0	164.2	170.2	174.4	174.0	142.9	123.8	122.7	
Net Change Content	kaf	1.7	7.7	6.2	0.8	0.7	4.2	6.0	4.2	-0.4	-31.1	-19.1	-1.1	-20.2
Diversions	2010	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
East Bench Demand	kaf								5.4	10.2	13.5	5.8	3.8	38.7
East Bench Req Rels	kaf								9.8	18.5	24.6	10.5	6.9	70.3
East Bench Div	kaf								9.8	18.5	24.6	10.5	6.9	70.3
East Bench Short	kaf													
CCWSC Tot Demand	kaf								8.8	24.4	28.9	27.3	8.9	98.3
CCWSC Req Rels	kaf								5.6	15.4	18.2	17.2	5.6	62.0
CCWSC Div	kaf								5.6	15.4	18.2	17.2	5.6	62.0
CCWSC Shortage	kaf													
Non-proj Demand	kaf								1.9	5.7	4.7	4.7	1.9	18.9

TABLE MTT12C

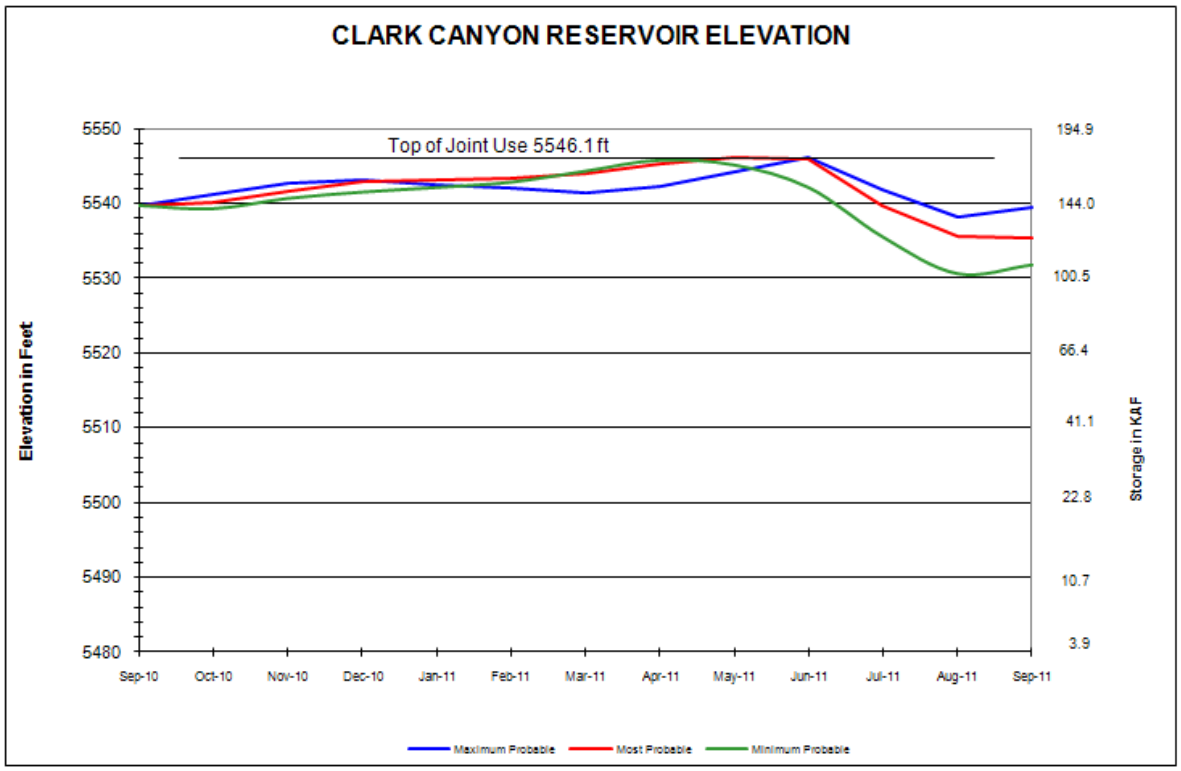
CLARK CANYON RESERVOIR OPERATING PLAN
Based on October 1 2010 Inflow Estimates

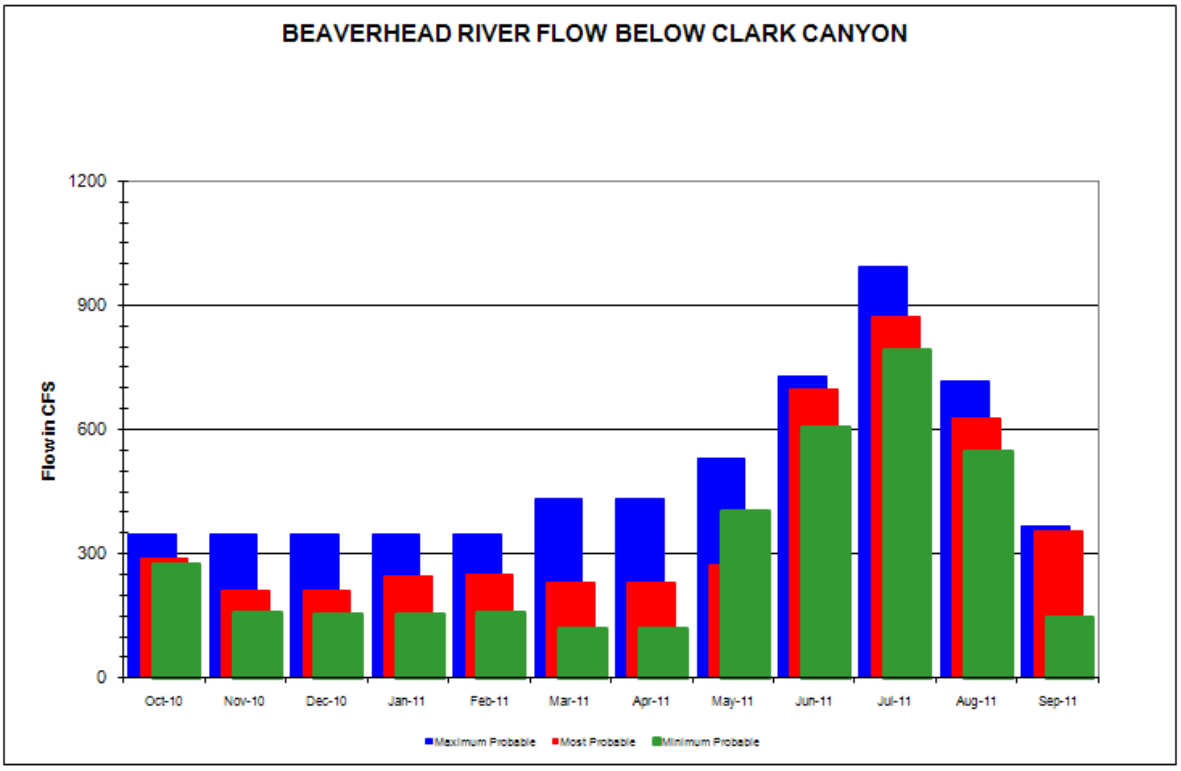
2011 Maximum Probable Plan

	2010	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Clark Canyon Reservoir		Initial Cont: 142.9 kaf					Minimum Cont: 10.0 kaf				Maximum Cont: 310.1 kaf			
				Elev: 5539.78 ft				Elev: 5489.22 ft				Elev: 5569.57 ft		
Hydrology	2010	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Monthly Inflow	kaf	28.4	27.3	23.7	18.8	17.0	22.8	30.0	43.0	53.1	39.0	26.7	27.9	357.7
Evaporation Loss	kaf	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
River Release	kaf	21.3	20.6	21.3	21.4	19.3	26.6	25.8	32.6	43.4	61.0	44.1	21.7	359.1
River Release	cfs	346	346	346	348	348	433	434	530	729	992	717	365	
Min Release	cfs	140	140	140	140	140	300	300	100	100	100	100	100	
Excess Release	kaf	12.7	12.3	12.7	12.8	11.5	8.2	7.9	8.2	8.0	16.2	16.2	15.7	
Gordon Spring Gain	kaf	1.5	1.5	1.5	1.5	1.4	1.5	1.5	1.5	1.5	1.5	1.5	1.5	
End-Month Elevation	ft	5541.25	5542.61	5543.09	5542.57	5542.10	5541.33	5542.18	5544.26	5546.16	5541.80	5538.16	5539.48	
End-Month Content	kaf	150.0	156.7	159.1	156.5	154.2	150.4	154.6	165.0	174.7	152.7	135.3	141.5	
Net Change Content	kaf	7.1	6.7	2.4	-2.6	-2.3	-3.8	4.2	10.4	9.7	-22.0	-17.4	6.2	-1.4
Diversions	2010	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
East Bench Demand	kaf								8.1	10.2	13.8	5.8	0.8	38.7
East Bench Req Rels	kaf								14.7	18.6	25.1	10.5	1.4	70.3
East Bench Div	kaf								14.7	18.6	25.1	10.5	1.4	70.3
East Bench Short	kaf													
CCWSC Tot Demand	kaf								15.8	23.4	28.9	25.3	4.9	98.3
CCWSC Req Rels	kaf								10.0	14.7	18.2	15.9	3.1	61.9
CCWSC Div	kaf								10.0	14.7	18.2	15.9	3.1	61.9
CCWSC Shortage	kaf													
Non-proj Demand	kaf								1.9	5.7	4.7	4.7	1.9	18.9

FIGURE MTG13

CLARK CANYON RESERVOIR





WATER YEAR 2011

Canyon Ferry Lake and Powerplant

Three operating plans were prepared for 2011 to show the operations of Canyon Ferry Lake which could occur under various runoff conditions. These operations for the three runoff conditions are shown in Tables MTT13A-C and Figure MTG14. These plans are presented only to show the probable limits of operations; therefore, actual conditions and operations could vary widely from the plans in order to comply with the authorized project purposes and the current general operating criteria established for Canyon Ferry Dam and Lake.

Power operations will be closely coordinated with Pennsylvania Power and Light, MT (PPL-MT), formerly known as Montana Power Company (MPC), as specified in the formal Agreement to Coordinate Hydroelectric Power Operations dated March 1972. Flood control operations will be coordinated with the Corps of Engineers (Corps) as specified by the Flood Control Regulations Report dated March 1972. The Corps will issue instructions on release rates when storage rises into or above the joint use space reserved for flood control. Both of these documents are on file and available for review at the Bureau of Reclamation's Montana Area Office.

The objectives of operations at Canyon Ferry are to meet all conservation commitments, to provide flood control in cooperation with the Corps, and to coordinate all operations with PPL-MT to achieve optimum benefits from the water resource. Except for special operations, the reservoir is generally operated under the following criteria and limitations:

(1) The top 3 feet between elevations 3797 feet (1,891,888 acre-feet) and 3800 feet (1,992,977 acre-feet) are used exclusively for downstream flood control and when storage rises into this pool, operation of the reservoir is directed by the Corps. This storage is generally evacuated as fast as downstream conditions permit.

(2) As soon as storage has peaked, usually in June or July, power releases are adjusted so that the pool will be drawn to near elevation 3780-3782 feet (1,358,973-1,416,767 acre-feet) by the following April 1. Each month inflows are re-evaluated and releases are adjusted accordingly. Releases to meet this schedule are limited to powerplant capacity. Water is generally not spilled to provide this drawdown.

(3) In accordance with operating procedures outlined in the license for the Madison-Missouri Hydro-electric Project, FERC Project No. 2188, most of the water stored in Hebgen Reservoir will be uniformly released from Hebgen during October through March. Releases during October and November may cause storage in Canyon Ferry Lake to rise slightly during these months. However, PPL-MT will try to limit the Hebgen drawdown during these months in an effort to maintain Canyon Ferry Lake below elevation 3794 feet (1,792,884 acre-feet) after December 1. Storage below elevation 3794 feet (1,792,884 acre-feet) prior to winter freeze-up is desired to reduce the potential for ice jam problems to occur at the head end of the lake.

(4) Beginning near the first of January and at least monthly thereafter through June, forecasts are made of the estimated spring runoff, based on snow cover and precipitation data.

When these forecasts become available, operational changes may be required. Releases are set based on the most probable spring inflow forecast to allow the reservoir to fill to the top of the joint-use pool at elevation 3797 feet (1,891,888 acre-feet) near the end of June. On occasions, high spring runoff may result in the reservoir filling above the top of the joint-use pool to the top of the exclusive flood at elevation 3800 feet (1,992,997 acre-feet).

(5) If spilling is required, it is made only to the extent current inflow and the reservoir content indicates additional spills are required. A ttempts are made to limit r iver releases to 15,000 cfs or full downstream channel capacity immediately downstream of Canyon Ferry Dam, as long as space is available.

(6) Depending on when the spring runoff starts, the release of water, based on inflow forecasts, may draw the pool as low as elevation 3770 feet (1,097,599 acre-feet). In a series of dry years, the pool may be drawn as low as elevation 3728 feet (396,031 acre-feet) to meet firm power generation requirements and satisfy PPL-MT's prior water rights. If storage is drawn below elevation 3728 feet (396,031 acre-feet), the powerplant efficiency is affected. If emergency maintenance is required on the dam or powerplant, the reservoir may be required to be drawn lower than elevation 3728 feet (396,031 acre-feet) however, the powerplant efficiency is affected.

(7) Whenever an adequate water supply is available, releases from Canyon Ferry Dam to the Missouri River will be maintained at rates required to sustain river flows equal to or greater than the minimum desired flow of 4,100 cfs below Holter Dam, to minimize impacts to downstream river fisheries and recreation activities. During below normal runoff years, it may be necessary to reduce the releases to less than 4,100 cfs but no lower than 2,800 cfs to fulfill contractual obligations with PPL-MT.

Precipitation in the Missouri River Basin above Canyon Ferry Lake improved considerably in August. The valley and mountain precipitation was 158 and 132 percent of average, respectively. As a result, the inflow into Canyon Ferry Lake remained at about 105 percent of average during August and September. With storage in Canyon Ferry Lake slightly above average in September, releases to the Missouri River were maintained at or above 4,100 cfs, allowing storage in Canyon Ferry Lake to slowly decline to 1,766,465 acre-feet at elevation 3793.19 feet. This was 103 percent of average and about 86,850 acre-feet or 2.69 feet higher than at the end of water year 2009.

The most probable October-February natural inflows to Canyon Ferry Lake, without the effects of Clark Canyon and Hebgen Reservoirs, were estimated to be approximately 100 percent of average. The most probable March-September natural inflows were estimated to equal median percentile natural inflows or natural inflows that have historically been exceeded 50 percent of the time.

Under the minimum probable operating plan, the October-February natural inflows to Canyon Ferry Lake, without the effects of Clark Canyon and Hebgen Reservoirs, were estimated to be about 10 percent lower than the most probable natural inflows.

The March-September natural inflows were estimated to equal lower decile natural inflows or natural inflows that have historically been exceeded 90 percent of the time.

Under the maximum probable operating plan, the October-February natural inflows to Canyon Ferry Lake, without the effects of Clark Canyon and Hebgen Reservoirs, were estimated to be about 15 percent higher than the most probable natural inflows. The maximum probable March-September natural inflows were estimated to equal 80 percentile natural inflows or natural inflows that have historically been exceeded 20 percent of the time.

Based on the storage level on October 1, 2010, Canyon Ferry Reservoir would be expected to fill to the top of the joint-use pool at elevation 3797 feet by the end of June only under the most probable and maximum probable runoff scenarios. However, under the minimum probable runoff condition, releases from Canyon Ferry Reservoir to the Missouri River downstream of Holter Dam would have to be decreased and maintained at about 3,500 cfs beginning in April through the remainder of the year to conserve storage and allow Canyon Ferry Reservoir to fill to elevation 3795.50 feet, about 1.5 feet below the top of the joint-use pool. Under the most probable and maximum probable runoff conditions, releases to the Missouri River downstream of Holter Dam would be able to be maintained at or above 4,100 cfs all year. Under these two runoff scenarios, it is anticipated the river releases would be increased above 4,100 cfs or higher beginning in April, to control the rate of fill in Canyon Ferry during the spring snowmelt runoff season.

The average power generation produced at Canyon Ferry Powerplant during 1967-2008 is 384.8 million kilowatt-hours. Under the minimum probable runoff conditions, power generation produced at Canyon Ferry Powerplant during 2010 would be about 55.0 million kilowatt-hours less than average. Under the most and maximum probable runoff condition, power generation would be about 75.5 and 112.7 million kilowatt-hours more than average, respectively. No spills are expected during the routine scheduled maintenance outages shown on Table MTT19.

TABLE MTT13A

CANYON FERRY LAKE MONTHLY OPERATIONS
Based on October 1 2010 Probable Inflow Estimates

2011 Minimum Probable Plan

Canyon Ferry Reservoir — Initial Cont 1766.5 kaf, Elev 3793.19 ft; Maximum Cont 1993.0 kaf, Elev 3800.00 ft; Minimum Cont 445.5 kaf, Elev 3732.31 ft

2010		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Reservoir Inflow	kaf	210.8	237.1	212.4	197.1	197.6	204.6	250.9	311.7	357.3	158.8	104.3	125.9	2568.5
Evaporation Loss	kaf	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
HV Canal Diversions	kaf	0.0	0.0	0.0	0.0	0.0	4.0	11.0	22.0	17.0	21.0	21.0	12.0	108.0
HV Pump Turbines	kaf	0.0	0.0	0.0	0.0	0.0	4.7	12.9	24.9	18.0	21.8	23.1	14.1	119.5
Turbine Release	kaf	246.6	237.9	244.4	247.5	219.4	236.9	186.5	188.7	180.6	186.8	188.1	190.0	2553.4
Turbine Release	cfs	4011	3998	3975	4025	3951	3853	3134	3069	3035	3038	3059	3193	
Spill/Waste	kaf	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
River Release	kaf	246.6	237.9	244.4	247.5	219.4	241.6	199.4	213.6	198.6	208.6	211.2	204.1	2672.9
River Release	cfs	4011	3998	3975	4025	3951	3929	3351	3474	3338	3393	3435	3430	
Min Release	cfs	4011	3998	3975	4025	3951	3929	3351	3474	3338	3393	3435	3430	
Total Dam Release	kaf	246.6	237.9	244.4	247.5	219.4	245.6	210.4	235.6	215.6	229.6	232.2	216.1	2780.9
Total Dam Release	cfs	4011	3998	3975	4025	3951	3994	3536	3832	3623	3734	3776	3632	
End-Month Content	kaf	1730.7	1729.9	1697.9	1647.5	1625.7	1584.7	1625.2	1701.3	1843.0	1772.2	1644.3	1554.1	
End-Month Elevation	ft	3792.1	3792.1	3791.1	3789.5	3788.8	3787.5	3788.8	3791.2	3795.5	3793.4	3789.4	3786.5	
Net Change	kaf	-35.8	-0.8	-32.0	-50.4	-21.8	-41.0	40.5	76.1	141.7	-70.8	-127.9	-90.2	-212.4

Canyon Ferry Power 2010		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Turbine Release	cfs	4011	3998	3975	4025	3951	3853	3134	3069	3035	3038	3059	3193	
Tailwater Elev	ft	3650.8	3650.8	3650.8	3650.8	3650.8	3650.8	3650.8	3650.8	3650.8	3650.8	3650.8	3650.8	
Average Head	ft	141.8	141.3	140.8	139.5	138.3	137.4	137.3	139.2	142.6	143.6	140.6	137.2	
Average Power	mw	44.3	44.0	43.6	43.9	42.7	41.2	32.1	31.6	31.8	32.0	31.8	32.9	
Average Kwh/Af		134	133	133	132	131	129	124	125	127	127	126	124	129
Generation	gwh	32.989	31.702	32.453	32.669	28.688	30.675	23.134	23.533	22.874	23.801	23.622	23.652	329.792
End-Month Power Cap	mw	60	60	60	60	60	60	60	60	60	60	60	60	

Hauser 2010		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Missouri Gain	kaf	4.0	4.8	7.1	4.5	7.2	8.6	7.8	0.4	1.9	1.9	0.9	1.8	50.9
End-Month Content	kaf	64.2	64.2	64.2	64.2	64.2	64.2	64.2	64.2	64.2	64.2	64.2	64.2	
Release	kaf	250.6	242.7	251.5	252.0	226.6	250.2	207.2	214.0	200.5	210.5	212.1	205.9	2723.8
Release	cfs	4076	4079	4090	4098	4080	4069	3482	3480	3370	3423	3449	3460	
Turbine Release	cfs	4076	4079	4090	4098	4080	4069	3482	3480	3370	3423	3449	3460	
Turbine Bypass	cfs	0	0	0	0	0	0	0	0	0	0	0	0	
Generation	gwh	10.553	10.220	10.590	10.610	9.541	10.535	8.724	9.010	8.444	8.863	8.930	8.669	114.689

Holter 2010		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Missouri Gain	kaf	1.5	1.3	0.6	0.1	1.1	1.9	1.1	1.2	7.8	4.7	3.1	2.4	26.8
End-Month Content	kaf	81.9	81.9	81.9	81.9	81.9	81.9	81.9	81.9	81.9	81.9	81.9	81.9	
Release	kaf	252.1	244.0	252.1	252.1	227.7	252.1	208.3	215.2	208.3	215.2	215.2	208.3	2750.6
Release	cfs	4100	4101	4100	4100	4100	4100	3501	3500	3501	3500	3500	3501	
Min Release	cfs	4100	4100	4100	4100	4100	4100	3500	3500	3500	3500	3500	3500	
Turbine Release	cfs	4100	4101	4100	4100	4100	4100	3501	3500	3501	3500	3500	3501	
Turbine Bypass	cfs	0	0	0	0	0	0	0	0	0	0	0	0	
Generation	gwh	21.475	20.787	21.475	21.475	19.397	21.475	17.746	18.332	17.746	18.332	18.332	17.746	234.318

TABLE MTT13B

CANYON FERRY LAKE MONTHLY OPERATIONS
Based on October 1 2010 Probable Inflow Estimates

2011 Most Probable Plan

Canyon Ferry Reservoir — Initial Cont 1766.5 kaf, Elev 3793.19 ft — Maximum Cont 1993.0 kaf, Elev 3800.00 ft — Minimum Cont 445.5 kaf, Elev 3732.31 ft

2010		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Reservoir Inflow	kaf	234.2	260.7	232.1	223.2	224.2	273.5	362.4	611.5	761.6	319.1	170.7	195.2	3868.4
Evaporation Loss	kaf	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
HV Canal Diversions	kaf	0.0	0.0	0.0	0.0	0.0	4.0	11.0	22.0	17.0	21.0	21.0	12.0	108.0
HV Pump Turbines	kaf	0.0	0.0	0.0	0.0	0.0	5.3	14.7	27.1	18.1	20.9	21.4	12.7	120.2
Turbine Release	kaf	264.3	287.7	297.7	325.1	293.7	319.8	324.5	353.7	321.0	277.2	223.0	222.0	3509.7
Turbine Release	cfs	4298	4835	4842	5287	5288	5201	5453	5752	5394	4508	3627	3731	
Spill/Waste	kaf	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	151.3	0.0	0.0	0.0	151.3
River Release	kaf	264.3	287.7	297.7	325.1	293.7	325.1	339.2	380.8	490.4	298.1	244.4	234.7	3781.2
River Release	cfs	4298	4835	4842	5287	5288	5287	5700	6193	8241	4848	3975	3944	
Min Release	cfs	3918	3936	3939	3928	3893	3880	3911	3959	3707	3981	3975	3944	
Total Dam Release	kaf	264.3	287.7	297.7	325.1	293.7	329.1	350.2	402.8	507.4	319.1	265.4	246.7	3889.2
Total Dam Release	cfs	4298	4835	4842	5287	5288	5352	5885	6551	8527	5190	4316	4146	
End-Month Content	kaf	1736.4	1709.4	1643.8	1541.9	1472.4	1416.8	1429.0	1637.7	1891.9	1891.9	1797.2	1745.7	
End-Month Elevation	ft	3792.3	3791.4	3789.4	3786.1	3783.9	3782.0	3782.4	3789.2	3797.0	3797.0	3794.1	3792.6	
Net Change	kaf	-30.1	-27.0	-65.6	-101.9	-69.5	-55.6	12.2	208.7	254.2	0.0	-94.7	-51.5	-20.8

Canyon Ferry Power 2010		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Turbine Release	cfs	4298	4835	4842	5287	5288	5201	5453	5752	5394	4508	3627	3731	
Tailwater Elev	ft	3650.9	3650.9	3650.9	3651.0	3651.0	3651.0	3651.0	3651.1	3651.4	3650.9	3650.8	3650.8	
Average Head	ft	141.8	140.9	139.5	136.8	134.0	131.9	131.2	134.8	141.7	146.1	144.8	142.5	
Average Power	mw	47.9	53.9	53.5	57.0	55.8	54.2	56.0	59.9	60.0	51.7	40.0	40.9	
Average Kwh/Af		135	135	134	130	128	126	124	126	135	139	134	133	131
Generation	gwh	35.652	38.822	39.804	42.371	37.504	40.295	40.306	44.595	43.200	38.487	29.790	29.462	460.288
End-Month Power Cap	mw	60	60	60	60	60	60	60	60	60	60	60	60	

Hauser 2010		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Missouri Gain	kaf	9.1	8.4	8.8	9.0	9.3	10.2	9.0	5.4	13.1	1.3	3.3	5.2	92.1
End-Month Content	kaf	64.2	64.2	64.2	64.2	64.2	64.2	64.2	64.2	64.2	64.2	64.2	64.2	
Release	kaf	273.4	296.1	306.5	334.1	303.0	335.3	348.2	386.2	503.5	299.4	247.7	239.9	3873.3
Release	cfs	4446	4976	4985	5434	5456	5453	5852	6281	8462	4869	4028	4032	
Turbine Release	cfs	4446	4740	4740	4740	4740	4740	4740	4740	4740	4740	4028	4032	
Turbine Bypass	cfs	0	236	245	694	716	713	1112	1541	3722	129	0	0	
Generation	gwh	11.511	11.877	12.272	12.272	11.085	12.272	11.877	12.272	11.877	12.272	10.429	10.103	140.119

Holter 2010		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Missouri Gain	kaf	2.1	1.4	1.1	1.6	2.2	3.3	2.3	3.3	10.3	6.0	4.4	4.1	42.1
End-Month Content	kaf	81.9	81.9	81.9	81.9	81.9	81.9	81.9	81.9	81.9	81.9	81.9	81.9	
Release	kaf	275.5	297.5	307.6	335.7	305.2	338.6	350.5	389.5	513.8	305.4	252.1	244.0	3915.4
Release	cfs	4481	5000	5003	5460	5495	5507	5890	6335	8635	4967	4100	4101	
Min Release	cfs	4100	4100	4100	4100	4100	4100	4100	4100	4100	4100	4100	4100	
Turbine Release	cfs	4481	5000	5003	5460	5495	5507	5890	6335	7100	4967	4100	4101	
Turbine Bypass	cfs	0	0	0	0	0	0	0	0	1535	0	0	0	
Generation	gwh	23.470	25.344	26.205	28.598	25.996	28.844	29.855	33.181	35.988	26.016	21.475	20.787	325.759

TABLE MTT13C

CANYON FERRY LAKE MONTHLY OPERATIONS
Based on October 1 2010 Probable Inflow Estimates

2011 Maximum Probable Plan

Canyon Ferry Reservoir — Initial Cont 1766.5 kaf, Elev 3793.19 ft; Maximum Cont 1993.0 kaf, Elev 3800.00 ft; Minimum Cont 445.5 kaf, Elev 3732.31 ft

2010		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Reservoir Inflow	kaf	269.3	298.0	269.3	260.7	261.9	319.6	419.0	758.5	1032.2	497.5	212.3	234.1	4832.4
Evaporation Loss	kaf	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
HV Canal Diversions	kaf	0.0	0.0	0.0	0.0	0.0	4.0	11.0	22.0	17.0	21.0	21.0	12.0	108.0
HV Pump Turbines	kaf	0.0	0.0	0.0	0.0	0.0	5.1	14.9	28.8	18.6	20.9	21.3	12.5	122.1
Turbine Release	kaf	296.8	321.8	336.2	343.1	318.9	361.1	364.5	369.2	326.4	322.2	237.5	239.8	3837.5
Turbine Release	cfs	4827	5408	5468	5580	5742	5873	6126	6005	5486	5240	3863	4030	
Spill/Waste	kaf	0.0	0.0	0.0	0.0	0.0	0.0	127.9	159.5	316.3	133.4	0.0	0.0	737.1
River Release	kaf	296.8	321.8	336.2	343.1	318.9	366.2	507.3	557.5	661.3	476.5	258.8	252.3	4696.7
River Release	cfs	4827	5408	5468	5580	5742	5956	8525	9067	11114	7750	4209	4240	
Min Release	cfs	3828	3911	4315	4315	3833	3825	3850	3711	3284	3731	3807	3838	
Total Dam Release	kaf	296.8	321.8	336.2	343.1	318.9	370.2	518.3	579.5	678.3	497.5	279.8	264.3	4804.7
Total Dam Release	cfs	4827	5408	5468	5580	5742	6021	8710	9425	11399	8091	4551	4442	
End-Month Content	kaf	1739.0	1715.2	1648.3	1565.9	1508.9	1458.3	1359.0	1538.0	1891.9	1891.9	1824.4	1794.2	
End-Month Elevation	ft	3792.3	3791.6	3789.5	3786.9	3785.1	3783.4	3780.0	3786.0	3797.0	3797.0	3795.0	3794.0	
Net Change	kaf	-27.5	-23.8	-66.9	-82.4	-57.0	-50.6	-99.3	179.0	353.9	0.0	-67.5	-30.2	27.7

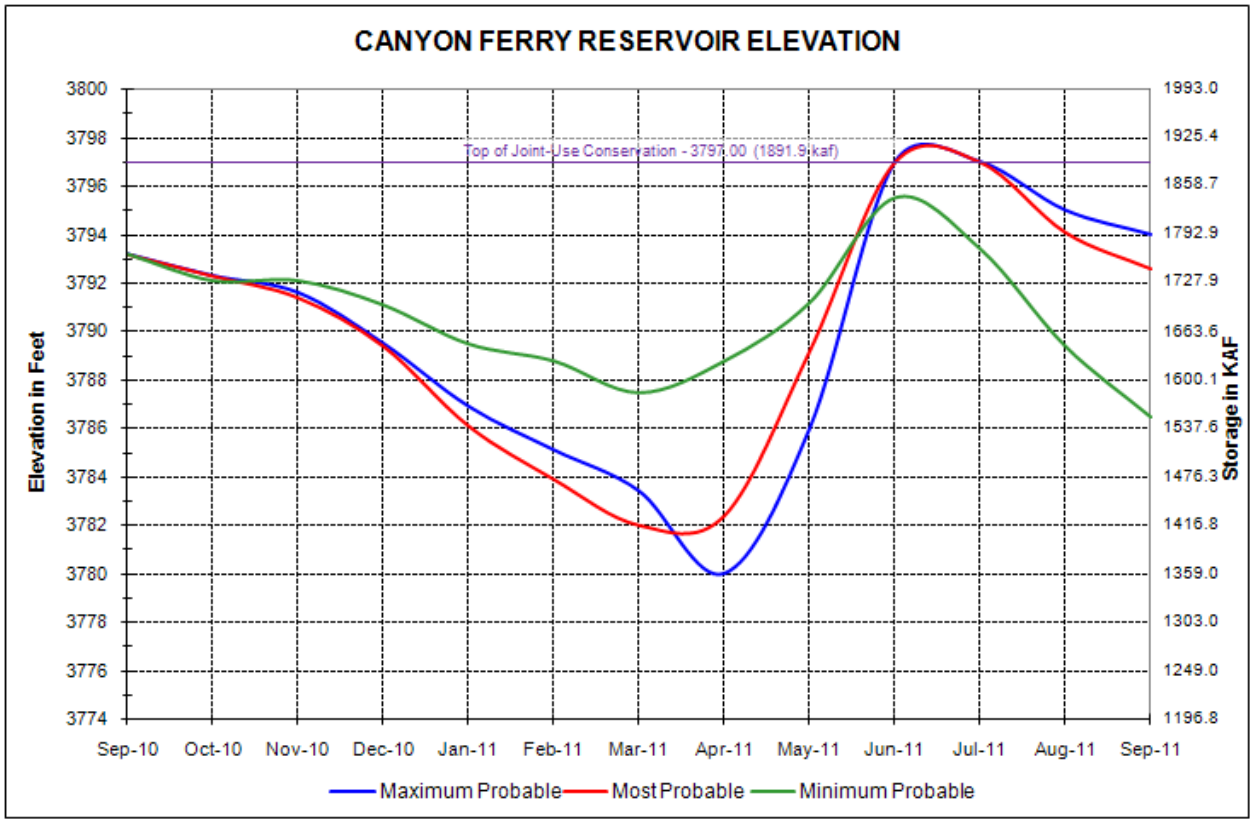
Canyon Ferry Power	2010	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Turbine Release	cfs	4827	5408	5468	5580	5742	5873	6126	6005	5486	5240	3863	4030	
Tailwater Elev	ft	3650.9	3651.0	3651.0	3651.0	3651.0	3651.1	3651.4	3651.5	3651.9	3651.3	3650.9	3650.9	
Average Head	ft	141.9	141.0	139.6	137.2	135.0	133.1	130.3	131.6	139.7	145.7	145.1	143.6	
Average Power	mw	54.2	59.8	59.8	59.7	60.0	60.0	60.0	60.0	60.0	60.0	43.2	45.0	
Average Kwh/Af		136	134	132	130	126	124	119	121	132	139	135	135	130
Generation	gwh	40.288	43.070	44.476	44.439	40.307	44.633	43.200	44.640	43.200	44.640	32.163	32.422	497.478
End-Month Power Cap	mw	60	60	60	60	60	60	60	60	60	60	60	60	

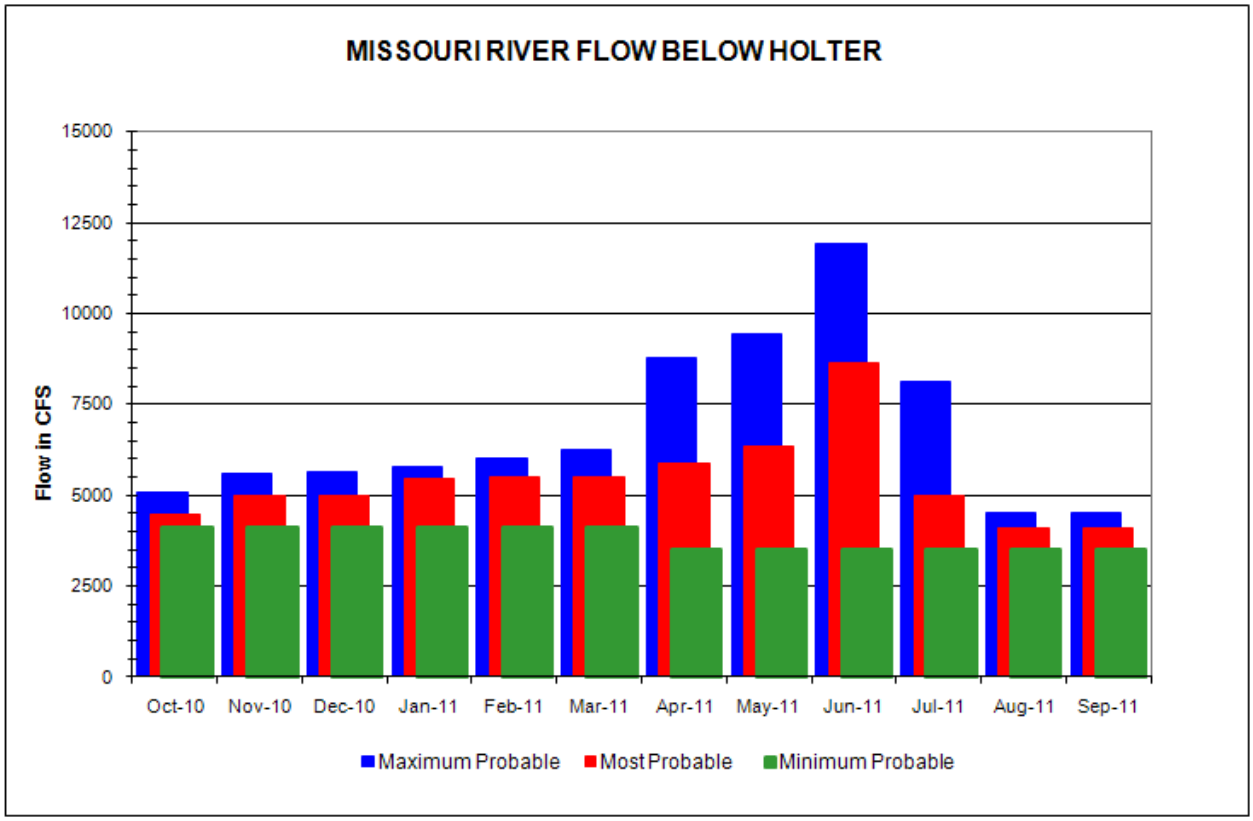
Hauser	2010	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Missouri Gain	kaf	13.0	9.3	9.4	8.9	11.9	13.3	11.8	17.2	34.1	13.3	10.8	10.0	163.0
End-Month Content	kaf	64.2	64.2	64.2	64.2	64.2	64.2	64.2	64.2	64.2	64.2	64.2	64.2	
Release	kaf	309.8	331.1	345.6	352.0	330.8	379.5	519.1	574.7	695.4	489.8	269.6	262.3	4859.7
Release	cfs	5038	5564	5621	5725	5956	6172	8724	9347	11687	7966	4385	4408	
Turbine Release	cfs	4740	4740	4740	4740	4740	4740	4740	4740	4740	4740	4385	4408	
Turbine Bypass	cfs	298	824	881	985	1216	1432	3984	4607	6947	3226	0	0	
Generation	gwh	12.272	11.877	12.272	12.272	11.085	12.272	11.877	12.272	11.877	12.272	11.353	11.045	142.746

Holter	2010	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Missouri Gain	kaf	3.7	2.0	2.0	2.5	2.9	3.6	3.1	6.7	14.5	9.4	7.2	5.6	63.2
End-Month Content	kaf	81.9	81.9	81.9	81.9	81.9	81.9	81.9	81.9	81.9	81.9	81.9	81.9	
Release	kaf	313.5	333.1	347.6	354.5	333.7	383.1	522.2	581.4	709.9	499.2	276.8	267.9	4922.9
Release	cfs	5099	5598	5653	5765	6009	6231	8776	9456	11930	8119	4502	4502	
Min Release	cfs	4100	4100	4500	4500	4100	4100	4100	4100	4100	4100	4100	4100	
Turbine Release	cfs	5099	5598	5653	5765	6009	6231	7100	7100	7100	7100	4502	4502	
Turbine Bypass	cfs	0	0	0	0	0	0	1676	2356	4830	1019	0	0	
Generation	gwh	26.707	28.375	29.609	30.196	28.428	32.636	35.988	37.188	35.988	37.188	23.580	22.820	368.703

FIGURE MTG14

CANYON FERRY RESERVOIR





WATER YEAR 2011

Gibson Reservoir

Three operating plans were prepared for 2011 to show the operations of Gibson Reservoir which could occur under various conditions. These plans are shown in Table MTT14A-C and Figure MTG15. The plans are presented only to show the probable limits of operations; therefore, actual operations may vary widely from these plans.

The primary objective of operations at Gibson Reservoir is to provide irrigation water to the Sun River Project. Gibson Reservoir is operated under the following criteria and limitations:

(1) Beginning near the first of January and at least monthly thereafter through June, forecasts are made of the estimated spring inflow from snow cover and precipitation data. When these forecasts become available, the Facility Operation and Maintenance Division provides assistance to Greenfields Irrigation District to provide incidental flood control and prevent storage content in Gibson Reservoir from exceeding elevation 4724.0 feet until the peak of the spring runoff has passed and has begun to recede.

(2) The spillway crest elevation is 4712.0 feet (81,255 acre-feet). The spillway gates will remain open until after the peak inflow has occurred. The remaining 12 feet of storage shall be filled with recession inflows. This will normally occur during mid to late June or early July.

(3) Once Gibson Reservoir has filled or reached its maximum level during spring runoff (normally late June or early July), releases are set to maintain the reservoir at or below elevation 4724.0 feet.

(4) After the spring runoff is over, releases during the remainder of the irrigation season from July through mid-October are adjusted as necessary to meet the irrigation demands of the Sun River Project.

(5) When irrigation demands on the Sun River Project place heavy demands on storage in Gibson Reservoir, the reservoir should not be drafted lower than elevation 4609.0 feet (5,000 acre-feet) to prevent sediment from being flushed through the reservoir in an effort to protect the water quality of the Sun River downstream of the dam.

(6) During the non-irrigation season, Gibson Reservoir should be maintained below elevation of 4712.0 feet (81,255 acre-feet) to provide incidental flood control. During most years, Gibson Reservoir is generally maintained below elevation 4702.5 feet (70,000 acre-feet). When normal or above normal inflow is forecast, the end-of-April target storage content is 55,000 acre-feet. When below normal inflow is forecast, the end-of-April target storage content can be increased but set no higher than 70,000 acre-feet.

(7) Whenever an adequate water supply is available, releases from Gibson Reservoir will be maintained at rates to sustain flows in the Sun River below Sun River Diversion Dam at 100 cfs or higher and in the river below the Fort Shaw Diversion Dam at 50 cfs or

higher. This is normally required to achieve the desired end-of-April content and minimize impacts to downstream river fisheries and recreation activities. During below normal runoff years, it may be necessary to reduce the releases to as low as 50 cfs in the Sun River below the Sun River Diversion Dam, the absolute minimum flow required to protect the river fishery.

(8) Releases during July-September are made as necessary to meet irrigation requirements.

Inflow into Gibson Reservoir during both August and September averaged 80 and 75 percent of average. The precipitation and temperatures stayed cool during late spring which caused a delayed snow melt. The total inflow for Gibson Reservoir during 2010 was 378,400 acre-feet, 61 percent of average. By the end of water year 2010, storage in Gibson Reservoir was drafted to 16,240 acre-feet at elevation 4635.23 feet. This was 58 percent of normal for this time of year, and 10,640 acre-feet or 14.30 feet higher than at the end of water year 2009.

The most probable October-December inflows to Gibson Reservoir were estimated to equal 30 percentile flows, or flows that would be exceeded 70 percent of the time. January through May flows are estimated to be 30 percentile flows, or flows that would be exceeded 70 percent of the time, and June through September inflows to Gibson Reservoir were estimated to equal 45 percentile inflows or inflows that have historically been exceeded 55 percent of the time.

The minimum probable October-April inflows to Gibson Reservoir were estimated to equal 10 percentile inflows or inflows that have historically been exceeded 90 percent of the time. While the May-September inflows were estimated to be 12.5 percentile flows or flows that would be exceeded 87.5 percent of the time.

The max probable October-May inflows to Gibson Reservoir were estimated to equal 50 percentile flows, or flows that would be exceeded 50 percent of the time. June through September inflows to Gibson Reservoir were estimated to equal 57 percentile inflows or inflows that have historically been exceeded 43 percent of the time.

With storage in Gibson Reservoir at 16,240 acre-feet or 58 percent of average on September 30, Gibson Reservoir is expected to fill to the top of the conservation pool at elevation 4724 feet (96,477 acre-feet) under all three runoff scenarios. Based upon the storage content of Gibson Reservoir on September 30, 2010, a winter release of approximately 80-100 cfs to the Sun River can be maintained to conserve storage for the 2010 irrigation season, as well as to provide a good winter fishery flow. These flow rates will vary as runoff and snowpack conditions change.

TABLE MTT14A

GIBSON RESERVOIR MONTHLY OPERATIONS
Based on October 2010 Inflow Estimates

2011 Minimum Probable Runoff

Gibson Reservoir — Initial Cont 16.2 kaf, Elev 4635.15 ft; Maximum Cont 96.5 kaf, Elev 4724.02 ft; Minimum Cont 5.0 kaf, Elev 4608.95 ft

2011		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Monthly Inflow	kaf	11.1	10.9	9.3	10.0	8.6	10.7	29.9	104.8	122.6	43.8	19.6	14.3	395.6
Spillway Rels	cfs	0	0	0	0	0	0	0	0	0	0	0	0	
Total Release	kaf	15.0	3.6	3.7	3.7	3.5	3.7	16.3	77.0	111.1	100.1	52.7	11.5	401.9
Total Release	cfs	244	61	60	60	61	60	274	1252	1867	1628	857	193	
End-Month Content	kaf	12.3	19.6	25.2	31.5	36.6	43.6	57.2	85.0	96.5	40.2	7.1	9.9	
End-Month Elevation	ft	4627.37	4641.40	4650.93	4660.52	4667.54	4676.17	4690.53	4715.01	4724.02	4672.13	4615.17	4622.09	
End-Month Area	acre	474.5	561.5	617.9	695.7	759.3	868.0	1013.4	1255.1	1296.2	813.7	376.3	432.8	
Net Change Content	kaf	-3.9	7.3	5.6	6.3	5.1	7.0	13.6	27.8	11.5	-56.3	-33.1	2.8	-6.3

Sun River Div Dam	2011	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Gain Below Gibson	cfs	11	10	10	10	9	10	30	99	123	42	20	15	
Rels to WFC	cfs	0	0	0	0	0	0	76	75	20	0	0	0	
Rels to PSC	cfs	185	0	0	0	0	0	158	888	1329	1327	651	0	
Total Diversion	kaf	11.4	0.0	0.0	0.0	0.0	0.0	13.9	59.2	80.3	81.6	40.0	0.0	286.4
Total Diversion	cfs	185	0	0	0	0	0	234	963	1349	1327	651	0	
Flow Over Div Dam	kaf	4.3	4.2	4.3	4.3	4.0	4.3	4.2	23.9	38.1	21.1	13.9	12.4	139.0
Flow Over Div Dam	cfs	70	71	70	70	70	70	71	389	640	343	226	208	
Min River Rels	kaf	4.3	4.2	4.3	4.3	4.0	4.3	4.2	4.3	4.2	4.3	4.3	4.2	50.9
Min River Rels	cfs	70	70	70	70	70	70	70	70	70	70	70	70	

Willow Crk Operations — Initial Cont 23.1 kaf, Elev 4135.71 ft; Maximum Cont 31.9 kaf, Elev 4142.04 ft; Minimum Cont 0.1 kaf, Elev 4093.42 ft

2011		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Native Inflow	kaf	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.2
Total Inflow	kaf	0.0	0.0	0.0	0.0	0.0	0.1	3.9	3.9	1.0	0.0	0.0	0.0	8.9
WCR Dam Rels	kaf	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	11.9	0.0	12.0
End-Month Content	kaf	23.0	23.0	23.0	23.0	23.0	23.1	27.0	30.9	31.9	31.9	20.0	20.0	
End-Month Elevation	ft	4135.64	4135.64	4135.64	4135.64	4135.64	4135.71	4138.59	4141.35	4142.04	4142.04	4133.28	4133.28	
Net Change Content	kaf	-0.1	0.0	0.0	0.0	0.0	0.1	3.9	3.9	1.0	0.0	-11.9	0.0	-3.1

Pishkun Operations — Initial Cont 20.3 kaf, Elev 4347.55 ft; Maximum Cont 46.7 kaf, Elev 4370.00 ft; Minimum Cont 16.0 kaf, Elev 4341.99 ft

2011		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Rels to PSC	kaf	11.4	0.0	0.0	0.0	0.0	0.0	9.4	54.6	79.1	81.6	40.0	0.0	276.1
Total Inflow	kaf	9.7	0.0	0.0	0.0	0.0	0.0	8.0	43.7	64.9	69.4	34.0	0.0	229.7
PSH Dam Rels	kaf	0.0	0.0	0.0	0.0	0.0	0.0	0.0	35.0	65.0	70.0	42.0	13.0	225.0
End-Month Content	kaf	30.0	30.0	30.0	30.0	30.0	30.0	38.0	46.7	46.6	46.0	38.0	25.0	
End-Month Elevation	ft	4357.68	4357.68	4357.68	4357.68	4357.68	4357.68	4364.01	4370.00	4369.94	4369.54	4364.01	4352.85	
Net Change Content	kaf	9.7	0.0	0.0	0.0	0.0	0.0	8.0	8.7	-0.1	-0.6	-8.0	-13.0	4.7

Greenfields Irrig	2011	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
GID Demand	kaf	0.0	0.0	0.0	0.0	0.0	0.0	0.0	35.0	65.0	70.0	42.0	13.0	225.0
GID Delivery	kaf	0.0	0.0	0.0	0.0	0.0	0.0	0.0	35.0	65.0	70.0	42.0	13.0	225.0

River Blw Div Dam	2011	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Flow Over Div Dam	cfs	70	71	70	70	70	70	71	389	640	343	226	208	
PSC Return Flow	cfs	26	0	0	0	0	0	18	141	192	169	88	0	
WCR Dam Rels	cfs	2	0	0	0	0	0	0	0	0	0	194	0	
Sr Demand Above	kaf	1.0	0.0	0.0	0.0	0.0	0.0	0.0	7.7	12.9	13.3	13.3	2.0	50.2
Sr Demand Below	kaf	1.0	0.0	0.0	0.0	0.0	0.0	0.0	5.5	5.4	5.5	5.5	2.0	24.9
Flow @ Ft.Shaw Div	cfs	80	79	83	85	85	94	138	428	632	213	213	151	
Ft Shaw Demand	kaf	1.0	0.0	0.0	0.0	0.0	0.0	0.7	8.0	9.0	10.0	10.0	6.0	44.7
Ft Shaw Tot Deliv	kaf	1.0	0.0	0.0	0.0	0.0	0.0	0.7	8.0	9.0	10.0	10.0	6.0	44.7
Flow blw Ft. Shaw	cfs	63	79	83	85	85	94	126	298	481	50	50	50	

TABLE MTT14B

GIBSON RESERVOIR MONTHLY OPERATIONS
Based on October 2010Inflow Estimates

2011 Most Probable Runoff

Gibson Reservoir — Initial Cont 16.2 kaf, Elev 4635.15 ft; Maximum Cont 96.5 kaf, Elev 4724.02 ft; Minimum Cont 5.0 kaf, Elev 4608.95 ft

	2011	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Monthly Inflow	kaf	15.0	13.4	12.5	11.6	10.2	12.7	34.6	140.6	177.4	60.6	20.8	20.2	529.6
Spillway Rels	cfs	0	0	0	0	0	0	0	0	0	0	0	0	
Total Release	kaf	16.6	5.2	5.3	5.4	5.2	5.3	28.4	103.4	172.9	98.1	72.9	19.5	538.2
Total Release	cfs	270	87	86	88	90	86	477	1682	2906	1595	1186	328	
End-Month Content	kaf	14.6	22.8	30.0	36.2	41.2	48.6	54.8	92.0	96.5	59.0	6.9	7.6	
End-Month Elevation	ft	4632.06	4646.96	4658.33	4667.01	4673.35	4681.71	4688.13	4720.53	4724.02	4692.29	4614.63	4616.48	
End-Month Area	acre	506.9	590.7	678.0	753.9	830.4	934.0	993.7	1282.3	1296.2	1027.3	370.3	387.0	
Net Change Content	kaf	-1.6	8.2	7.2	6.2	5.0	7.4	6.2	37.2	4.5	-37.5	-52.1	0.7	-8.6

Sun River Div Dam	2011	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Gain Below Gibson	cfs	15	13	13	11	10	13	35	137	178	59	20	20	
Rels to WFC	cfs	0	0	0	0	0	0	76	75	20	0	0	0	
Rels to PSC	cfs	185	0	0	0	0	0	336	1091	1333	1360	807	178	
Total Diversion	kaf	11.4	0.0	0.0	0.0	0.0	0.0	24.5	71.7	80.5	83.6	49.6	10.6	331.9
Total Diversion	cfs	185	0	0	0	0	0	412	1166	1353	1360	807	178	
Flow Over Div Dam	kaf	6.1	6.0	6.1	6.1	5.8	6.1	6.0	40.1	103.0	18.1	24.5	10.1	238.0
Flow Over Div Dam	cfs	99	101	99	99	101	99	101	652	1731	294	398	170	
Min River Rels	kaf	6.1	6.0	6.1	6.1	5.8	6.1	6.0	6.1	6.0	6.1	6.1	6.0	72.5
Min River Rels	cfs	100	100	100	100	100	100	100	100	100	100	100	100	

Willow Crk Operations — Initial Cont 23.1 kaf, Elev 4135.71 ft; Maximum Cont 31.9 kaf, Elev 4142.04 ft; Minimum Cont 0.1 kaf, Elev 4093.42 ft

	2011	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Native Inflow	kaf	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.2
Total Inflow	kaf	0.0	0.0	0.0	0.0	0.0	0.1	3.9	3.9	1.0	0.0	0.0	0.0	8.9
WCR Dam Rels	kaf	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.2	0.0	2.7	7.0
End-Month Content	kaf	23.0	23.0	23.0	23.0	23.0	23.1	27.0	30.9	31.9	27.7	27.7	25.0	
End-Month Elevation	ft	4135.64	4135.64	4135.64	4135.64	4135.64	4135.71	4138.59	4141.35	4142.04	4139.10	4139.10	4137.13	
Net Change Content	kaf	-0.1	0.0	0.0	0.0	0.0	0.1	3.9	3.9	1.0	-4.2	0.0	-2.7	1.9

Pishkun Operations — Initial Cont 20.3 kaf, Elev 4347.55 ft; Maximum Cont 46.7 kaf, Elev 4370.00 ft; Minimum Cont 16.0 kaf, Elev 4341.99 ft

	2011	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Rels to PSC	kaf	11.4	0.0	0.0	0.0	0.0	0.0	20.0	67.1	79.3	83.6	49.6	10.6	321.6
Total Inflow	kaf	9.7	0.0	0.0	0.0	0.0	0.0	17.0	53.7	65.0	71.1	42.2	9.0	267.7
PSH Dam Rels	kaf	0.0	0.0	0.0	0.0	0.0	0.0	9.0	45.0	65.0	80.0	45.0	14.0	258.0
End-Month Content	kaf	30.0	30.0	30.0	30.0	30.0	30.0	38.0	46.7	46.7	37.8	35.0	30.0	
End-Month Elevation	ft	4357.68	4357.68	4357.68	4357.68	4357.68	4357.68	4364.01	4370.00	4370.00	4363.86	4361.78	4357.68	
Net Change Content	kaf	9.7	0.0	0.0	0.0	0.0	0.0	8.0	8.7	0.0	-8.9	-2.8	-5.0	9.7

Greenfields Irrig	2011	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
GID Demand	kaf	0.0	0.0	0.0	0.0	0.0	0.0	9.0	45.0	65.0	80.0	45.0	14.0	258.0
GID Delivery	kaf	0.0	0.0	0.0	0.0	0.0	0.0	9.0	45.0	65.0	80.0	45.0	14.0	258.0

River Blw Div Dam	2011	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Flow Over Div Dam	cfs	99	101	99	99	101	99	101	652	1731	294	398	170	
PSC Return Flow	cfs	26	0	0	0	0	0	40	174	192	172	109	27	
WCR Dam Rels	cfs	2	0	0	0	0	0	0	0	0	68	0	45	
Sr Demand Above	kaf	1.0	0.0	0.0	0.0	0.0	0.0	0.0	7.7	12.9	13.3	13.3	2.0	50.2
Sr Demand Below	kaf	1.0	0.0	0.0	0.0	0.0	0.0	0.0	5.5	5.4	5.5	5.5	2.0	24.9
Flow @ Ft.Shaw Div	cfs	109	109	112	114	116	124	190	724	1723	236	213	185	
Ft Shaw Demand	kaf	1.0	0.0	0.0	0.0	0.0	0.0	1.0	8.5	8.5	11.4	10.0	8.0	48.4
Ft Shaw Tot Deliv	kaf	1.0	0.0	0.0	0.0	0.0	0.0	1.0	8.5	8.5	11.4	10.0	8.0	48.4
Flow blw Ft. Shaw	cfs	93	109	112	114	116	124	173	585	1580	50	50	50	

TABLE MTT14C

GIBSON RESERVOIR MONTHLY OPERATIONS
Based on October 2010 Inflow Estimates

2011 Maximum Probable Runoff

Gibson Reservoir — Initial Cont 16.2 kaf, Elev 4635.15 ft; Maximum Cont 96.5 kaf, Elev 4724.02 ft; Minimum Cont 5.0 kaf, Elev 4608.95 ft

2011		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Monthly Inflow	kaf	20.6	17.4	15.7	13.2	11.7	14.7	41.2	187.7	201.0	68.4	27.4	20.9	639.9
Spillway Rels	cfs	0	0	0	0	0	0	0	0	0	0	0	0	
Total Release	kaf	24.1	5.0	8.2	8.4	7.9	8.4	23.4	162.0	195.5	102.4	76.7	22.7	644.7
Total Release	cfs	392	84	133	137	137	137	393	2635	3285	1665	1247	381	
End-Month Content	kaf	12.7	25.1	32.6	37.4	41.2	47.5	65.3	91.0	96.5	62.5	13.2	11.4	
End-Month Elevation	ft	4628.21	4650.76	4662.08	4668.59	4673.35	4680.53	4698.27	4719.75	4724.02	4695.65	4629.24	4625.45	
End-Month Area	acre	480.7	616.6	708.9	769.9	830.4	921.9	1085.8	1278.9	1296.2	1056.1	488.4	460.1	
Net Change Content	kaf	-3.5	12.4	7.5	4.8	3.8	6.3	17.8	25.7	5.5	-34.0	-49.3	-1.8	-4.8

Sun River Div Dam	2011	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Gain Below Gibson	cfs	20	17	16	13	12	13	42	182	202	67	26	22	
Rels to WFC	cfs	0	0	0	0	0	0	61	75	32	0	0	0	
Rels to PSC	cfs	312	0	0	0	0	0	225	1112	1333	1360	903	249	
Total Diversion	kaf	19.2	0.0	0.0	0.0	0.0	0.0	17.0	73.0	81.2	83.6	55.5	14.8	344.3
Total Diversion	cfs	312	0	0	0	0	0	286	1187	1365	1360	903	249	
Flow Over Div Dam	kaf	6.1	6.0	9.2	9.2	8.6	9.2	8.9	100.2	126.3	22.9	22.8	9.2	338.6
Flow Over Div Dam	cfs	99	101	150	150	150	150	150	1630	2123	372	371	155	
Min River Rels	kaf	6.1	6.0	9.2	9.2	8.6	9.2	8.9	9.2	8.9	9.2	9.2	9.2	102.9
Min River Rels	cfs	100	100	150	150	150	150	150	150	150	150	150	155	

Willow Crk Operations — Initial Cont 23.1 kaf, Elev 4135.71 ft; Maximum Cont 31.9 kaf, Elev 4142.04 ft; Minimum Cont 0.1 kaf, Elev 4093.42 ft

2011		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Native Inflow	kaf	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.2
Total Inflow	kaf	0.0	0.0	0.0	0.0	0.0	0.1	3.2	3.9	1.6	0.0	0.0	0.0	8.8
WCR Dam Rels	kaf	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.9	3.3	4.2
End-Month Content	kaf	23.1	23.1	23.1	23.1	23.1	23.2	26.4	30.3	31.9	31.9	31.0	27.7	
End-Month Elevation	ft	4135.71	4135.71	4135.71	4135.71	4135.71	4135.79	4138.16	4140.93	4142.04	4142.04	4141.42	4139.10	
Net Change Content	kaf	0.0	0.0	0.0	0.0	0.0	0.1	3.2	3.9	1.6	0.0	-0.9	-3.3	4.6

Pishkun Operations — Initial Cont 20.3 kaf, Elev 4347.55 ft; Maximum Cont 46.7 kaf, Elev 4370.00 ft; Minimum Cont 16.0 kaf, Elev 4341.99 ft

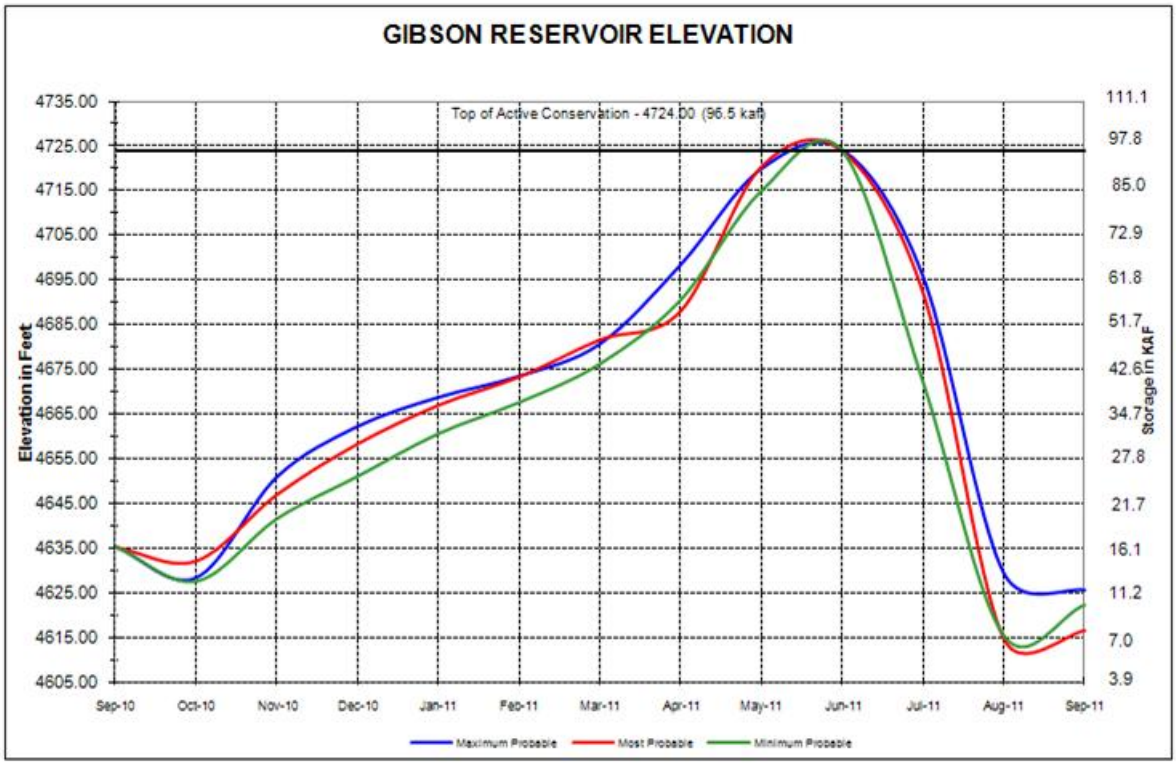
2011		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Rels to PSC	kaf	19.2	0.0	0.0	0.0	0.0	0.0	13.4	68.4	79.3	83.6	55.5	14.8	334.2
Total Inflow	kaf	16.3	0.0	0.0	0.0	0.0	0.0	11.4	54.7	65.0	71.1	47.2	12.6	278.3
PSH Dam Rels	kaf	0.0	0.0	0.0	0.0	0.0	0.0	9.0	47.0	65.0	82.0	43.0	16.0	262.0
End-Month Content	kaf	36.6	36.6	36.6	36.6	36.6	36.6	39.0	46.7	46.7	35.8	40.0	36.6	
End-Month Elevation	ft	4362.99	4362.99	4362.99	4362.99	4362.99	4362.99	4364.73	4370.00	4370.00	4362.39	4365.44	4362.99	
Net Change Content	kaf	16.3	0.0	0.0	0.0	0.0	0.0	2.4	7.7	0.0	-10.9	4.2	-3.4	16.3

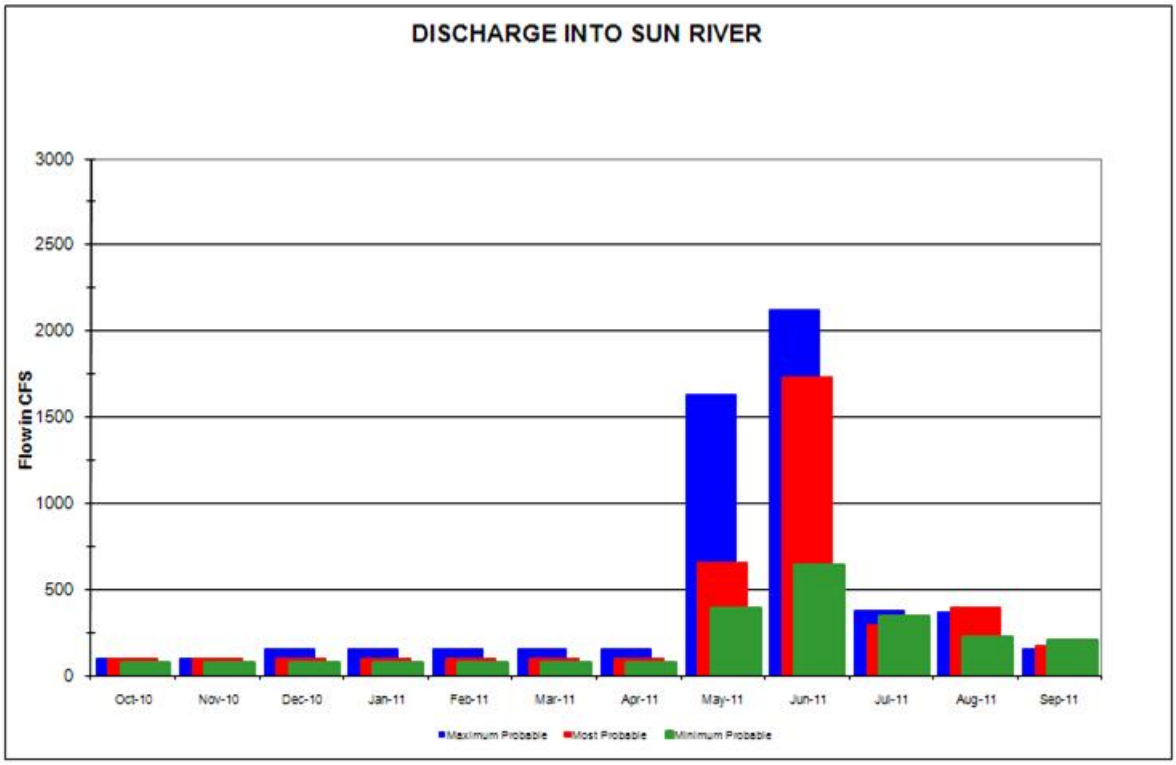
Greenfields Irrig	2011	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
GID Demand	kaf	0.0	0.0	0.0	0.0	0.0	0.0	9.0	47.0	65.0	82.0	43.0	16.0	262.0
GID Delivery	kaf	0.0	0.0	0.0	0.0	0.0	0.0	9.0	47.0	65.0	82.0	43.0	16.0	262.0

River Blw Div Dam	2011	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Flow Over Div Dam	cfs	99	101	150	150	150	150	150	1630	2123	372	371	155	
PSC Return Flow	cfs	46	0	0	0	0	0	27	179	192	172	122	37	
WCR Dam Rels	cfs	0	0	0	0	0	0	0	0	0	0	15	55	
Sr Demand Above	kaf	1.0	0.0	0.0	0.0	0.0	0.0	0.0	7.7	12.9	13.3	13.3	2.0	50.2
Sr Demand Below	kaf	1.0	0.0	0.0	0.0	0.0	0.0	0.0	5.5	5.4	5.5	5.5	2.0	24.9
Flow @ Ft.Shaw Div	cfs	127	109	163	164	165	174	225	1706	2114	246	213	190	
Ft Shaw Demand	kaf	1.0	0.0	0.0	0.0	0.0	0.0	1.0	10.0	10.0	12.0	10.0	8.0	52.0
Ft Shaw Tot Deliv	kaf	1.0	0.0	0.0	0.0	0.0	0.0	1.0	10.0	10.0	12.0	10.0	8.0	52.0
Flow blw Ft. Shaw	cfs	111	109	163	164	165	174	208	1543	1946	50	50	55	

FIGURE MTG15

GIBSON RESERVOIR





WATER YEAR 2011

Lake Elwell (Tiber Dam)

Three operating plans were prepared for 2011 to show the operations of Lake Elwell which could occur under various runoff conditions. These operations for the three runoff conditions are shown in Table MTT15 and Figure MTG16. These plans are presented only to show the probable limits of operations; therefore, actual conditions and operations could vary widely from the plans.

In 2002, Reclamation surveyed Lake Elwell to develop a topographic map and compute a present storage-elevation relationship (area-capacity tables). The data were used to calculate reservoir capacity lost due to sediment accumulation since dam closure in October of 1957. The 2002 survey determined that Lake Elwell has a storage capacity of 925,649 acre-feet and a surface area of 18,275 acres at a reservoir elevation of 2993.00 feet. Since closure in 1957, the reservoir has accumulated a sediment volume of 42,179 acre-feet below elevation 2993.00 feet. This volume represents a 4.4 percent change in total capacity at this elevation. The revised area-capacity table was put into effect on October 1, 2005, reflecting the new storage levels.

The objectives of operations at Lake Elwell are to provide flood control in cooperation with the Corps, to provide fish and wildlife enhancement to the area, and supply water for irrigation and municipal uses. The reservoir is operated under the following criteria and limitations:

1. Whenever an adequate water supply is available, Tiber Dam and Reservoir is operated to maintain a minimum flow of 500 cfs or more in the Marias River immediately below Tiber Dam to provide a healthy river fishery. When an adequate water supply is not available to maintain a release of 500 cfs, releases will be reduced to 380 cfs during the irrigation season and to 320 cfs during the non-irrigation season. During periods of extreme extended drought it may be necessary to reduce releases to as low as 250 cfs during the non-irrigation season.

2. During unusually low runoff years, the reservoir may not fill in order to maintain the desired or minimum flow levels.

3. Based on monthly seasonal water supply forecasts prepared during January through June, releases are adjusted to allow storage to fill to elevation 2993 feet (925,649 acre-feet) (top of joint-use pool) by the end of June.

4. To minimize lowland flooding, maximum releases are currently maintained below 5,500 cfs. The maximum safe channel capacity of the Marias River is currently established as 10,000 cfs.

5. After storage has peaked, usually in June, releases are adjusted to evacuate storage to an elevation between 2976-2980 feet (667,213-719,885 acre-feet) by March 1. This elevation is dependent upon the monthly water supply forecasts in order to provide adequate space to control the next season's snowmelt runoff.

6. Maintain Tiber Reservoir at or above elevation 2982 feet (747,953 acre-feet) during Memorial Day Weekend in late May through Labor Day Weekend in early September, to protect flat water recreation interests.

7. During October to early November, set a release that can be reasonably maintained through the fall and winter. A stable flow or one that is gradually increased during the winter is needed to protect the spawning habitat for brown trout. This flow rate should be low enough to minimize the possibility that flows may need to be reduced as a result of below normal winter mountain snowpack and runoff projections.

8. If conditions allow, attempt to maintain stable releases to Marias River during April 1 through May 15 to protect goose nesting.

9. If conditions allow, avoid dropping the reservoir level during April and May, to protect fish spawning in the reservoir.

10. In close coordination with MFWP, whenever an adequate water supply is available and conditions allow, releases will be scheduled to assimilate a natural spring runoff hydrograph which normally occurs in late May or early June.

11. All flood control operations are closely coordinated with the Corps. If the Corps advises that replacement storage is desirable during the maximum probable runoff, releases during the spring runoff period from March through June will be maintained at about 500 cfs, allowing storage to exceed elevation 2993 feet (925,649 acre-feet), the top of the joint use pool.

12. March-June releases are based on forecasted inflows with the objective of filling Lake Elwell to an elevation of 2993 feet (925,649 acre-feet) by the end of June. However, in some years, March-June releases may be based on filling the reservoir to as high as an elevation of 3008 feet (1,227,174 acre-feet) by the end of June, to provide replacement storage and assist the Corps with the operations of their main stem reservoir system.

13. Whenever possible, attempts are made to maintain water temperatures in the Marias River between 55°F and 60°F during June 1 through September 15.

14. To prevent ice jam flooding from occurring, the maximum desired winter release is maintained no higher than 700 cfs.

15. Under normal operations, river releases of up to about 700 cfs will generally be released through the 7.5 MW FERC powerplant. If releases greater than 700 cfs are required, flows in excess of the powerplant capacity will be released through a combination of the river outlet works regulating gate, through the auxiliary outlet works or through the spillway gates.

By the end of water year 2010, the total annual valley precipitation was above average at 128 percent of average and the total annual mountain precipitation in the Marias River Basin was below average at 79 percent of average. The total annual runoff into Lake Elwell during 2010 was 388,323 acre-feet, 58 percent of normal and 37,431 acre-feet less than experienced in 2009. At the beginning of water year 2011, the storage content in Lake Elwell was 842,438 acre-feet at elevation 2988.23 feet, approximately 108 percent of normal and 91 percent of full capacity. This was 821 acre-feet higher than at this same time a year ago.

The most probable October-March inflows to Lake Elwell were estimated to equal 25 percentile inflows or inflows that are historically exceeded 75 percent of the time. Most probable April-September inflows were estimated to equal 30 percentile inflows or inflows that are historically exceeded 70 percent of the time.

The minimum probable October-September inflows to Lake Elwell were estimated to equal 10 percentile inflows or inflows that are historically exceeded 90 percent of the time.

The maximum probable October-April inflows to Lake Elwell were estimated to equal inflows that are 25 percent more than the most probable inflows. The maximum probable May inflows were estimated to equal flows of a median year or a year with a 50 percent chance of being exceeded based on historic records. June-September inflows were estimated to equal 75 percentile inflows or inflows that are historically exceeded 25 percent of the time.

Lake Elwell is not expected to fill during 2011 under the minimum probable runoff conditions, but would fill under the most probable and maximum probable runoff conditions. Water levels under the minimum probable runoff conditions are expected to peak in late June or early July at approximately 4 feet below the top of the joint use pool. Under the most probable and maximum probable runoff conditions, the water level in Lake Elwell is expected to peak in late June or early July at or near the top of the joint use pool. A minimum river release of 500 cfs would be maintained through the winter under all three runoff conditions.

TABLE MTT15

TIBER RESERVOIR OPERATING PLAN
Based on October 1 2010 Inflow Estimates

2011 MINIMUM Probable Inflow Forecast

Tiber Reservoir — Initial Cont 842.4 kaf, Elev 2988.23 ft; Maximum Cont 1356.5 kaf, Elev 3013.69 ft; Minimum Cont 260.7 kaf, Elev 2932.27 ft

	2010	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Monthly Inflow	kaf	8.3	10.1	8.7	10.2	12.1	18.7	38.5	87.6	61.1	19.9	4.9	4.1	284.2
Evaporation	kaf	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dam Release	kaf	30.7	29.8	30.7	30.7	27.8	24.6	23.8	24.6	23.8	24.6	24.6	23.8	319.5
Dam Release	cfs	499	501	499	499	501	400	400	400	400	400	400	400	
End-Month Content	kaf	820.0	800.3	778.3	757.8	742.1	736.2	750.9	813.9	851.2	846.5	826.8	807.1	
End-Month Elevation	ft	2986.84	2985.56	2984.09	2982.69	2981.59	2981.17	2982.21	2986.45	2988.76	2988.48	2987.26	2986.01	
Net Change Content	kaf	-22.4	-19.7	-22.0	-20.5	-15.7	-5.9	14.7	63.0	37.3	-4.7	-19.7	-19.7	-35.3

2011 MOST Probable Inflow Forecast

Tiber Reservoir — Initial Cont 842.4 kaf, Elev 2988.23 ft; Maximum Cont 1356.5 kaf, Elev 3013.69 ft; Minimum Cont 260.7 kaf, Elev 2932.27 ft

	2010	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Monthly Inflow	kaf	12.3	14.0	10.8	13.3	15.2	30.7	49.1	125.3	107.2	36.7	11.8	9.2	435.6
Evaporation	kaf	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dam Release	kaf	30.8	29.8	30.8	30.8	27.8	30.7	29.8	42.8	41.4	42.8	42.8	41.4	421.7
Dam Release	cfs	501	501	501	501	501	499	501	696	696	696	696	696	
End-Month Content	kaf	823.9	808.1	788.1	770.6	758.0	758.0	777.3	859.8	925.6	919.5	888.5	856.3	
End-Month Elevation	ft	2987.08	2986.07	2984.75	2983.57	2982.70	2982.70	2984.02	2989.27	2993.00	2992.66	2990.94	2989.07	
Net Change Content	kaf	-18.5	-15.8	-20.0	-17.5	-12.6	0.0	19.3	82.5	65.8	-6.1	-31.0	-32.2	13.9

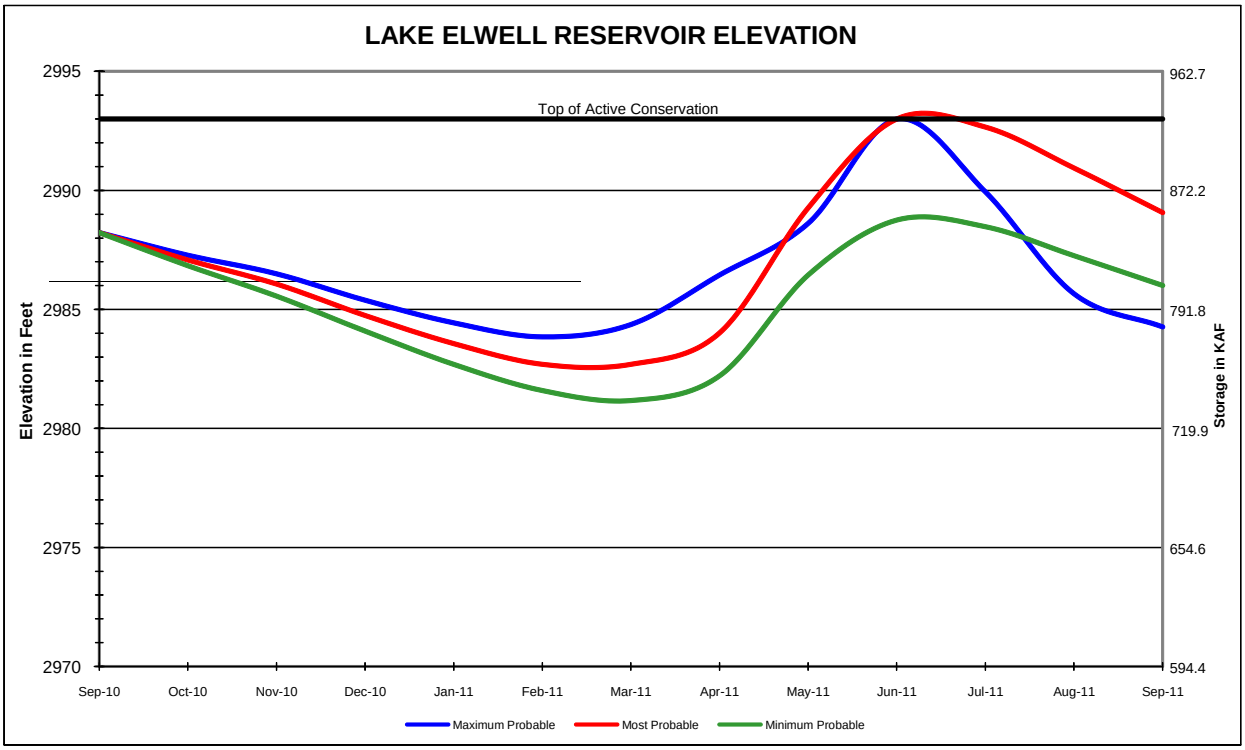
2011 MAXIMUM Probable Inflow Forecast

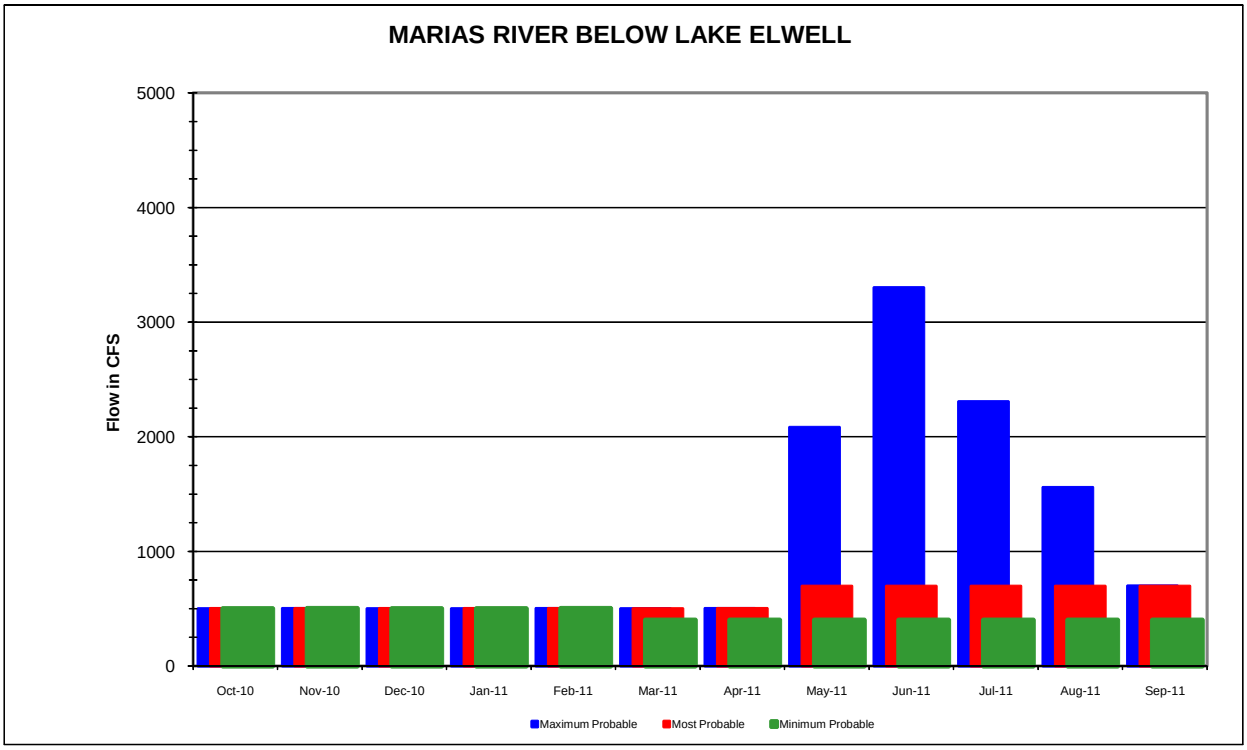
Tiber Reservoir — Initial Cont 842.4 kaf, Elev 2988.23 ft; Maximum Cont 1356.5 kaf, Elev 3013.69 ft; Minimum Cont 260.7 kaf, Elev 2932.27 ft

	2010	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Monthly Inflow	kaf	15.4	17.5	13.5	16.6	19.0	38.4	61.4	162.9	273.2	87.3	26.5	20.7	752.4
Evaporation	kaf	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dam Release	kaf	30.7	29.8	30.7	30.7	27.8	30.7	29.8	128.1	196.4	141.8	95.8	41.6	813.9
Dam Release	cfs	499	501	499	499	501	499	501	2083	3301	2306	1558	699	
End-Month Content	kaf	827.1	814.8	797.6	783.5	774.7	782.4	814.0	848.8	925.6	871.1	801.8	780.9	
End-Month Elevation	ft	2987.28	2986.50	2985.39	2984.44	2983.85	2984.37	2986.45	2988.62	2993.00	2989.94	2985.66	2984.27	
Net Change Content	kaf	-15.3	-12.3	-17.2	-14.1	-8.8	7.7	31.6	34.8	76.8	-54.5	-69.3	-20.9	-61.5

FIGURE MTG16

LAKE ELWELL





WATER YEAR 2011

Milk River Project

The 120,000-acre Milk River Project is served by three reservoirs: Sherburne, Fresno, and Nelson. All are single-purpose irrigation structures except Fresno, which has some joint-use flood control space and furnishes a small amount of municipal water to Havre, Chinook, and Harlem, Montana, and to the Hill County Water District.

Lake Sherburne

Storage on September 30, 2010, was 30,888 acre-feet, 369 percent of normal at elevation 4763.48 feet. The total inflow to Lake Sherburne during water year 2010 was 132,900 acre-feet, 92 percent of normal. The division of the waters of the St. Mary River, including Lake Sherburne inflow, is carried out in accordance with the Order of the International Joint Commission dated October 4, 1921. There are no agreements for reservoir releases specifically for fish, wildlife, or recreation purposes. There is no minimum release requirement. All stored water is required for irrigation use, and other uses are incidental. Lake Sherburne lands are administered for recreation and wildlife habitat by the National Park Service in accordance with the management plan for Glacier National Park. Lake Sherburne is operated under the following criteria:

1. Near the end of the spring runoff, the discharge should be regulated based on snow measurements and inflow forecasts to insure filling the reservoir to elevation 4788.00 feet. The final reservoir filling up to elevation 4788.00 feet should be delayed until near the end of the spring runoff. During this final phase, care should be taken to avoid use of the outlet works overflow crest because of less desirable hydraulic flow conditions which develop in the conduit. When the water surface reaches elevation 4788.00 feet, the outlet gates must be opened to the extent necessary to maintain this elevation. If reservoir inflows continue to increase, the outlet gates must be fully opened and maintained in the full open position until the water surface recedes to elevation 4788.00 feet.

2. Every effort must be made to prevent the reservoir from spilling while assuring a full reservoir. During all stages, except the final stage of the spring runoff, the outlet gates should be adjusted to maintain the water surface no higher than elevation 4788.00 feet. The outlet gates should be fully opened during the spring runoff when the water surface rises to or above elevation 4788.00 feet and fully open at any time the water surface is above elevation 4788.00 feet. Three operating plans were prepared for 2010 to show the operations which could occur under various runoff conditions. These plans were prepared to show the probable limits of operations, therefore, actual conditions and operations could vary widely from the plans.

The most probable plan estimates October and December inflows decreasing from 100 percentile to 75 percentile values. The January-April inflows are estimated to decrease from 57 percentile to 50 percentile values. The May-June inflows are estimated to equal 57 percentile values. July-September inflows are estimated to be equal to the 50 percentile values.

October-December flows for the St. Mary River near the International Boundary are estimated to equal approximately 75 percentile flows and January-April are estimated to equal 50 percentile flows. May and June flows are estimated at 57 percentile values while July-September flows are estimated at 50 percentile values.

The minimum probable October inflow is estimated to be near average. The November through September inflows to Lake Sherburne were estimated to equal 25 percentile inflows or inflows that are exceeded 75 percent of the time. October through September flows in the St. Mary River near the International Boundary is also estimated to equal 12.5 percentile flows.

The maximum probable October through September inflows to Lake Sherburne are estimated to equal 90 percentile flows or inflows that are exceeded 10 percent of the time.

Fresno Reservoir

The cumulative precipitation through the end of June was 111 percent of average, however, as the summer continued the precipitation patterns improved slightly. July and August valley precipitation were 118 and 198 percent of average, respectively. Total inflow for the year was 346,258 acre-feet, 131 percent of average. This was 125,256 acre-feet or 47 percent more than the inflow experienced during water year 2009. Storage on September 30, 2010, was 76,344 acre-feet, 191 percent of average and 82 percent of normal full capacity. Releases continued into October in an attempt to draw storage in Fresno Reservoir down to the desired spring flood control target level at elevation 2567.00 feet. The natural runoff of the Milk River at the Eastern Crossing, which is immediately upstream of Fresno Reservoir, is computed as part of the International Joint Commission accounting and published in associated report each subsequent water year. The initial estimate of natural flow at Eastern Crossing for water year 2010 is approximately 143,131 acre-feet.

The storage is primarily for irrigation and municipal water supply. However, the operation of the joint use storage space does provide both conservation use and limited flood control benefits. There is no exclusive flood control space, but some flood benefits are obtained by maintaining the water level below elevation 2567.0 feet by March 1, prior to spring runoff. Maintaining the water level below elevation 2567.0 feet provides 32,534 acre-feet of space for storage of spring runoff.

Winter releases will be the amount necessary to provide a minimum of 32,534 acre-feet of space before spring runoff begins, however, no less than 25 cfs to the Milk River as measured at the highway bridge at Havre. An anticipated release of 45 to 60 cfs will be made from Fresno Reservoir during October through February to meet contractual amounts required for the maintenance of suitable water quality for municipal use for the cities of Havre, Chinook, and Harlem, Montana. After spring runoff begins, releases will be made only to meet conservation requirements until it becomes obvious that the reservoir will fill and spill. At that time, releases will be gradually increased so that spill will be minimized when the pool rises above the spillway crest.

The only required summer releases will be those for irrigation and municipal uses. Municipal requirements are established by contract and scheduled in advance by the municipal water contractors. The most probable inflows during October through September are estimated to be 50 percentile flows.

The minimum probable inflows during October through September to Fresno Reservoir are estimated to equal 12.5 percentile inflows that transition to 25 percentile inflows.

The maximum probable inflows during October through January to Fresno Reservoir are estimated to equal median flow conditions. The February-September inflows are estimated to equal 60 percentile inflows or inflows that have historically been exceeded 40 percent of the time.

Nelson Reservoir

Storage in Nelson Reservoir on September 30, 2010, was 77,488 acre-feet, 137 percent of average at elevation 2221.26 feet. Nelson Reservoir is filled in the spring, prior to the irrigation season, utilizing Dodson South Canal to convey water from the Milk River to the reservoir. Under most circumstances, water is transferred from storage in Fresno Reservoir in the early spring instead of in the fall to minimize seepage losses from Nelson Reservoir during the winter. However, if water is available in Fresno Reservoir after the irrigation season, it may be transferred to Nelson Reservoir to ensure a full supply for the following irrigation season. Nelson Reservoir is operated to satisfy irrigation demands and all other uses are incidental to irrigation. In conjunction with delivering water to Nelson Reservoir, water is conveyed through the Dodson South Canal to provide the Bowdoin Wildlife Refuge adequate water for migratory birds. Bowdoin usually receives a proportional share of their full contract allotment, 3,500 acre-feet, based on the irrigation supply. The operation of Nelson Reservoir and delivery to Bowdoin is integrated with the operation of Fresno Reservoir and Lake Sherburne to ensure maximum utilization of expected runoff.

Irrigation shortages are not expected to occur under the maximum or most probable expected runoff, but could possibly occur under the minimum probable expected runoff. Lake Sherburne is expected to fill under all three plans. Fresno Reservoir is expected to fill under all three plans as well due to the high carryover from 2010. These operations for the three runoff conditions are shown in Table MTT16A-C and Figure MTG17-18. Water will need to be transferred to Nelson Reservoir during late spring of 2010 to provide water for those users dependent on a full and supplemental supply from Nelson Reservoir. The projected transfer of water during March and April is anticipated to be approximately 10,000-14,000 acre-feet for all three operational plans depending on irrigation allotments and available natural runoff.

TABLE MTT16A
RIVER BASIN OPERATING PLAN
Based on October 1 Inflow Estimates

2011 Minimum Probable Runoff

Sherburne Reservoir — Initial Cont 30.9 kaf; Elev 4763.50 ft — Maximum Cont 66.2 kaf; Elev 4788.03 ft — Minimum Cont 3.1 kaf; Elev 4731.73 ft

2011		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Monthly Inflow	kaf	6.0	4.8	3.5	2.6	2.0	2.7	8.5	29.5	33.9	16.2	7.7	5.2	122.6
Release	kaf	0.0	0.0	0.0	0.0	0.0	0.0	25.8	11.2	24.7	40.7	42.3	0.8	145.5
Release	cfs	0	0	0	0	0	0	434	182	415	662	688	13	
Net Change Content	kaf	6.0	4.8	3.5	2.6	2.0	2.7	-17.3	18.3	9.2	-24.5	-34.6	4.4	-22.9
End-Month Content	kaf	36.9	41.7	45.2	47.8	49.8	52.5	35.2	53.5	62.7	38.2	3.6	8.0	
End-Month Elevation	ft	4768.53	4772.26	4774.77	4776.56	4777.90	4779.67	4767.14	4780.31	4785.97	4769.57	4732.63	4739.33	

St. Mary River	2011	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
St. Mary Gain	kaf	19.5	13.4	6.7	5.4	5.0	6.3	11.5	86.0	117.2	54.9	26.1	17.2	369.2
Nat. flow at bound.	kaf	25.5	18.2	10.2	8.0	7.0	9.0	20.0	115.5	151.1	71.1	33.8	22.4	491.8
US share	kaf	6.4	9.1	5.1	4.0	3.5	4.5	5.0	47.5	65.6	25.3	8.5	5.6	190.1
Can share	kaf	19.1	9.1	5.1	4.0	3.5	4.5	15.0	68.0	85.5	45.8	25.3	16.8	301.7
Can del.	kaf	19.1	9.1	5.1	4.0	3.5	4.5	15.0	68.0	102.6	55.0	27.8	16.8	330.5
Excess to Canada	kaf	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
US share to Canada	kaf	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Max canal flow	cfs	0	0	0	0	0	0	650	650	660	660	660	20	
Desired canal div	cfs	0	0	0	0	0	30	375	475	660	660	660	20	
St. Mary Canal Div	cfs	0	0	0	0	0	0	375	475	660	660	660	20	
St. Mary Canal Div	kaf	0.0	0.0	0.0	0.0	0.0	0.0	22.3	29.2	39.3	40.6	40.6	1.2	173.2

Fresno Reservoir — Initial Cont 76.3 kaf; Elev 2571.32 ft — Maximum Cont 105.0 kaf; Elev 2577.34 ft — Minimum Cont 0.5 kaf; Elev 2530.27 ft

2011		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Milk R. runoff	kaf	2.2	1.6	1.2	0.2	1.7	4.9	7.4	6.6	12.0	11.0	2.0	6.0	56.8
From St. Mary Canal	kaf	0.0	0.0	0.0	0.0	0.0	0.0	20.1	26.3	35.4	36.5	36.5	1.1	155.9
Total inflow	kaf	2.2	1.6	1.2	0.2	1.7	4.9	27.5	32.9	47.4	47.5	38.5	7.1	212.7
Release	kaf	11.7	2.8	2.9	2.9	2.7	2.9	2.6	27.0	60.7	68.7	46.3	16.3	247.5
Release	cfs	190	47	47	47	47	47	44	439	1020	1117	753	274	
Project irr req	kaf	6.2	0.0	0.0	0.0	0.0	0.0	0.0	17.3	47.6	54.3	27.7	3.7	156.8
Bowdoin WR req	kaf	0.0	0.0	0.0	0.0	0.0	0.0	1.1	0.0	0.0	0.0	0.0	0.0	1.1
Ft Belknap irr req	kaf	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.0	5.0	4.0	13.0
Nelson transfer	kaf	0.0	0.0	0.0	0.0	0.0	0.0	0.0	12.0	8.0	9.0	12.0	12.0	53.0
Irrigation delivery	kaf	6.2	0.0	0.0	0.0	0.0	0.0	1.1	17.3	47.6	58.3	32.7	7.7	170.9
Fresno bypass	kaf	9.8	2.8	2.9	2.9	2.7	2.9	2.6	0.0	0.0	0.0	0.0	0.0	45.4
Irrigation shortage	kaf	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Net Change Content	kaf	-9.5	-1.2	-1.7	-2.7	-1.0	2.0	24.9	5.9	-13.3	-21.2	-7.9	-9.2	-34.9
End-Month Content	kaf	66.8	65.6	63.9	61.2	60.2	62.2	87.1	93.0	79.7	58.5	50.7	41.5	
End-Month Elevation	ft	2568.87	2568.54	2568.06	2567.26	2566.96	2567.56	2573.78	2575.02	2572.13	2566.43	2563.72	2560.09	

Nelson Reservoir — Initial Cont 77.5 kaf; Elev 2221.26 ft — Maximum Cont 79.0 kaf; Elev 2221.61 ft — Minimum Cont 18.0 kaf; Elev 2199.91 ft

2011		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Nelson delivery	kaf	0.0	0.0	0.0	0.0	0.0	0.0	0.0	11.5	7.9	8.5	11.7	11.4	51.0
Nelson Release	kaf	0.0	0.0	0.0	0.0	0.0	0.0	0.0	9.9	11.7	20.5	14.8	1.2	58.1
Malta irr req	kaf	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.6	7.8	13.7	8.7	0.8	38.6
Glasgow irr req	kaf	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.0	3.9	6.8	6.1	0.4	19.2
Net Change Content	kaf	0.0	-1.8	-1.8	-1.8	-1.7	-1.8	6.0	4.4	-2.3	-13.8	-4.9	8.4	-11.1
End-Month Content	kaf	77.5	75.7	73.9	72.1	70.4	68.6	74.6	79.0	76.7	62.9	58.0	66.4	
End-Month Elevation	ft	2221.26	2220.84	2220.41	2219.97	2219.55	2219.10	2220.58	2221.61	2221.08	2217.64	2216.33	2218.54	

TABLE MTT16B
MILK RIVER BASIN OPERATING PLAN
Based on October 1 Inflow Estimates

2011 Most Probable Runoff

Sherburne Reservoir — Initial Cont 30.9 kaf, Elev 4763.50 ft; Maximum Cont 66.2 kaf, Elev 4788.03 ft; Minimum Cont 3.1 kaf, Elev 4731.73 ft

2011		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Monthly Inflow	kaf	7.3	6.6	3.9	2.8	2.9	3.2	9.0	34.5	43.1	19.1	9.5	7.1	149.0
Release	kaf	0.0	0.0	0.0	0.0	0.0	0.0	15.2	19.7	43.1	38.7	53.0	0.5	170.2
Release	cfs	0	0	0	0	0	0	255	320	724	629	862	8	
Net Change Content	kaf	7.3	6.6	3.9	2.8	2.9	3.2	-6.2	14.8	0.0	-19.6	-43.5	6.6	-21.2
End-Month Content	kaf	38.2	44.8	48.7	51.5	54.4	57.6	51.4	66.2	66.2	46.6	3.1	9.7	
End-Month Elevation	ft	4769.57	4774.49	4777.17	4779.02	4780.88	4782.88	4778.95	4788.03	4788.03	4775.74	4731.73	4741.59	

St. Mary River 2011		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
St. Mary Gain	kaf	24.7	20.8	13.0	8.2	6.0	8.7	13.8	102.8	146.3	79.0	31.4	19.1	473.8
Nat. flow at bound.	kaf	32.0	27.4	16.9	11.0	8.9	11.9	22.8	137.3	189.4	98.1	40.9	26.2	622.8
US share	kaf	8.0	13.7	8.5	5.5	4.5	6.0	5.7	58.4	84.8	38.8	10.2	6.6	250.7
Can share	kaf	24.0	13.7	8.4	5.5	4.4	5.9	17.1	78.9	104.6	59.3	30.7	19.6	372.1
Can del.	kaf	24.0	13.7	8.4	5.5	4.4	5.9	17.1	78.9	136.0	77.1	44.5	19.6	435.1
Excess to Canada	kaf	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.6	14.1	0.0	0.0	0.0	17.7
US share to Canada	kaf	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.6	45.5	0.0	0.0	0.0	49.1
Max canal flow	cfs	0	0	0	0	0	0	650	650	660	660	650	0	
Desired canal div	cfs	0	0	0	0	0	0	200	500	660	660	650	0	
St. Mary Canal Div	cfs	0	0	0	0	0	0	200	651	660	660	649	0	
St. Mary Canal Div	kaf	0.0	0.0	0.0	0.0	0.0	0.0	11.9	40.0	39.3	40.6	39.9	0.0	171.7

Fresno Reservoir — Initial Cont 76.3 kaf, Elev 2571.32 ft; Maximum Cont 98.0 kaf, Elev 2576.02 ft; Minimum Cont 0.5 kaf, Elev 2530.27 ft

2011		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Milk R. runoff	kaf	4.7	2.4	1.4	0.8	1.7	10.5	13.4	15.5	16.3	16.0	5.0	9.0	96.7
From St. Mary Canal	kaf	0.0	0.0	0.0	0.0	0.0	0.0	10.7	36.0	35.4	36.5	35.9	0.0	154.5
Total inflow	kaf	4.7	2.4	1.4	0.8	1.7	10.5	24.1	51.5	51.7	52.5	40.9	9.0	251.2
Release	kaf	13.5	2.8	2.9	2.9	2.7	2.9	2.8	49.9	65.7	58.0	56.0	25.4	285.5
Release	cfs	220	47	47	47	47	47	47	812	1104	943	911	427	
Project irr req	kaf	9.5	0.0	0.0	0.0	0.0	0.0	0.0	17.7	48.7	39.7	36.4	11.9	163.9
Bowdoin WR req	kaf	0.0	0.0	0.0	0.0	0.0	0.0	1.1	0.0	0.0	0.0	0.0	0.0	1.1
Ft Belknap irr req	kaf	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.0	5.0	4.0	14.0
Nelson transfer	kaf	0.0	0.0	0.0	0.0	0.0	0.0	10.0	20.0	12.0	14.0	12.0	12.0	80.0
Irrigation delivery	kaf	10.5	0.0	0.0	0.0	0.0	0.0	1.1	17.7	48.7	43.7	41.4	15.9	179.0
Fresno bypass	kaf	6.8	2.8	2.9	2.9	2.7	2.9	2.8	26.1	0.0	0.0	0.0	0.0	66.5
Irrigation shortage	kaf	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Net Change Content	kaf	-8.8	-0.4	-1.5	-2.1	-1.0	7.6	21.3	1.6	-14.0	-5.5	-15.1	-16.4	-34.3
End-Month Content	kaf	67.5	67.1	65.6	63.5	62.5	70.1	91.4	93.0	79.0	73.5	58.4	42.0	
End-Month Elevation	ft	2569.06	2568.96	2568.54	2567.94	2567.65	2569.76	2574.69	2575.02	2571.97	2570.63	2566.39	2560.30	

Nelson Reservoir — Initial Cont 77.5 kaf, Elev 2221.26 ft; Maximum Cont 79.0 kaf, Elev 2221.61 ft; Minimum Cont 18.0 kaf, Elev 2199.91 ft

2011		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Nelson delivery	kaf	0.0	0.0	0.0	0.0	0.0	0.0	2.0	8.2	11.3	13.4	11.7	11.4	58.0
Nelson Release	kaf	0.0	0.0	0.0	0.0	0.0	0.0	0.0	11.9	12.8	15.1	18.1	10.2	68.1
Malta irr req	kaf	0.0	0.0	0.0	0.0	0.0	0.0	0.0	9.8	8.0	10.1	11.8	6.7	46.4
Glasgow irr req	kaf	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.1	4.8	5.0	6.3	3.5	21.7
Net Change Content	kaf	0.0	-1.8	-1.8	-1.8	-1.7	0.6	8.0	0.0	0.0	-3.5	-8.2	-0.6	-10.8
End-Month Content	kaf	77.5	75.7	73.9	72.1	70.4	71.0	79.0	79.0	79.0	75.5	67.3	66.7	
End-Month Elevation	ft	2221.26	2220.84	2220.41	2219.97	2219.55	2219.70	2221.61	2221.61	2221.61	2220.79	2218.77	2218.62	

TABLE MTT16C
MILK RIVER BASIN OPERATING PLAN
Based on October 1 Inflow Estimates

2011 Maximum Probable Runoff

Sherburne Reservoir — Initial Cont 30.9 kaf, Elev 4763.50 ft; Maximum Cont 66.2 kaf, Elev 4788.03 ft; Minimum Cont 3.1 kaf, Elev 4731.73 ft

2011		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Monthly Inflow	kaf	8.0	9.1	4.1	3.5	2.8	3.4	9.7	36.3	56.4	28.1	12.3	8.0	181.7
Release	kaf	0.0	0.0	0.0	0.0	0.0	0.0	5.3	36.3	56.4	49.7	53.8	1.5	203.0
Release	cfs	0	0	0	0	0	0	89	590	948	808	875	25	
Net Change Content	kaf	8.0	9.1	4.1	3.5	2.8	3.4	4.4	0.0	0.0	-21.6	-41.5	6.5	-21.3
End-Month Content	kaf	38.9	48.0	52.1	55.6	58.4	61.8	66.2	66.2	66.2	44.6	3.1	9.6	
End-Month Elevation	ft	4770.13	4776.70	4779.41	4781.64	4783.38	4785.44	4788.03	4788.03	4788.03	4774.35	4731.73	4741.46	
St. Mary River	2011	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
St. Mary Gain	kaf	44.7	33.5	20.9	15.7	14.4	21.5	45.9	147.3	213.7	130.3	51.7	39.1	778.7
Nat. flow at bound.	kaf	52.7	42.6	25.0	19.2	17.2	24.9	55.6	183.6	270.1	158.4	64.0	47.1	960.4
US share	kaf	16.1	21.3	12.5	9.6	8.6	12.5	17.9	81.5	125.1	68.9	21.7	13.6	409.3
Can share	kaf	36.6	21.3	12.5	9.6	8.6	12.4	37.7	102.1	145.0	89.5	42.3	33.5	551.1
Can del.	kaf	36.6	21.3	12.5	9.6	8.6	12.4	37.7	102.1	217.5	139.4	65.6	33.5	696.8
Excess to Canada	kaf	0.0	0.0	0.0	0.0	0.0	0.0	5.3	11.7	13.3	0.0	0.0	0.0	30.3
US share to Canada	kaf	0.0	0.0	0.0	0.0	0.0	0.0	7.5	60.0	85.8	0.0	0.0	0.0	153.3
Max canal flow	cfs	0	0	0	0	0	0	100	350	660	660	660	20	
Desired canal div	cfs	0	0	0	0	0	20	50	275	660	660	660	20	
St. Mary Canal Div	cfs	0	0	0	0	0	0	101	350	660	660	649	20	
St. Mary Canal Div	kaf	0.0	0.0	0.0	0.0	0.0	0.0	6.0	21.5	39.3	40.6	39.9	1.2	148.5

Fresno Reservoir — Initial Cont 76.3 kaf, Elev 2571.32 ft; Maximum Cont 97.0 kaf, Elev 2575.83 ft; Minimum Cont 0.5 kaf, Elev 2530.27 ft

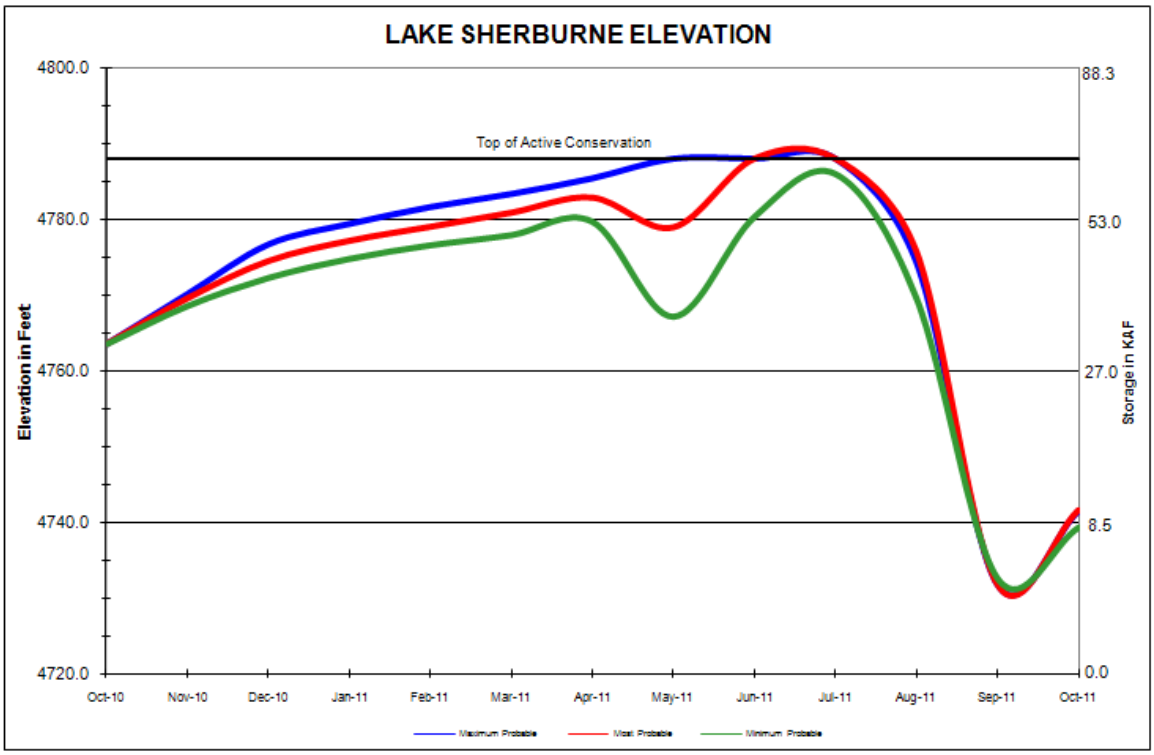
2011		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Milk R. runoff	kaf	7.4	3.2	2.2	1.5	2.9	19.2	22.2	23.4	20.4	20.0	4.1	8.7	135.2
From St. Mary Canal	kaf	0.0	0.0	0.0	0.0	0.0	0.0	5.4	19.4	35.4	36.5	35.9	1.1	133.7
Total inflow	kaf	7.4	3.2	2.2	1.5	2.9	19.2	27.6	42.8	55.8	56.5	40.0	9.8	268.9
Release	kaf	23.1	2.6	2.6	2.6	2.5	6.3	7.7	42.8	62.8	59.4	55.0	34.6	302.0
Release	cfs	376	44	42	42	43	102	129	696	1055	966	894	581	
Project irr req	kaf	7.4	0.0	0.0	0.0	0.0	0.0	0.0	20.6	47.5	42.5	38.5	22.1	178.6
Bowdoin WR req	kaf	0.0	0.0	0.0	0.0	0.0	0.0	1.1	0.0	0.0	1.0	0.0	0.0	2.1
Ft Belknap irr req	kaf	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.0	5.0	4.0	13.0
Nelson transfer	kaf	0.0	0.0	0.0	0.0	0.0	10.0	8.0	20.0	14.0	12.0	12.0	10.0	86.0
Irrigation delivery	kaf	7.4	0.0	0.0	0.0	0.0	0.0	1.1	20.6	47.5	47.5	43.5	26.1	193.7
Fresno bypass	kaf	21.9	2.6	2.6	2.6	2.5	6.3	7.7	10.3	0.0	0.0	0.0	0.0	69.8
Irrigation shortage	kaf	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Net Change Content	kaf	-15.7	0.6	-0.4	-1.1	0.4	12.9	19.9	0.0	-7.0	-3.0	-15.0	-24.8	-33.2
End-Month Content	kaf	60.6	61.2	60.8	59.7	60.1	73.0	92.9	92.9	85.9	83.0	68.0	43.2	
End-Month Elevation	ft	2567.08	2567.26	2567.14	2566.80	2566.92	2570.50	2575.00	2575.00	2573.53	2572.87	2569.20	2560.83	

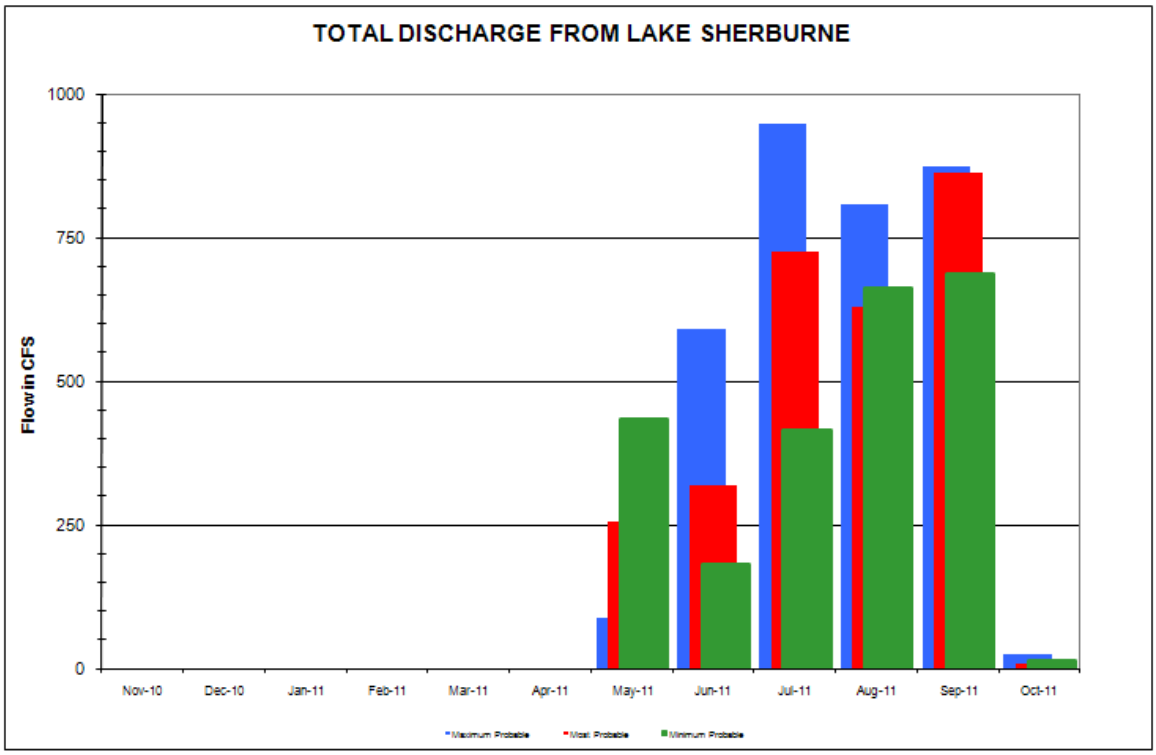
Nelson Reservoir — Initial Cont 77.5 kaf, Elev 2221.26 ft; Maximum Cont 79.0 kaf, Elev 2221.61 ft; Minimum Cont 18.0 kaf, Elev 2199.91 ft

2011		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Nelson delivery	kaf	0.0	0.0	0.0	0.0	0.0	10.0	4.0	14.9	13.5	11.3	11.4	9.5	74.6
Nelson Release	kaf	0.0	0.0	0.0	0.0	0.0	0.0	0.0	13.1	13.9	19.8	14.4	7.5	68.7
Malta irr req	kaf	0.0	0.0	0.0	0.0	0.0	0.0	0.0	9.0	9.3	14.0	9.2	4.4	45.9
Glasgow irr req	kaf	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.1	4.6	5.8	5.2	3.1	22.8
Net Change Content	kaf	-1.8	-1.8	-1.8	-1.8	-1.7	8.2	2.2	0.0	-2.2	-10.3	-4.8	3.2	-12.6
End-Month Content	kaf	75.7	73.9	72.1	70.3	68.6	76.8	79.0	79.0	76.8	66.5	61.7	64.9	
End-Month Elevation	ft	2220.84	2220.41	2219.97	2219.53	2219.10	2221.10	2221.61	2221.61	2221.10	2218.57	2217.32	2218.16	

FIGURE MTG17

LAKE SHERBURNE

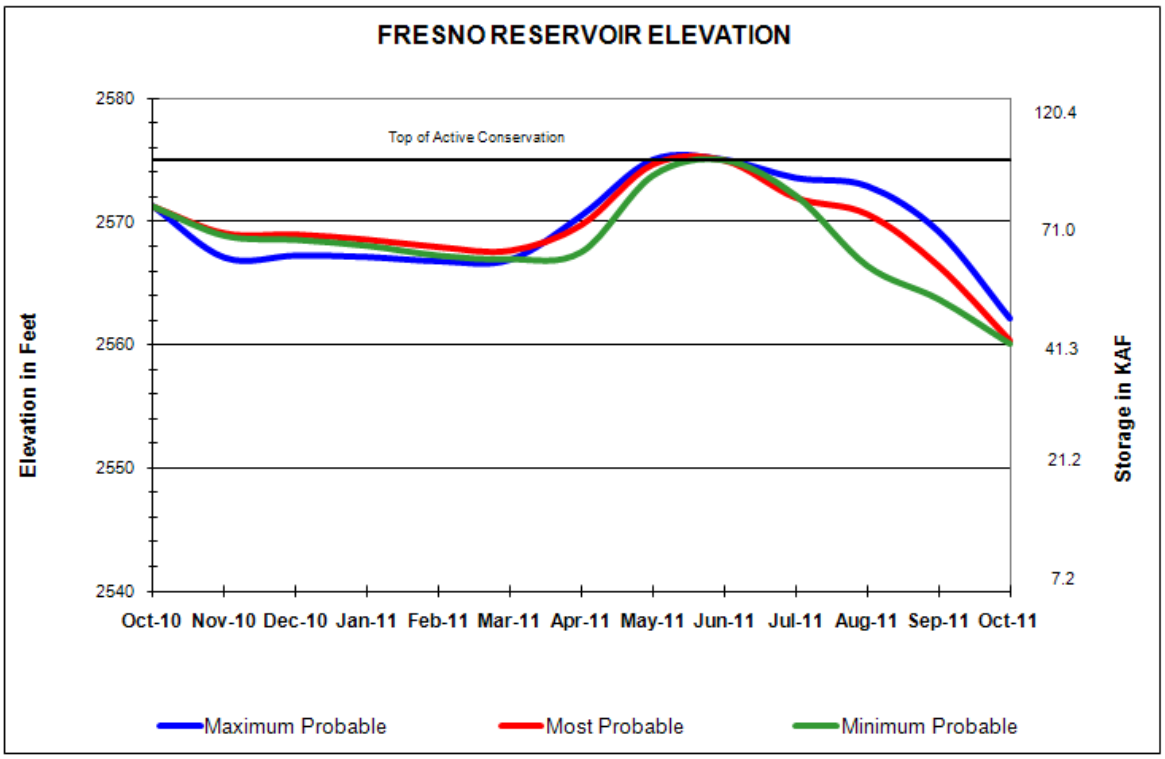


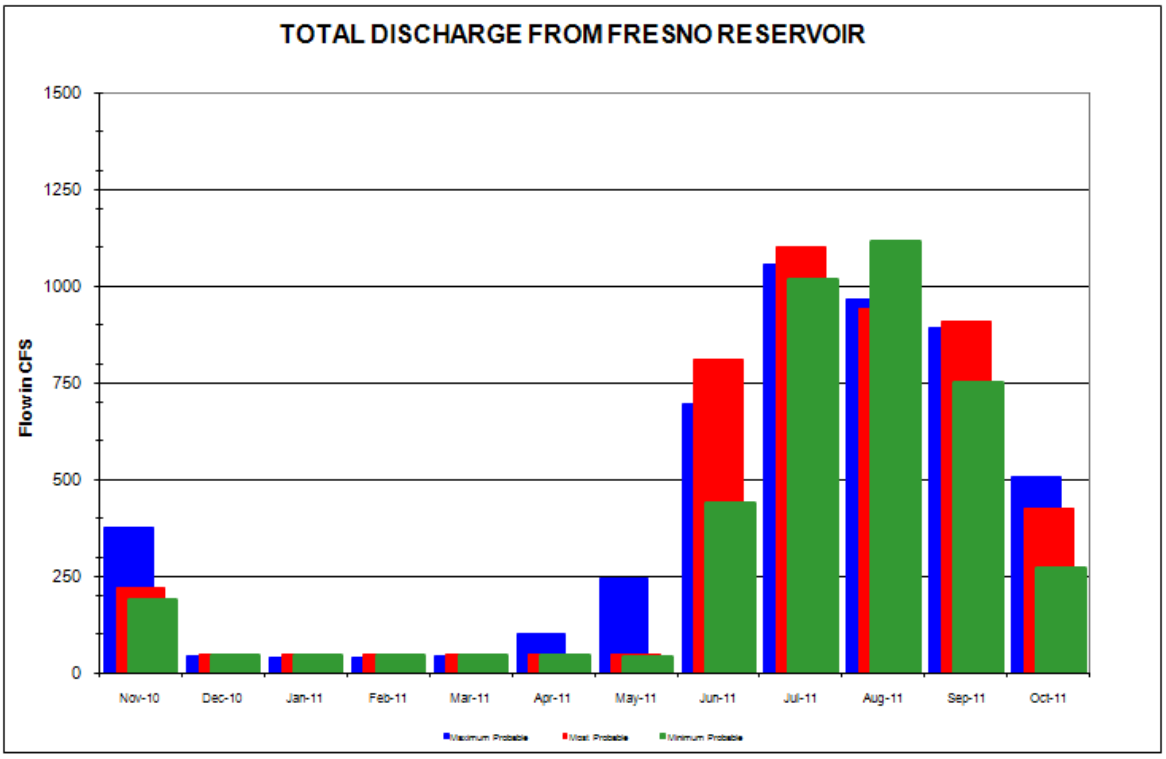


WATER YEAR 2011

FIGURE MTG18

FRESNO RESERVOIR





WATER YEAR 2011

Bighorn Lake and Yellowtail Powerplant

Three operating plans were prepared for 2011 to show the operations of Bighorn Lake which could occur under various runoff conditions. These operations for the three runoff conditions are shown in Tables MTT17A-C and Figure MTG19. These plans were prepared only to show the probable limits of operations and therefore, actual conditions and operations could vary widely from the plans in order to conform with the authorized project purposes and the current general operating criteria established for Yellowtail Dam and Bighorn Lake.

The objectives of operations at Yellowtail are to meet all contractual and agreement obligations, all conservation commitments, to optimize generation, provide flood control in cooperation with the Corps of Engineers, and meet fish, wildlife, and recreational needs. The reservoir is operated under the following criteria and limitations:

(1) Beginning near the first of January and at least monthly thereafter through June, forecasts are made of the estimated spring inflow from snow cover and precipitation data. When these forecasts become available, Yellowtail Dam and Bighorn Lake is managed and regulated to allow storage to fill to the top of the joint-use pool at elevation 3640 feet (1,070,029 acre-feet) and prevent storage in Bighorn Lake from exceeding this level until the peak of the runoff has passed or has begun to recede. If releases in excess of full powerplant capacity are required, they are made only to the extent that current inflow and reservoir content indicate that spills are required. Depending on when the spring runoff starts and the volume of water forecasted, the release of water may draw Bighorn Lake below elevation 3618.0 feet (858,442 acre-feet).

(2) Once Bighorn Lake has filled or reached its maximum level during spring runoff (normally late June or early July), it is desirable to adjust the releases to maintain storage near the top of the joint-use pool at elevation 3640 feet (1,070,029 acre-feet) through October. Maintaining Bighorn Lake near this elevation provides suitable waterfowl habitat, enhances flat-water recreation, enhances habitat for the lake fisheries, and minimizes dust problems around the southern area of Bighorn Lake.

(3) In late fall, a uniform release from Bighorn Lake to the Bighorn River is scheduled during November through March with the objective of evacuating storage to an elevation between 3615-3621 feet (836,677-881,369 acre-feet) by the end of March, depending on the forecasted snowmelt runoff into Bighorn Lake. This attempt to provide the required storage space needed to safely store the spring runoff while protecting the desired reservoir levels for summer and fall lake recreation activities.

(4) Releases during October and early November are generally maintained at the lowest forecasted minimum release rate to protect the brown trout spawn, if dry winter conditions require reducing releases later during the winter months.

(5) Whenever an adequate water supply is available, releases from Bighorn Lake will be maintained at rates to sustain flows in the Bighorn River at 2,500 cfs or higher. When there is not an adequate water supply available, it may be necessary to reduce releases to

the Bighorn River to 2,000 cfs or the absolute minimum flow of 1,500 cfs required to protect a lower quality river fishery. These flow levels affect the river fishery as follows:

2,500 cfs - provides good spawning, rearing, and cover conditions in all major side channels.
2,000 cfs - provides adequate spawning and rearing conditions in most side channels but cover for adult fish is limited.
1,500 cfs - protects main channel habitat but not important side channels.

(6) During years of below normal runoff, storage in Bighorn Lake may not reach the top of the joint-use pool in efforts to protect the desired minimum river fishery flow levels. During some critical dry years, it has been observed that river flows have even been reduced to less than 1,500 cfs to ensure the operation of the Yellowtail powerplant and also provide desirable lake levels for the recreation season.

(7) All water released from Bighorn Lake is generally released through the Yellowtail Powerplant. Releasing any water in excess of the powerplant capacity (normally 7,500-8,200 cfs) is avoided, except during times of unusually heavy inflow or scheduled powerplant maintenance.

(8) For downstream flood control purposes, avoid making releases that would cause flows in the Bighorn River to exceed 20,000 cfs at St. Xavier and 25,000 cfs at Bighorn and 65,000 cfs in the Yellowstone River at Miles City.

(9) During April through October, water is diverted to the Bighorn Canal to meet downstream irrigation demands of the Crow Indian Irrigation Project. Maximum diversions to the Bighorn Canal are limited to a maximum of about 550 cfs.

(10) During low flow years when the Yellowstone River flow rate at Forsyth, Montana, drops below 6,000 cfs anytime between August 10 and September 15, river releases will be increased by 100 cfs to meet contractual commitments with Pennsylvania Power & Light, MT (PPL-MT) concerning their operations of Castle Rock Reservoir at Colstrip Powerplant. This release will continue for approximately 10-30 days.

(11) Every 3 years about mid-October after the irrigation season is over, all storage is evacuated from the Yellowtail Afterbay, except for approximately 190 acre-feet, to allow for the measurement of seepage downstream of Yellowtail Dam. During this time, releases to the Bighorn River are reduced to no lower than 400 cfs for approximately 5½ hours. To minimize effects to downstream water users and landowners, changes in release rates from the Afterbay are done gradually.

(12) Release rates during the winter are generally not changed or fluctuated more than 100 cfs in 6 hours when the downstream river channel is ice covered.

(13) Because the inflow to Bighorn Lake is heavily dependent upon the releases from Boysen and Buffalo Bill Reservoirs, all reservoir and river operations are closely coordinated with the WYAO.

(14) In an Agreement with the Northern Cheyenne Indian Tribe and pursuant to the Northern Cheyenne Indian Reserved Water Rights Settlement Act of 1992, Reclamation recognizes 30,000 acre-feet of stored water in Bighorn Reservoir for use or disposition by the Tribe. The United States shall furnish a maximum of 30,000 acre-feet of water annually to the Tribe in accordance with the limitations set forth in the Compact and the Settlement Act.

During May through July, the inflows into Bighorn Lake were well above normal at 146 percent of average. With mountain precipitation in the Bighorn River Basin well below normal during August and September, inflows into Bighorn Lake declined to about 76 percent of average in August and to 70 percent of average in September. In response, releases from Bighorn Lake to the Bighorn River during September were decreased and maintained near 2,500 cfs. This flow rate remained higher than the inflows causing storage in Bighorn Lake to slowly decline to 960,869 acre-feet at elevation 3630.14 feet by September 30, 2010. This was 94 percent of average and 9.86 feet below the top of the joint-use pool and 9.12 feet and 99,926 acre-feet lower than reported on September 30, 2009.

The forecasted inflows to Bighorn Lake are based upon the natural accretions between Boysen and Buffalo Bill Reservoirs to Yellowtail Dam plus the projected releases out of Boysen and Buffalo Bill Dams.

The most probable October-March accretions were estimated to equal 82 percent of the long-term historic monthly average October-March accretions. The April-September accretions were estimated to equal 40 percentile historic accretions or accretions that have historically been exceeded 60 percent of the time.

The minimum probable October-March accretions were estimated to be about 11 percent less than the most probable October-March accretions. The April-September accretions were estimated to equal 10 percentile historic accretions or accretions that have historically been exceeded 90 percent of the time.

The maximum probable October-March accretions were estimated to be 11 percent greater than the most probable October-March accretions. The April-September accretions were estimated to equal 70 percentile historic accretions or accretions that have been exceeded 30 percent of the time.

Under the most probable and maximum probable runoff conditions, storage in Bighorn Lake would be expected to fill to the top of the joint-use pool at elevation 3640 feet (1,070,029 acre-feet) by the end of July and essentially remain full through September. However, under the minimum probable runoff scenario, Bighorn Lake would be expected to slowly fill to near elevation 3630 feet by the end of June. This would be about 10.0 feet below the top of the joint-use pool. Under the most probable runoff condition, it is anticipated the minimum fall and

winter release from Bighorn Lake to the Bighorn River will be maintained at or above 2,370 cfs to better assure the reservoir of filling to the top of the joint-use pool by late June or early July. Under the minimum probable runoff condition, it is anticipated the minimum release from Bighorn Lake to the Bighorn River would need to be decreased to 1,750 cfs during April through September to best assure the reservoir of filling to levels that would enhance and meet the operating objectives of the lake during water year 2010. Under the most and maximum probable runoff conditions, it is anticipated river releases would be maintained at 2,500 cfs or higher all year.

The average power generation produced annually at Yellowtail Powerplant during 1967-2009 is 863.2 million kilowatt-hours. Under the minimum and most probable runoff conditions, power generation produced at Yellowtail Powerplant during 2011 would be expected to be about 267.8 million kilowatt-hours and 70.6 million kilowatt-hours less than average, respectively. Under the maximum probable runoff condition, power generation would be about 332.1 million kilowatt-hours greater than average.

In all three plans, maintenance outages are scheduled as shown on Table MTT19. Only under maximum probable runoff conditions, would a spill in excess of full powerplant capacity be expected during these 2011 power outages.

TABLE MTT17A
BIGHORN LAKE OPERATING PLAN
Based on October 1 2010 Inflow Estimates

2011 MINIMUM PROBABLE RUNOFF

Bighorn Reservoir — Initial Cont 960.9 kaf, Elev 3630.14 ft; Maximum Cont 1328.4 kaf, Elev 3657.00 ft; Minimum Cont 300.0 kaf, Elev 3547.00 ft

2010		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Boysen Release	kaf	49.2	47.7	49.2	49.2	44.5	49.2	47.7	67.6	69.9	76.9	69.2	59.5	679.8
Boysen Release	cfs	800	802	800	800	801	800	802	1099	1175	1251	1125	1000	
Buffalo Bill Riv Flo	kaf	37.2	28.2	21.8	21.8	19.7	21.8	31.7	101.2	105.0	118.7	104.3	82.3	693.7
Buffalo Bill Riv Flo	cfs	605	474	355	355	355	355	533	1646	1765	1930	1696	1383	
Station Gain	kaf	38.4	51.1	33.3	32.2	35.5	60.2	21.4	17.5	-3.4	-99.3	-70.0	5.1	122.0
Monthly Inflow	kaf	124.8	127.0	104.3	103.2	99.7	131.2	100.8	186.3	171.5	96.3	103.5	146.9	1495.5
Monthly Inflow	cfs	2030	2134	1696	1678	1795	2134	1694	3030	2882	1566	1683	2469	
Turbine Release	kaf	141.4	129.3	133.7	133.7	120.8	133.7	100.5	127.9	126.7	131.0	130.1	118.7	1527.5
Bypass/Spill/Waste	kaf	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Release	kaf	141.4	129.3	133.7	133.7	120.8	133.7	100.5	127.9	126.7	131.0	130.1	118.7	1527.5
Total Release	cfs	2300	2173	2174	2174	2175	2174	1689	2080	2129	2131	2116	1995	
Spring Flow	kaf	4.3	4.2	4.3	4.3	3.9	4.3	4.2	4.3	4.2	4.3	4.3	4.2	50.8
Irrigation Reqmnt	kaf	0.0	0.0	0.0	0.0	0.0	0.0	0.6	24.6	26.8	27.7	26.8	18.8	125.3
Afterbay Rels	kaf	145.7	133.5	138.0	138.0	124.7	138.0	104.7	132.2	130.9	135.3	134.4	122.9	1578.3
Afterbay Rels	cfs	2370	2244	2244	2244	2245	2244	1760	2150	2200	2200	2186	2065	
River Release	kaf	145.7	133.5	138.0	138.0	124.7	138.0	104.1	107.6	104.1	107.6	107.6	104.1	1453.0
River Release	cfs	2370	2244	2244	2244	2245	2244	1749	1750	1749	1750	1750	1749	
Min Release	kaf	145.7	119.0	123.0	123.0	111.1	123.0	104.1	107.6	104.1	107.6	107.6	104.1	1379.9
End-Month Targets	kaf	1070.0					858.5				1070.0			
End-Month Content	kaf	944.3	942.0	912.6	882.1	861.0	858.5	858.8	917.2	962.0	927.3	900.7	928.9	
End-Month Elevation	ft	3628.38	3628.14	3624.81	3621.09	3618.34	3618.01	3618.05	3625.35	3630.25	3626.51	3623.39	3626.69	
Net Change Content	kaf	-16.6	-2.3	-29.4	-30.5	-21.1	-2.5	0.3	58.4	44.8	-34.7	-26.6	28.2	-32.0

Yellowtail Power	2010	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Turbine Release	kaf	141.4	129.3	133.7	133.7	120.8	133.7	100.5	127.9	126.7	131.0	130.1	118.7	1527.5
Generation	gwh	55.909	50.965	52.421	51.886	46.454	51.196	38.468	49.473	49.882	51.661	50.780	46.343	595.438
End-Month Power Cap	mw	276.1	275.9	272.7	269.2	266.7	266.4	266.4	273.2	277.9	274.3	271.4	274.5	
% Max Gen		26	25	24	24	24	24	19	23	24	24	24	22	
Ave kwh/af		395	394	392	388	385	383	383	387	394	394	390	390	390
Upstream Generation	gwh	12.479	11.760	10.021	9.961	8.390	9.860	11.449	25.316	25.322	27.680	25.017	20.540	197.795
Total Generation	gwh	68.388	62.725	62.442	61.847	54.844	61.056	49.917	74.789	75.204	79.341	75.797	66.883	793.233

TABLE MTT17B
BIGHORN LAKE OPERATING PLAN
Based on October 1 2010 Inflow Estimates

2011 MOST PROBABLE RUNOFF

Bighorn Reservoir — Initial Cont 960.9 kaf, Elev 3630.14 ft; Maximum Cont 1328.4 kaf, Elev 3657.00 ft; Minimum Cont 493.6 kaf, Elev 3547.00 ft

	2010	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Boysen Release	kaf	49.2	47.6	49.2	49.2	44.4	49.2	74.4	138.5	132.4	120.4	96.9	59.5	910.9
Boysen Release	cfs	800	800	800	800	799	800	1250	2252	2225	1958	1576	1000	
Buffalo Bill Riv Flo	kaf	41.7	26.6	21.8	21.8	19.7	21.8	31.7	110.8	168.0	178.1	122.2	98.8	863.0
Buffalo Bill Riv Flo	cfs	678	447	355	355	355	355	533	1802	2823	2897	1987	1660	
Station Gain	kaf	48.3	56.5	38.7	37.6	40.9	65.8	28.6	38.0	74.5	-60.8	-49.8	15.7	334.0
Monthly Inflow	kaf	139.2	130.7	109.7	108.6	105.0	136.8	134.7	287.3	374.9	237.7	169.3	174.0	2107.9
Monthly Inflow	cfs	2264	2196	1784	1766	1891	2225	2264	4672	6300	3866	2753	2924	
Turbine Release	kaf	144.5	136.6	141.2	141.3	127.6	141.2	137.2	174.0	274.2	237.7	176.2	163.4	1995.1
Bypass/Spill/Waste	kaf	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Release	kaf	144.5	136.6	141.2	141.3	127.6	141.2	137.2	174.0	274.2	237.7	176.2	163.4	1995.1
Total Release	cfs	2350	2296	2296	2298	2298	2296	2306	2830	4608	3866	2866	2746	
Spring Flow	kaf	4.3	4.2	4.3	4.3	3.9	4.3	4.2	4.3	4.2	4.3	4.3	4.2	50.8
Irrigation Reqmnt	kaf	0.0	0.0	0.0	0.0	0.0	0.0	0.6	24.6	26.8	27.7	26.8	18.8	125.3
Afterbay Rels	kaf	148.8	140.8	145.5	145.6	131.5	145.5	141.4	178.3	278.4	242.0	180.5	167.6	2045.9
Afterbay Rels	cfs	2420	2366	2366	2368	2368	2366	2376	2900	4679	3936	2936	2817	
River Release	kaf	148.8	140.8	145.5	145.6	131.5	145.5	140.8	153.7	251.6	214.3	153.7	148.8	1920.6
River Release	cfs	2420	2366	2366	2368	2368	2366	2366	2500	4228	3485	2500	2501	
Min Release	kaf	148.8	139.8	144.5	144.5	130.5	144.5	140.8	153.7	148.8	153.7	153.7	148.8	1752.1
End-Month Targets	kaf	1070.0					858.5			1070.0	1070.0			
End-Month Content	kaf	955.6	949.7	918.2	885.5	862.9	858.5	856.0	969.3	1070.0	1070.0	1063.1	1073.7	
End-Month Elevation	ft	3629.59	3628.97	3625.47	3621.52	3618.59	3618.01	3617.67	3631.00	3640.00	3640.00	3639.44	3640.29	
Net Change Content	kaf	-5.3	-5.9	-31.5	-32.7	-22.6	-4.4	-2.5	113.3	100.7	0.0	-6.9	10.6	112.8

Yellowtail Power	2010	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Turbine Release	kaf	144.5	136.6	141.2	141.3	127.6	141.2	137.2	174.0	274.2	237.7	176.2	163.4	1995.1
Generation	gwh	57.240	54.012	55.486	54.921	49.116	54.087	52.489	67.883	110.748	97.463	72.174	66.967	792.586
End-Month Power Cap	mw	277.2	276.6	273.3	269.6	266.9	266.4	266.1	278.6	287.5	287.5	287.0	287.8	
% Max Gen		27	26	26	26	25	25	25	32	53	45	34	32	
Ave kwh/af		396	395	393	389	385	383	383	390	404	410	410	410	397
Upstream Generation	gwh	13.745	11.316	10.066	10.026	8.456	9.965	13.778	33.167	33.877	34.216	32.064	25.839	236.515
Total Generation	gwh	70.985	65.328	65.552	64.947	57.572	64.052	66.267	101.050	144.625	131.679	104.238	92.806	1029.101

TABLE MTT17C
BIGHORN LAKE OPERATING PLAN
Based on October 1 2010 Inflow Estimates

2011 MAXIMUM PROBABLE RUNOFF

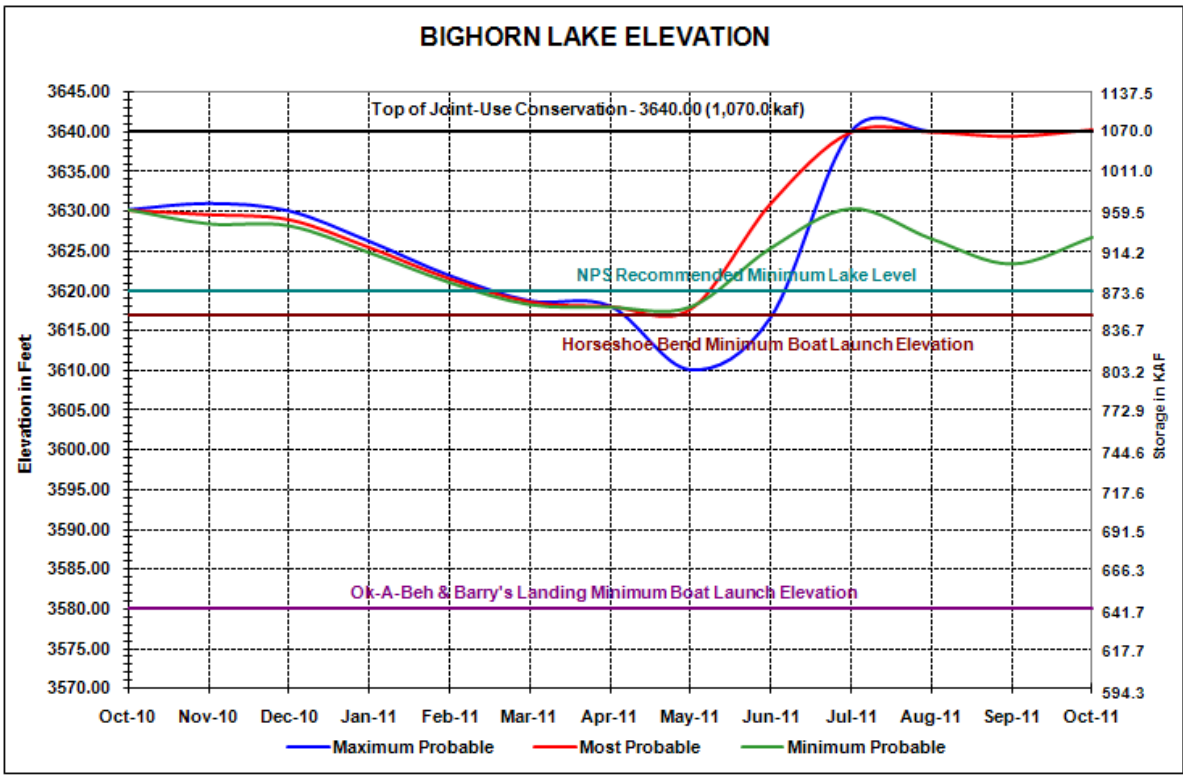
Bighorn Reservoir — Initial Cont 960.9 kaf, Elev 3630.14 ft; Maximum Cont 1328.4 kaf, Elev 3657.00 ft; Minimum Cont 493.6 kaf, Elev 3547.00 ft

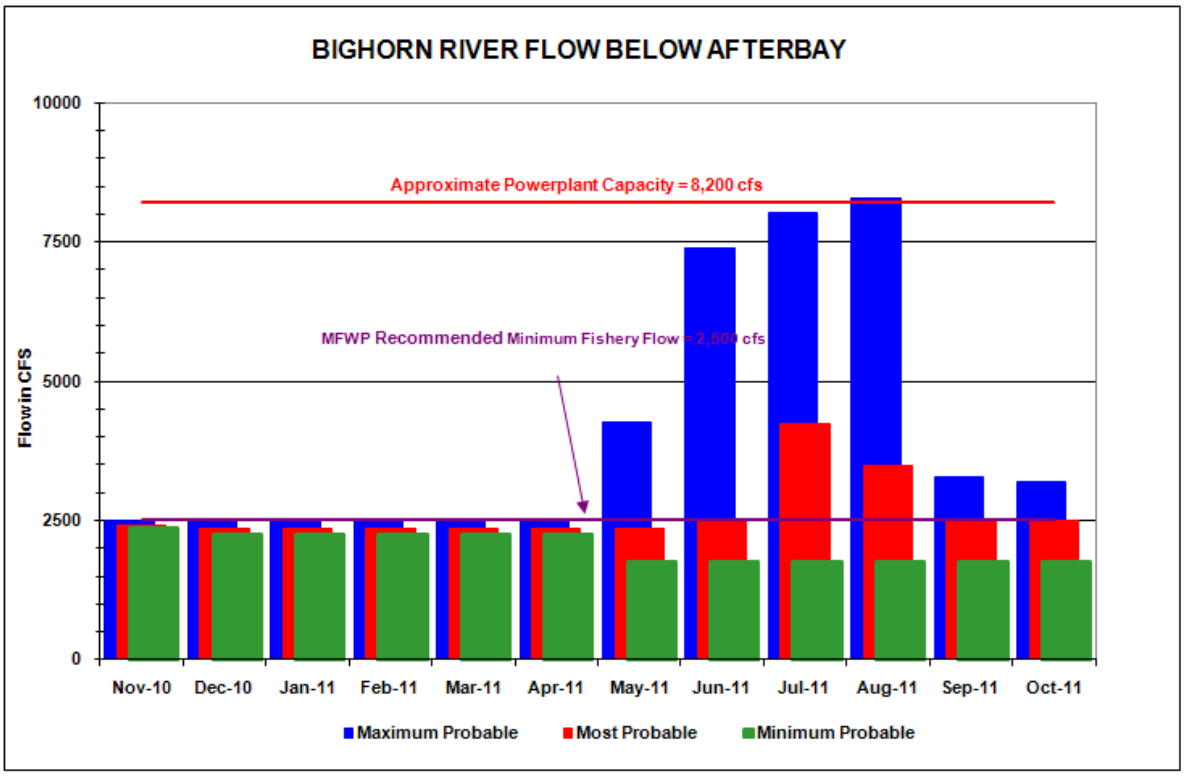
2010		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Boysen Release	kaf	49.2	47.6	49.2	49.2	44.5	49.2	129.1	264.2	275.2	269.1	115.5	74.6	1416.6
Boysen Release	cfs	800	800	800	800	801	800	2170	4297	4625	4376	1878	1254	
Buffalo Bill Riv Flo	kaf	46.7	24.8	21.8	21.8	19.7	21.8	31.7	190.2	312.0	277.2	147.4	100.2	1215.3
Buffalo Bill Riv Flo	cfs	760	417	355	355	355	355	533	3093	5243	4508	2397	1684	
Station Gain	kaf	60.8	62.8	43.0	42.0	45.8	73.1	33.3	52.6	130.1	-14.1	-37.7	23.8	515.5
Monthly Inflow	kaf	156.7	135.2	114.0	113.0	110.0	144.1	194.1	507.0	717.3	532.2	225.2	198.6	3147.4
Monthly Inflow	cfs	2548	2272	1854	1838	1981	2344	3262	8246	12055	8655	3663	3338	
Turbine Release	kaf	149.1	144.3	149.1	149.1	134.7	149.1	249.3	462.1	495.5	521.7	225.1	198.5	3027.6
Bypass/Spill/Waste	kaf	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	10.5	0.0	0.0	10.5
Total Release	kaf	149.1	144.3	149.1	149.1	134.7	149.1	249.3	462.1	495.5	532.2	225.1	198.5	3038.1
Total Release	cfs	2425	2425	2425	2425	2425	2425	4190	7515	8327	8655	3661	3336	
Spring Flow	kaf	4.3	4.2	4.3	4.3	3.9	4.3	4.2	4.3	4.2	4.3	4.3	4.2	50.8
Irrigation Reqmnt	kaf	0.0	0.0	0.0	0.0	0.0	0.0	0.5	11.2	21.8	27.7	26.8	11.9	99.9
Afterbay Rels	kaf	153.4	148.5	153.4	153.4	138.6	153.4	253.5	466.4	499.7	536.5	229.4	202.7	3088.9
Afterbay Rels	cfs	2495	2496	2495	2495	2496	2495	4260	7585	8398	8725	3731	3406	
River Release	kaf	153.4	148.5	153.4	153.4	138.6	153.4	253.0	455.2	477.9	508.8	202.6	190.8	2989.0
River Release	cfs	2495	2496	2495	2495	2496	2495	4252	7403	8031	8275	3295	3207	
Min Release	kaf	153.4	119.0	123.0	123.0	111.1	123.0	119.0	153.7	148.8	153.7	153.7	148.8	1630.2
End-Month Targets	kaf	1070.0					858.5			1070.0	1070.0			
End-Month Content	kaf	968.5	959.4	924.3	888.2	863.5	858.5	803.3	848.2	1070.0	1070.0	1070.1	1070.2	
End-Month Elevation	ft	3630.92	3629.99	3626.17	3621.86	3618.67	3618.01	3610.01	3616.61	3640.00	3640.00	3640.01	3640.01	
Net Change Content	kaf	7.6	-9.1	-35.1	-36.1	-24.7	-5.0	-55.2	44.9	221.8	0.0	0.1	0.1	109.3

Yellowtail Power 2010		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Turbine Release	kaf	149.1	144.3	149.1	149.1	134.7	149.1	249.3	462.1	495.5	521.7	225.1	198.5	3027.6
Generation	gwh	59.187	57.267	58.745	58.041	51.879	57.119	94.448	174.728	196.335	213.908	92.298	81.394	1195.349
End-Month Power Cap	mw	278.5	277.6	274.0	269.9	267.0	266.4	259.0	265.1	287.5	287.5	287.5	287.5	
% Max Gen		28	28	27	27	27	27	46	82	95	100	43	39	
Ave kwh/af		397	397	394	389	385	383	379	378	396	410	410	410	395
Upstream Generation	gwh	15.129	10.841	10.110	10.086	8.556	10.067	18.475	33.949	33.825	35.260	33.718	27.435	247.451
Total Generation	gwh	74.316	68.108	68.855	68.127	60.435	67.186	112.923	208.677	230.160	249.168	126.016	108.829	1442.800

FIGURE MTG19

BIGHORN LAKE





WATER YEAR 2011

ENERGY GENERATION OPERATION PLANS

Energy generation at Canyon Ferry and Yellowtail powerplants for conditions of minimum probable, most probable, and maximum probable runoff is expected to vary between 925,000,000 and 1,692,000,000 kilowatt-hours as shown in Table MTT18.

Table MTT18

Estimated Energy Generation During Water Year 2011
(Million Kilowatt-Hours)

Plant	Minimum Probable Runoff	Most Probable Runoff	Maximum Probable Runoff
Canyon Ferry	330	460	497
Yellowtail	595	793	1,195
Total	925	1,253	1,692

Operation of powerplants and transmission facilities in the Eastern and Western Divisions will be coordinated to bring about the most efficient utilization of power production to realize maximum project benefits. It is also anticipated that the marketing from all Federal power systems in the Missouri and Colorado River Basins will be closely coordinated to optimize the revenues to the Federal Government.

Powerplant maintenance is performed periodically throughout the year and the schedule for water year 2011 is shown on Table MTT19.

Table MTT19
2011 SCHEDULED OUTAGES

YELLOWTAIL RESERVOIR

FACILITY	DESCRIPTION OF WORK	SCHEDULED DATE
Yellowtail Afterbay	2 day outage when maximum Afterbay elevation cannot exceed 3187.5 feet as the Fort Smith Government Camp sewage lagoon is drawn down in preparation for winter	10/26-27/2010
Unit #1	23-day outage for 4-year electrical and mechanical maintenance. RTU points check. Unbalanced headgate closure test.	01/03-02/02/2011
Unit #2	10-day outage for annual electrical and mechanical maintenance. RTU points check.	02/07-16/2011
Unit #3	10-day outage for annual electrical and mechanical maintenance. RTU points check.	02/22-03/03/2011
Unit #4	10-day outage for annual electrical and mechanical maintenance. RTU points check.	03/07-16/2011
Yellowtail Afterbay	12-day outage for sluice gate maintenance. Maintain Afterbay elevation of 3183 feet to discharge all releases to the Bighorn River through the radial gates.	04/11-22/2011
Black Start Unit #4	Annual black start requirement from 0900-1200. Units #3 & #4 will be unavailable during this time.	04/19/2011
Yellowtail Afterbay	12-day outage for sluice gate maintenance. Maintain Afterbay elevation of 3183 feet to discharge all releases to the Bighorn River through the radial gates.	08/22-09/02/2011

CANYON FERRY RESERVOIR

FACILITY	DESCRIPTION OF WORK	SCHEDULED DATE
Unit #2	8-day outage for annual maintenance.	10/12-21/2010
Unit #2	4-day outage for annual maintenance.	10/18-21/2010
Unit #3	4-day outage for annual maintenance.	11/15-18/2010
Transformer K3A	1-day outage for annual maintenance.	11/17/2010
Unit #3	18-day outage for 3-year maintenance.	02/22-03/17/2011
Transformer K3A	4-day outage for 3-year maintenance.	02/28-03/03/2011
Unit #1 Protective Relays	2-day outage for relay functional test.	03/16-17/2011
Crow Creek	4-day outage for annual maintenance on OCB 412 and transformer KY1A	04/04-07/2011
Unit #1	4-day outage for annual inspection and maintenance.	04/11-14/2011
Unit #1	4-day annual inspection and maintenance.	04/18-21/2011
OCB 162	4-day outage for annual electrical and mechanical maintenance.	05/23-26/2011
OCB 266	4-day outage for annual electrical and mechanical maintenance.	06/06-09/2011
OCB 262	4-day outage for annual electrical and mechanical maintenance.	06/13-16/2011
OCB 366	4-day outage for annual electrical and mechanical maintenance.	06/20-23/2011

Bull Lake

Three operating plans were prepared for water year 2011 to show the operations which could occur under various runoff conditions. The operations for the three runoff conditions are shown in Table WYT10A, WYT10B, WYT10C, and Figure WYG6. These plans were prepared only to show the probable limits of operations and therefore actual conditions and operations could vary widely from the most probable plan.

The primary objective of operations at Bull Lake is to provide irrigation water to the Midvale Irrigation District (Midvale). Under normal operation, the reservoir also provides small incidental flood control benefits and a water resource for fish, wildlife, and recreation. Bull Lake is operated under the following criteria and limitations:

(1) Based on forecasted inflows, March-June releases are scheduled with the objective of filling the lake to a content of 152,459 acre-feet (AF) at elevation 5805.00 feet during July while eliminating or minimizing any spill.

(2) During April-October, releases must be adequate to meet the irrigation needs of Midvale and downstream irrigators with senior water rights on Bull Lake Creek.

(3) Based on the available water supply, non-irrigation season releases from Bull Lake to Bull Lake Creek are generally maintained between 20 and 45 cubic feet per second (cfs).

(4) The reservoir water surface elevation will be kept below elevation 5794.00 feet during the winter to prevent ice damage to the spillway gates. The gates were not designed to withstand ice pressure. To prevent damage to the concrete in the spillway inlet from ice, the reservoir is operated to have a storage level of 100,000 AF or less by November 30. The objective at the onset of winter is to be as close as possible to the 100,000 AF level (5787.13 feet) to also provide winter fish habitat.

2011 Operating Plans

Storage in Bull Lake at the end of water year 2010 was 65,846 AF at elevation 5773.61 feet, which is 43 percent of capacity and 87 percent of the end of September average. Projected inflows for all months of water year 2011 under most probable inflow conditions are estimated to be median flows, or flows which have historically been exceeded 50 percent of the time. The reservoir is expected to fill if most probable or greater inflows are realized. If reasonable minimum condition inflows occurred during each month of water year 2011, the reservoir would fall about 18,000 AF short of filling.

Reasonable minimum condition inflows are estimated to be lower decile flows for all months in water year 2011. Lower decile flows are flows which have historically been exceeded 90 percent of the time.

Under reasonable maximum inflow conditions, upper decile flows are expected for all months in water year 2011. Upper decile flows are flows which have historically been exceeded 10 percent of the time.

Under all three inflow scenarios, releases in October following the end of irrigation season and continuing through the fall and winter would be held at 25 cfs with the objective of maintaining the reservoir level through the winter period.

Water diverted into the Wyoming Canal can be delivered to Midvale lands directly or routed through Pilot Butte Reservoir and delivered to district lands via the Pilot Canal. In June of 2009 both units at Pilot Butte Powerplant were placed in "Mothballed" status and are not expected to generate electricity in water year 2011.

TABLE WYT10A

RIVERTON PROJECT OPERATING PLAN
Based on October 1 Inflow Estimates
2011 Reasonable Minimum Inflow Estimates

Bull Lake Reservoir Operations — Initial Content 65.8 Kaf — Operating Limits: Max 151.9 Kaf, 5804.82 Ft. Min 20.0 Kaf, 5750.93 Ft.

		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Reservoir Inflow	kaf	4.7	2.2	1.8	1.6	1.2	1.5	2.6	25.8	40.2	26.5	14.6	7.2	129.9
Total Dam Release	kaf	1.5	1.5	1.5	1.5	1.4	1.5	1.5	1.5	1.5	39.5	55.8	46.7	155.5
Total Dam Release	cfs	25.	25.	25.	25.	25.	25.	25.	25.	25.	642.	907.	784.	
Excess Release	kaf	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
End-month Content	kaf	69.0	69.7	69.9	70.0	69.8	69.8	70.9	95.2	133.9	120.9	79.7	40.2	
End-month Elevation	ft	5774.9	5775.2	5775.3	5775.4	5775.3	5775.3	5775.7	5785.3	5799.0	5794.6	5779.3	5761.8	
BLR Net Change	kaf	3.2	0.7	0.3	0.1	-0.2	0.0	1.1	24.3	38.7	-13.0	-41.2	-39.5	-25.6

Wind River		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Flow abv BL Creek	kaf	27.5	22.1	18.0	15.6	13.5	16.1	23.1	70.4	93.2	60.9	37.7	27.2	425.3
Crowheart Gage Flow	kaf	29.0	23.6	19.5	17.1	14.9	17.6	24.6	71.9	94.7	100.4	93.5	73.9	580.8
Flow Below Div Dam	kaf	10.5	23.6	19.5	17.1	14.9	17.6	4.7	21.9	27.2	30.3	24.8	18.3	230.4
Gain/Return Flow	kaf	0.0	0.0	0.0	0.0	0.0	0.0	4.8	7.4	7.1	7.4	6.1	5.4	38.2
Indian Irrigation	kaf	1.2	0.0	0.0	0.0	0.0	0.0	1.8	6.1	6.0	6.1	5.5	4.5	31.3
LeClair/Riverton	kaf	5.0	0.0	0.0	0.0	0.0	0.0	3.5	18.8	24.2	27.2	21.1	15.0	114.8
LeC/Riv Shortage	kaf	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Riverton Gage Flow	cfs	70.0	396.4	317.7	278.7	268.1	286.8	70.0	70.0	70.0	70.0	70.0	70.0	

Wyoming Canal		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Total Diversion	kaf	18.5	0.0	0.0	0.0	0.0	0.0	19.9	50.1	67.5	70.1	68.7	55.6	350.4
North Canal Flow	kaf	3.4	0.0	0.0	0.0	0.0	0.0	9.8	26.4	31.2	36.5	30.9	27.0	165.2
North Canal Shortage	kaf	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Pilot Butte Reservoir Operations — Initial Content 13.6 Kaf — Operating Limits: Max 29.9 Kaf, 5459.98 Ft. Min 10.0 Kaf, 5433.49 Ft.

		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Reservoir Inflow	kaf	15.1	0.0	0.0	0.0	0.0	0.0	10.1	23.7	36.3	33.6	37.8	28.6	185.2
Power Generated	mwh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pilot Canal Release	kaf	3.4	0.0	0.0	0.0	0.0	0.0	6.7	28.0	33.1	43.9	37.4	33.3	185.8
Pilot Canal Shortage	kaf	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
End-month Content	kaf	25.1	24.9	24.8	24.7	24.6	24.4	27.6	23.0	25.8	15.0	15.0	10.0	
PBR Net Change	kaf	11.5	-0.2	-0.1	-0.1	-0.1	-0.2	3.2	-4.6	2.8	-10.8	0.0	-5.0	-3.6
End-month Elevation	ft	5454.5	5454.2	5454.1	5454.0	5453.9	5453.6	5457.4	5451.9	5455.3	5441.3	5441.3	5433.5	

TABLE WYT10B

RIVERTON PROJECT OPERATING PLAN
Based on October 1 Inflow Estimates
2011 Most Probable Inflow Estimates

Bull Lake Reservoir Operations — Initial Content 65.8 Kaf — Operating Limits: Max 151.9 Kaf, 5804.82 Ft. Min 20.0 Kaf, 5750.93 Ft.

		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Reservoir Inflow	kaf	6.0	3.3	2.4	2.6	1.5	1.8	2.5	30.9	61.5	50.1	20.2	10.4	193.2
Total Dam Release	kaf	1.5	1.5	1.5	1.5	1.4	1.5	1.5	15.4	24.6	26.0	42.0	44.7	163.1
Total Dam Release	cfs	25.	25.	25.	25.	25.	25.	25.	251.	413.	423.	683.	750.	
Excess Release	kaf	0.0	0.0	0.0	0.0	0.0	0.0	0.0	13.9	24.6	26.0	12.4	0.0	76.8
End-month Content	kaf	70.3	72.1	72.9	74.0	74.1	74.4	75.4	90.9	127.8	151.9	130.1	95.9	
End-month Elevation	ft	5775.5	5776.2	5776.6	5777.0	5777.1	5777.2	5777.6	5783.7	5796.9	5804.8	5797.7	5785.6	
BLR Net Change	kaf	4.5	1.8	0.9	1.1	0.1	0.3	1.0	15.5	36.9	24.1	-21.8	-34.3	30.1

Wind River		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Flow abv BL Creek	kaf	33.5	24.3	18.4	16.1	14.7	17.1	26.7	108.0	169.6	115.2	53.8	33.0	630.4
Crowheart Gage Flow	kaf	35.0	25.8	19.9	17.6	16.1	18.6	28.2	123.4	194.2	141.2	95.8	77.7	793.5
Flow Below Div Dam	kaf	13.6	25.8	19.9	17.6	16.1	18.6	8.9	68.7	129.5	60.3	39.0	20.1	438.1
Gain/Return Flow	kaf	0.0	0.0	0.0	0.0	0.0	0.0	4.8	7.4	7.1	7.4	6.1	5.4	38.2
Indian Irrigation	kaf	1.2	0.0	0.0	0.0	0.0	0.0	1.8	6.1	6.0	6.1	5.5	4.5	31.3
LeClair/Riverton	kaf	5.0	0.0	0.0	0.0	0.0	0.0	3.5	18.8	24.2	27.2	21.1	15.0	114.8
LeC/Riv Shortage	kaf	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Riverton Gage Flow	cfs	120.5	433.4	324.2	286.8	289.7	303.1	140.5	831.9	1789.2	558.2	300.9	100.0	

Wyoming Canal		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Total Diversion	kaf	21.4	0.0	0.0	0.0	0.0	0.0	19.3	54.7	64.7	80.9	56.8	57.6	355.4
North Canal Flow	kaf	3.4	0.0	0.0	0.0	0.0	0.0	9.8	26.4	31.2	36.5	30.9	27.0	165.2
North Canal Shortage	kaf	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Pilot Butte Reservoir Operations — Initial Content 13.6 Kaf — Operating Limits: Max 29.9 Kaf, 5459.98 Ft. Min 10.0 Kaf, 5433.49 Ft.

		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Reservoir Inflow	kaf	18.0	0.0	0.0	0.0	0.0	0.0	9.5	28.3	33.5	44.4	25.9	30.6	190.2
Power Generated	mwh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pilot Canal Release	kaf	3.4	0.0	0.0	0.0	0.0	0.0	6.7	28.0	33.1	43.9	37.4	33.3	185.8
Pilot Canal Shortage	kaf	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
End-month Content	kaf	28.0	27.8	27.7	27.6	27.5	27.3	29.9	29.9	29.9	29.9	18.0	15.0	
PBR Net Change	kaf	14.4	-0.2	-0.1	-0.1	-0.1	-0.2	2.6	0.0	0.0	0.0	-11.9	-3.0	1.4
End-month Elevation	ft	5457.8	5457.6	5457.5	5457.4	5457.3	5457.0	5460.0	5460.0	5460.0	5460.0	5445.5	5441.3	

TABLE WYT10C

RIVERTON PROJECT OPERATING PLAN

Based on October 1 Inflow Estimates

2011 Reasonable Maximum Inflow Estimates

Bull Lake Reservoir Operations — Initial Content 65.8 Kaf — Operating Limits: Max 151.9 Kaf, 5804.82 Ft.; Min 20.0 Kaf, 5750.93 Ft.

		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Reservoir Inflow	kaf	6.3	3.6	2.7	2.8	1.8	2.2	4.8	29.5	88.1	74.5	32.9	12.4	261.6
Total Dam Release	kaf	1.5	1.5	1.5	1.5	1.4	1.5	1.5	22.1	47.7	49.9	50.4	48.8	229.4
Total Dam Release	cfs	25.	25.	25.	25.	25.	25.	25.	359.	802.	812.	820.	820.	
Excess Release	kaf	0.0	0.0	0.0	0.0	0.0	0.0	0.0	20.5	47.7	49.9	50.4	20.2	188.8
End-month Content	kaf	70.6	72.7	73.8	75.1	75.5	76.2	79.5	86.9	127.3	151.9	134.4	98.0	
End-month Elevation	ft	5775.6	5776.5	5777.0	5777.5	5777.6	5777.9	5779.3	5782.2	5796.8	5804.8	5799.1	5786.4	
BLR Net Change	kaf	4.8	2.1	1.2	1.3	0.4	0.7	3.3	7.4	40.4	24.6	-17.5	-36.4	32.2

Wind River		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Flow abv BL Creek	kaf	34.8	25.0	20.5	18.8	16.3	20.0	25.2	113.9	312.9	185.4	80.8	45.8	899.4
Crowheart Gage Flow	kaf	36.3	26.5	22.0	20.3	17.7	21.5	26.7	136.0	360.6	235.3	131.2	94.6	1128.8
Flow Below Div Dam	kaf	15.5	26.5	22.0	20.3	17.7	21.5	6.9	81.3	295.9	154.4	74.4	37.0	773.4
Gain/Return Flow	kaf	0.0	0.0	0.0	0.0	0.0	0.0	4.8	7.4	7.1	7.4	6.1	5.4	38.2
Indian Irrigation	kaf	1.2	0.0	0.0	0.0	0.0	0.0	1.8	6.1	6.0	6.1	5.5	4.5	31.3
LeClair/Riverton	kaf	5.0	0.0	0.0	0.0	0.0	0.0	3.2	16.9	21.8	24.5	19.0	13.5	103.9
LeC/Riv Shortage	kaf	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Riverton Gage Flow	cfs	150.0	445.1	358.4	330.8	318.5	350.3	111.7	1066.9	4626.6	2132.7	911.2	409.7	

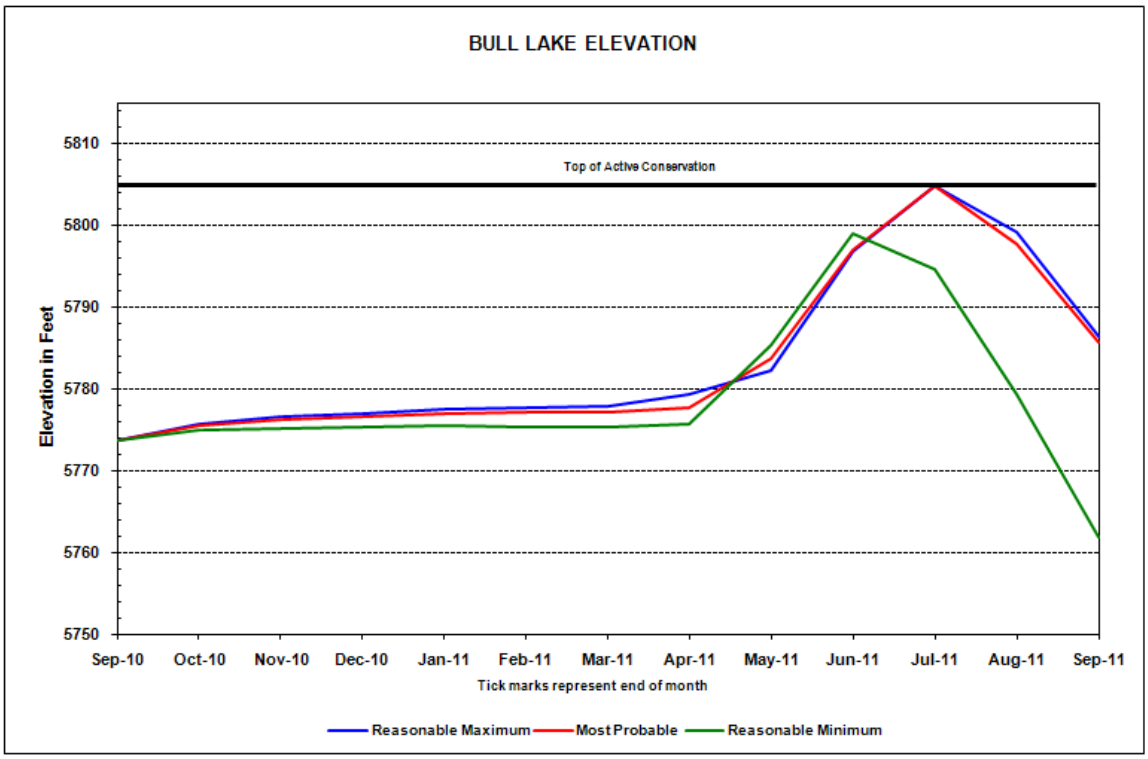
Wyoming Canal		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Total Diversion	kaf	20.9	0.0	0.0	0.0	0.0	0.0	19.8	54.7	64.7	80.9	56.8	57.6	355.4
North Canal Flow	kaf	3.4	0.0	0.0	0.0	0.0	0.0	9.8	26.4	31.2	36.5	30.9	27.0	165.2
North Canal Shortage	kaf	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

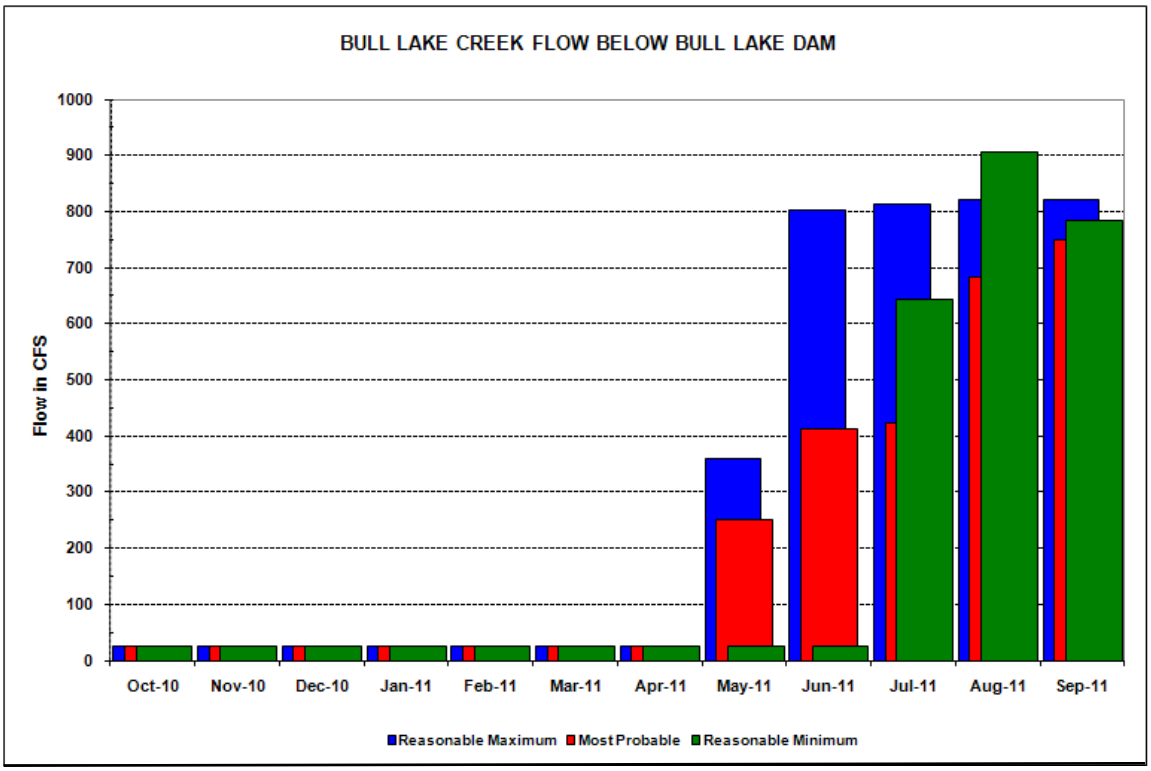
Pilot Butte Reservoir Operations — Initial Content 13.6 Kaf — Operating Limits: Max 29.9 Kaf, 5459.98 Ft.; Min 10.0 Kaf, 5433.49 Ft.

		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Reservoir Inflow	kaf	17.5	0.0	0.0	0.0	0.0	0.0	10.0	28.3	33.5	44.4	25.9	30.6	190.2
Power Generated	mwh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pilot Canal Release	kaf	3.4	0.0	0.0	0.0	0.0	0.0	6.7	28.0	33.1	43.9	37.4	33.3	185.8
Pilot Canal Shortage	kaf	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
End-month Content	kaf	27.5	27.3	27.2	27.1	27.0	26.8	29.9	29.9	29.9	29.9	18.0	15.0	
PBR Net Change	kaf	13.9	-0.2	-0.1	-0.1	-0.1	-0.2	3.1	0.0	0.0	0.0	-11.9	-3.0	1.4
End-month Elevation	ft	5457.3	5457.0	5456.9	5456.8	5456.7	5456.4	5460.0	5460.0	5460.0	5460.0	5445.5	5441.3	

FIGURE WYG6

BULL LAKE RESERVOIR





Boysen Reservoir and Powerplant

Three operating plans were prepared for water year 2011 to show the operations of Boysen Reservoir which could occur under various runoff conditions. The operations for the three runoff conditions are shown in Table WYT11 and Figure WYG7. These plans are presented only to show the probable limits of operations and therefore, actual conditions and operations could vary widely from the most probable plan.

The operating objectives at Boysen Dam and Reservoir are to provide water for irrigation, municipal and industrial use, and power generation; provide flood control in cooperation with the Corps of Engineers; and enhance fish, wildlife, and recreation opportunities in both the reservoir and the Wind/Bighorn River.

Irrigation Season Release

During the irrigation season, water releases from Boysen Reservoir are made to satisfy all downstream senior water rights and storage contract commitments. Generally, demands for downstream senior water rights are met with a reservoir release between 900 and 1,200 cfs. Releases above what is required to meet irrigation demands may be made to manage reservoir levels and generate power.

Non-irrigation Season Release

During the non-irrigation season, releases are made to produce power, enhance the river and reservoir fishery, and provide storage space for the expected spring runoff or conserve storage if the reservoir is not expected to fill. Winter releases are generally in the range between 400 cfs and 1,150 cfs, depending on reservoir conditions going into the winter. The Wyoming Game and Fish Department considers 800 cfs to be the preferred fishery flow from October through February and flows below 600 cfs to be detrimental to the river fishery. A release of approximately 1,150 cfs can be made through one unit at Boysen Powerplant. By releasing less than the capacity of one powerplant unit, annual maintenance can be performed on the other unit during the winter months.

General Operating Procedures

(1) October - February: Releases of water for power generation are scheduled to evacuate storage while assuring an adequate water supply for the upcoming irrigation season. It is desirable to maintain a uniform release during November through February to reduce the risk of flooding due to river ice.

(2) March - July: Based upon monthly water supply forecasts and as soon as river ice conditions allow, releases are scheduled to meet the irrigation demand as a minimum. Greater releases may be made if necessary to eliminate or minimize a spill, with the objective of filling the reservoir to elevation 4724.50 feet (731,841 AF) by the end of July.

Depending on inflows, attempts will be made to provide a reservoir level of at least elevation 4707.00 feet from the end of May through the end of August for recreational boating access.

For the spawning of rainbow trout it is desirable to have stable or slightly rising river flows from mid-March through early June. When conditions are suitable and without affecting power operations, attempts will be made to limit the drop in reservoir level to 2 feet or less during the reservoir fish spawn and hatch period (which begins in March and ends in May). A rising pool is desirable during this period.

(3) August - September: As soon as storage has peaked, water releases are scheduled to meet the irrigation demand and generate power. Releases above what is needed to meet irrigation demand may be made in order to generate power and prevent the need to release water through the spillway gates if inflow conditions warrant.

2011 Operating Plans

At the beginning of water year 2011, storage was 639,219 AF at elevation 4719.48 feet. This was 106 percent of average and about 20,358 AF less than the reservoir held at the beginning of water year 2010. Projected inflows for all months of water year 2011 under most probable inflow conditions are estimated to be median flows, or flows which have historically been exceeded 50 percent of the time. A release of 800 cfs is scheduled for the months of October through March. Under most probable inflow conditions, end of month reservoir content is expected to peak in July with 732,000 AF at reservoir elevation 4724.50 feet. The reservoir is expected to fill if most probable or greater inflows are realized. If reasonable minimum condition inflows occurred during each month of water year 2011 the reservoir level would decline during each month of the water year except June when the projected inflow is expected to be slightly more than the release.

Reasonable minimum condition inflows are estimated to be lower decile flows for all months in water year 2011. Lower decile flows are flows which have historically been exceeded 90 percent of the time. Under reasonable maximum inflow conditions, upper decile flows are expected for all months in water year 2011. Upper decile flows are flows which have historically been exceeded 10 percent of the time.

Winter releases under minimum and maximum inflow scenarios are the same as under the most probable condition. This is due to the fact that a release which meets the operating objectives under the range of inflows which could be expected to occur needs to be set prior to the time when the river might freeze. At the time the winter release is set, very limited information is available on snowpack and what inflows might be during the snowmelt runoff period. It must be assumed that releases cannot be changed significantly from mid-December through mid-March as the changes could cause flooding downstream of the reservoir if ice conditions are present on the river. It was determined that with a winter release of 800 cfs, the reservoir would be maintained at a level through the winter that would enable storing most probable condition inflows without having to release water in excess of the powerplant capacity during the spring and summer. Power unit maintenance outages for the Boysen Powerplant are scheduled as shown in Table WYT13.

TABLE WYT11

BOYSEN RESERVOIR OPERATING PLAN - Based on October 1 Inflow Estimates
2011 Reasonable Minimum Inflow Estimates

Boysen Reservoir Initial Cont 639.2 kaf Maximum Cont 892.2 kaf Minimum Cont 219.2 kaf
Elev 4719.48 ft Elev 4732.20 ft Elev 4685.00 ft

2010	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Monthly Inflow kaf	40.0	41.8	35.0	32.4	31.6	45.7	41.5	67.0	76.5	39.3	25.2	29.8	505.8
Monthly Inflow cfs	651	702	569	527	569	743	697	1090	1286	639	410	501	
Turbine Release kaf	42.8	47.7	49.2	49.2	44.5	49.2	47.7	67.6	69.9	76.9	69.2	59.5	673.4
Bypass/Spill kaf	6.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.4
Total Release kaf	49.2	47.7	49.2	49.2	44.5	49.2	47.7	67.6	69.9	76.9	69.2	59.5	679.8
Total Release cfs	800	802	800	800	801	800	802	1099	1175	1251	1125	1000	
End-Month Content kaf	630.0	624.1	609.9	593.1	580.2	576.7	570.5	569.9	576.5	538.9	494.9	465.2	
End-Month Elevation ft	4718.95	4718.60	4717.76	4716.73	4715.93	4715.71	4715.31	4715.27	4715.69	4713.22	4710.16	4707.97	
Net Change Content kaf	-9.2	-5.9	-14.2	-16.8	-12.9	-3.5	-6.2	-0.6	6.6	-37.6	-44.0	-29.7	-174.0

Boysen Power Plant 2010	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Turbine Release kaf	42.8	47.7	49.2	49.2	44.5	49.2	47.7	67.6	69.9	76.9	69.2	59.5	673.4
Turbine Release cfs	696	802	800	800	801	800	802	1099	1175	1251	1125	1000	
Generation gwh	3.736	4.147	4.253	4.216	3.780	4.158	4.019	5.652	5.849	6.363	5.581	4.657	56.411
Max Generation gwh	3.738	11.520	11.904	11.904	10.752	11.904	11.520	11.904	11.520	11.904	11.904	11.520	131.994
% Max Generation %	100	36	36	35	35	35	35	47	51	53	47	40	
Ave kwh/af	87	87	86	86	85	85	84	84	84	83	81	78	84
End-Month Power Cap mw	16	16	16	16	16	16	16	16	16	16	15	14	

BOYSEN RESERVOIR OPERATING PLAN - Based on October 1 Inflow Estimates
2011 Most Probable Inflow Estimates

Boysen Reservoir Initial Cont 639.2 kaf Maximum Cont 892.2 kaf Minimum Cont 219.2 kaf
Elev 4719.48 ft Elev 4732.20 ft Elev 4685.00 ft

2010	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Monthly Inflow kaf	45.0	51.1	40.2	36.5	38.2	52.2	50.3	155.8	250.1	127.7	69.9	57.1	974.1
Monthly Inflow cfs	732	859	654	594	688	849	845	2534	4203	2077	1137	960	
Turbine Release kaf	42.8	47.6	49.2	49.2	44.4	49.2	74.4	138.5	132.4	120.4	96.9	59.5	904.5
Bypass/Spill kaf	6.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.4
Total Release kaf	49.2	47.6	49.2	49.2	44.4	49.2	74.4	138.5	132.4	120.4	96.9	59.5	910.9
Total Release cfs	800	800	800	800	799	800	1250	2252	2225	1958	1576	1000	
End-Month Content kaf	635.0	638.5	629.5	616.8	610.6	613.6	589.5	606.8	724.5	731.8	704.8	702.4	
End-Month Elevation ft	4719.24	4719.44	4718.92	4718.17	4717.80	4717.98	4716.51	4717.57	4724.12	4724.50	4723.09	4722.96	

Net Change Content	kaf	-4.2	3.5	-9.0	-12.7	-6.2	3.0	-24.1	17.3	117.7	7.3	-	27.0	-2.4	63.2

Boysen Power Plant 2010		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Turbine Release	kaf	42.8	47.6	49.2	49.2	44.4	49.2	74.4	138.5	132.4	120.4	96.9	59.5	904.5
Turbine Release	cfs	696	800	800	800	799	800	1250	2252	2225	1958	1576	1000	
Generation	gwh	3.741	4.160	4.294	4.268	3.831	4.242	6.326	11.602	11.520	10.837	8.720	5.361	78.902
Max Generation	gwh	3.738	11.520	11.904	11.904	10.752	11.904	11.520	11.904	11.520	11.904	11.904	11.520	131.994
% Max Generation	%	100	36	36	36	36	36	55	97	100	91	73	47	
Ave kwh/af		87	87	87	87	86	86	85	84	87	90	90	90	87
End-Month Power Cap	mw	16	16	16	16	16	16	16	16	16	16	16	16	

BOYSEN RESERVOIR OPERATING PLAN - Based on October 1 Inflow Estimates
2011 Reasonable Maximum Inflow Estimates

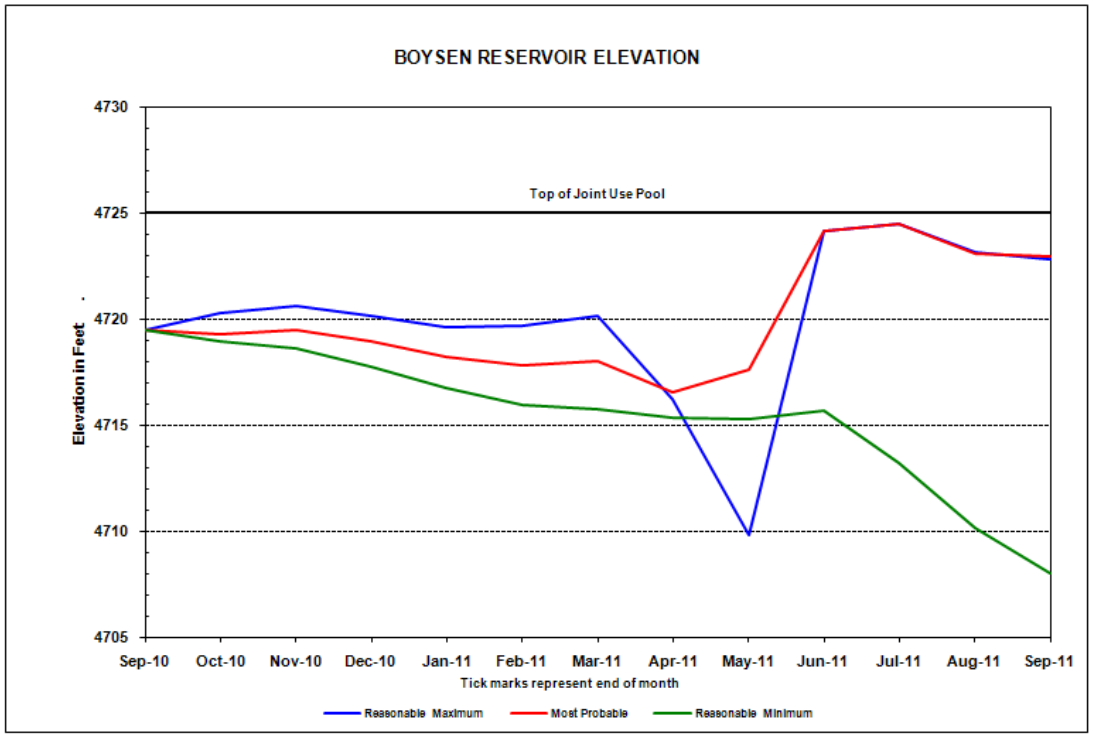
Boysen Reservoir Initial Cont 639.2 kaf Maximum Cont 892.2 kaf Minimum Cont 219.2 kaf
Elev 4719.48 ft Elev 4732.20 ft Elev 4685.00 ft

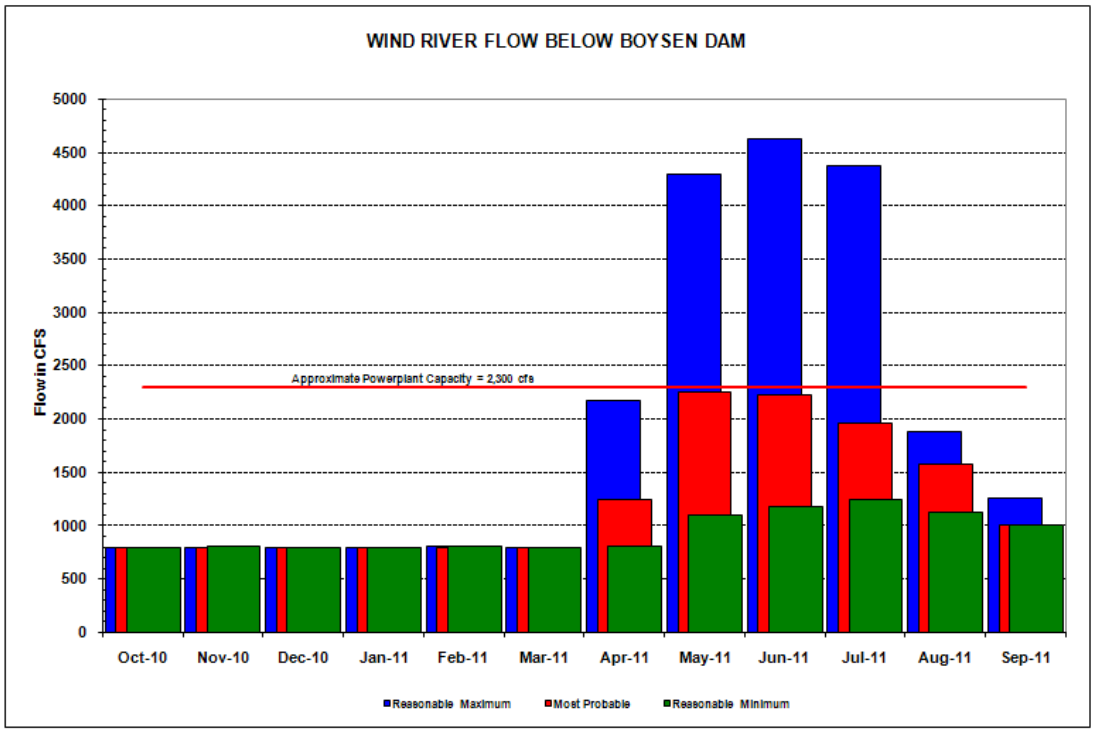
2010		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Monthly Inflow	kaf	62.7	53.5	41.1	40.2	46.0	57.2	62.4	169.4	510.1	276.6	88.9	69.1	1477.2
Monthly Inflow	cfs	1020	899	668	654	828	930	1049	2755	8573	4498	1446	1161	
Turbine Release	kaf	42.8	47.6	49.2	49.2	44.5	49.2	129.1	140.0	138.5	135.0	115.5	74.6	1015.2
Bypass/Spill	kaf	6.4	0.0	0.0	0.0	0.0	0.0	0.0	124.2	136.7	134.1	0.0	0.0	401.4
Total Release	kaf	49.2	47.6	49.2	49.2	44.5	49.2	129.1	264.2	275.2	269.1	115.5	74.6	1416.6
Total Release	cfs	800	800	800	800	801	800	2170	4297	4625	4376	1878	1254	
End-Month Content	kaf	652.7	658.6	650.5	641.5	643.0	651.0	584.3	489.5	724.4	731.9	705.3	699.8	
End-Month Elevation	ft	4720.24	4720.57	4720.12	4719.61	4719.69	4720.15	4716.19	4709.77	4724.11	4724.50	4723.11	4722.82	
Net Change Content	kaf	13.5	5.9	-8.1	-9.0	1.5	8.0	-66.7	-94.8	234.9	7.5	-	26.6	-5.5	60.6

Boysen Power Plant 2010		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Turbine Release	kaf	42.8	47.6	49.2	49.2	44.5	49.2	129.1	140.0	138.5	135.0	115.5	74.6	1015.2
Turbine Release	cfs	696	800	800	800	801	800	2170	2277	2328	2196	1878	1254	
Generation	gwh	3.759	4.202	4.341	4.321	3.901	4.324	10.949	11.027	11.424	11.900	10.358	6.692	87.198
Max Generation	gwh	3.762	11.520	11.904	11.904	10.752	11.904	11.520	11.904	11.520	11.904	11.904	11.520	132.018
% Max Generation	%	100	36	36	36	36	36	95	93	99	100	87	58	
Ave kwh/af		88	88	88	88	88	88	85	79	82	88	90	90	86
End-Month Power Cap	mw	16	16	16	16	16	16	16	14	16	16	16	16	

FIGURE WYG7

BOYSEN RESERVOIR





Buffalo Bill Reservoir and Powerplants

Three operating plans were prepared for water year 2011 to show the operations of Buffalo Bill Reservoir which could occur under various runoff conditions. The operations for the three runoff conditions are shown in Table WYT12A, WYT12B, WYT12C, and Figure WYG8. These plans were prepared only to show the probable limits of operations, therefore, actual conditions and operations could vary widely from the most probable plan.

Normal Operating Procedures

At the end of the irrigation season, releases will be adjusted with the objective of filling the reservoir to elevation 5393.50 feet (646,565 AF) while meeting the release criteria of the ***Buffalo Bill Reservoir Enlargement Winter Release Operation Agreement***. Under the Agreement, Buffalo Bill Reservoir will be operated to insure that a minimum flow of 100 cfs is provided in the river below the dam at all times. Additional winter releases beyond the 100 cfs minimum release up to a combined total of 350 cfs in the river below Buffalo Bill Powerplant will be provided based on the criteria set forth in the Agreement.

Reservoir releases to meet downstream irrigation requirements will, to the extent possible, be made through the most efficient power turbines available, after meeting winter flow requirements. A release of at least 100 cfs will be made through the Shoshone Powerplant, whenever the powerplant is available, to provide the required river flow directly below the dam. If the Shoshone Powerplant is not available, the release will be made through the jetflow valve at the dam.

During irrigation season, releases are determined by the requirements for irrigation, and municipal and industrial demand. If snow conditions, inflow, and reservoir content indicate an assured fill of the reservoir, additional releases may be required after the start of the spring runoff to provide flood control and make optimum use of the water for power generation. An attempt is made to maintain a release of 7,000 cfs or less during the runoff season and also assure that outflow is less than inflow at all times of flood rate inflow.

2011 Operating Plans

Inflow to Buffalo Bill Reservoir during August and September 2010 was near average and average inflow, is expected to continue into water year 2011 under most probable inflow conditions. Projected flows for all months of water year 2011 are estimated to be median flows, or flows which have historically been exceeded 50 percent of the time.

The reasonable minimum inflows are estimated to equal lower decile flows for all months of water year 2011. A lower decile flow is a flow which has historically been exceeded 90 percent of the time.

Upper decile flows, flows which have historically been exceeded 10 percent of the time are projected for all months of water year 2011 under reasonable maximum conditions.

At the beginning of water year 2011, storage in Buffalo Bill Reservoir was 485,526 AF at elevation 5372.44 feet. This was about 500 AF less water than the reservoir held at the beginning of water year 2010. Winter releases under minimum and maximum inflow scenarios are the same as under most probable conditions. Based on the criteria set forth in the ***Buffalo Bill Reservoir Enlargement Winter Release Operation Agreement***, the release from Buffalo Bill Dam through the winter will be 350 cfs. Ice in the Shoshone River can limit Reclamation's ability to change releases during the winter because of possible flooding due to ice jams, particularly near Lovell, Wyoming.

The Shoshone, Buffalo Bill, Heart Mountain, and Spirit Mountain Powerplants will all be available for power generation in water year 2011. Releases from Buffalo Bill Reservoir will be dependent upon the most efficient operation of all the powerplants while providing the required flow in the Shoshone River.

Under the most probable runoff plan, total generation from all the plants is expected to be 152,800,000 kilowatt hours (kWh). T otal generation with reasonable minimum inflows is expected to be 134,500,000 kWh while generation is expected to total 156,200,000 kWh under the plan with reasonable maximum inflows.

Power unit maintenance outages for the Shoshone, Buffalo Bill, Heart Mountain, and Spirit Mountain Powerplants are scheduled as shown in Table WYT13.

TABLE WYT12A

BUFFALO BILL RESERVOIR OPERATING PLAN
Based on October 1 Inflow Estimates
2011 Reasonable Minimum Inflow Estimates

Buffalo Bill Reservoir		Initial Cont		482.1 kaf			Maximum Cont		643.1 kaf			Minimum Cont		41.8 kaf	
			Elev	5372.53 ft				Elev	5393.59 ft				Elev	5259.64 ft	
	2010	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Monthly Inflow	kaf	25.1	22.1	14.4	12.8	11.8	16.1	39.2	144.0	199.6	71.7	25.8	21.0	603.6
Shoshone Release	kaf	6.2	6.0	6.1	6.1	3.8	6.1	6.0	6.1	6.0	6.2	6.2	6.0	70.8
Non-Power Release	kaf	0.0	0.0	0.0	0.0	1.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.8
Total Flow Below Dam	kaf	6.2	6.0	6.1	6.1	5.6	6.1	6.0	6.1	6.0	6.2	6.2	6.0	72.6
Buffalo Bill Release	kaf	22.7	21.9	15.4	15.4	13.8	15.4	14.8	52.5	49.7	51.2	52.1	42.7	367.6
Municipal Delivery	kaf	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	3.6
Heart Mtn Release	kaf	0.0	0.0	0.0	0.0	0.0	0.0	3.6	6.3	7.0	13.0	4.7	1.3	35.9
Heart Mtn Delivery	kaf	8.0	0.0	0.0	0.0	0.0	0.0	7.0	36.0	42.0	48.0	41.0	32.0	214.0
Total Outflow	kaf	37.2	28.2	21.8	21.8	19.7	21.8	31.7	101.2	105.0	118.7	104.3	82.3	693.7
Bypass/Spill	kaf	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
End-Month Targets	kaf		463.9								625.0		485.0	
End-Month Content	kaf	470.0	463.9	456.5	447.5	439.6	433.9	441.4	484.2	578.8	531.8	453.3	392.0	
Est Total Storage	kaf	473.4	467.3	459.9	450.9	443.0	437.3	444.8	487.6	582.2	535.2	456.7	395.4	
End-Month Elevation	ft	5370.85	5370.00	5368.96	5367.68	5366.55	5365.73	5366.81	5372.82	5385.46	5379.27	5368.51	5359.40	
Net Change Content	kaf	-12.1	-6.1	-7.4	-9.0	-7.9	-5.7	7.5	42.8	94.6	-47.0	-78.5	-61.3	-90.1
Flow Below BB Pwr	kaf	28.9	27.9	21.5	21.5	19.4	21.5	20.8	58.6	55.7	57.4	58.3	48.7	440.2
Flow Below BB Pwr	cfs	470	469	350	350	349	350	350	953	936	934	948	818	
Spring Inflow	kaf	3.7	3.6	3.7	3.7	3.3	3.7	3.6	3.7	3.6	3.7	3.7	3.6	43.6
Passing Cody Gage	kaf	32.6	31.5	25.2	25.2	22.7	25.2	28.0	68.6	66.3	74.1	66.7	53.6	519.7
Passing Cody Gage	cfs	530	529	410	410	409	410	471	1116	1114	1205	1085	901	

Shoshone Power	2010	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Shoshone Release	kaf	6.2	6.0	6.1	6.1	3.8	6.1	6.0	6.1	6.0	6.2	6.2	6.0	70.8
Generation	gwh	1.150	1.108	1.122	1.116	0.692	1.106	1.088	1.123	1.148	1.201	1.161	1.078	13.093
Max Generation	gwh	2.232	2.160	2.232	2.232	0.685	2.232	2.160	2.232	2.160	2.232	2.232	2.160	24.949
% Max Generation		52	51	50	50	101	50	50	50	53	54	52	50	
Ave kwh/af		185	185	184	183	182	181	181	184	191	194	187	180	185
End-Month Power Cap	mw	3	3	3	3	1	3	3	3	3	3	3	3	

Buffalo Bill Power	2010	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Buffalo Bill Release	kaf	22.7	21.9	15.4	15.4	13.8	15.4	14.8	52.5	49.7	51.2	52.1	42.7	367.6
Generation	gwh	6.213	5.990	4.216	4.200	3.749	4.170	3.995	13.262	12.820	13.112	13.287	10.856	95.870
Max Generation	gwh	13.392	12.960	13.392	13.392	12.096	13.392	12.960	13.392	12.960	13.392	13.392	12.960	157.680
% Max Generation		46	46	31	31	31	31	31	99	99	98	99	84	
Ave kwh/af		274	274	274	273	272	271	270	253	258	256	255	254	261
End-Month Power Cap	mw	18	18	18	18	18	18	18	18	18	18	18	18	

Spirit Mtn Power	2010	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Spirit Mtn Release	kaf	8.0	0.0	0.0	0.0	0.0	0.0	10.6	34.4	33.3	34.4	34.4	33.3	188.4
Generation	gwh	0.844	0.000	0.000	0.000	0.000	0.000	1.071	2.954	3.042	3.076	3.040	2.891	16.918
Max Generation	gwh	1.674	0.000	0.000	0.000	0.000	0.000	1.620	3.348	3.240	3.348	3.348	3.240	19.818
% Max Generation		50	0	0	0	0	0	66	88	94	92	91	89	
Ave kwh/af		106						101	86	91	89	88	87	90
End-Month Power Cap	mw	1	0	0	0	0	0	2	4	5	4	4	4	

Heart Mtn Power	2010	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Heart Mtn Release	kaf	0.0	0.0	0.0	0.0	0.0	0.0	3.6	6.3	7.0	13.0	4.7	1.3	35.9
Generation	gwh	0.000	0.000	0.000	0.000	0.000	0.000	0.862	1.508	1.676	3.112	1.125	0.311	8.594
Max Generation	gwh	0.000	0.000	0.000	0.000	0.000	0.000	2.160	4.464	4.320	4.464	4.464	4.320	24.192
% Max Generation		0	0	0	0	0	0	40	34	39	70	25	7	
Ave kwh/af								239	239	239	239	239	239	239
End-Month Power Cap	mw	0	0	0	0	0	0	3	6	6	6	6	6	

Total Generation	2010	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Total Generation	gwh	8.207	7.098	5.338	5.316	4.441	5.276	7.016	18.847	18.686	20.501	18.613	15.136	134.475
End-month Power Cap	mw	22	21	21	21	19	21	26	31	32	31	31	31	

TABLE WYT12B

BUFFALO BILL RESERVOIR OPERATING PLAN
Based on October 1 Inflow Estimates
2011 Most Probable Inflow Estimates

Buffalo Bill Reservoir		Initial Cont 482.1 kaf Elev 5372.53 ft					Maximum Cont 643.1 kaf Elev 5393.59 ft			Minimum Cont 41.8 kaf Elev 5259.64 ft				
	2010	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Monthly Inflow	kaf	27.8	22.3	17.6	15.5	13.4	16.3	34.7	140.1	310.2	187.0	52.5	28.5	865.9
Shoshone Release	kaf	6.1	6.0	6.1	6.1	3.8	6.1	6.0	6.1	11.3	11.2	10.9	6.0	85.7
Non-Power Release	kaf	0.0	0.0	0.0	0.0	1.8	0.0	0.0	0.0	45.1	48.5	0.0	0.0	95.4
Total Flow Below Dam	kaf	6.1	6.0	6.1	6.1	5.6	6.1	6.0	6.1	56.4	59.7	10.9	6.0	181.1
Buffalo Bill Release	kaf	27.3	20.3	15.4	15.4	13.8	15.4	14.8	52.7	51.3	51.5	51.4	49.3	378.6
Municipal Delivery	kaf	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	3.6
Heart Mtn Release	kaf	0.0	0.0	0.0	0.0	0.0	0.0	3.6	15.7	18.0	18.6	18.6	11.2	85.7
Heart Mtn Delivery	kaf	8.0	0.0	0.0	0.0	0.0	0.0	7.0	36.0	42.0	48.0	41.0	32.0	214.0
Total Outflow	kaf	41.7	26.6	21.8	21.8	19.7	21.8	31.7	110.8	168.0	178.1	122.2	98.8	863.0
Bypass/Spill	kaf	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	45.1	48.5	0.0	0.0	93.6
End-Month Targets	kaf		463.9								625.0		485.0	
End-Month Content	kaf	468.2	463.9	459.7	453.4	447.1	441.6	444.6	473.9	616.1	625.0	555.3	485.0	
Est Total Storage	kaf	471.6	467.3	463.1	456.8	450.5	445.0	448.0	477.3	619.5	628.4	558.7	488.4	
End-Month Elevation	ft	5370.60	5370.00	5369.41	5368.52	5367.63	5366.84	5367.27	5371.40	5390.23	5391.35	5382.39	5372.93	
Net Change Content	kaf	-13.9	-4.3	-4.2	-6.3	-6.3	-5.5	3.0	29.3	142.2	8.9	-69.7	-70.3	2.9
Flow Below BB Pwr	kaf	33.4	26.3	21.5	21.5	19.4	21.5	20.8	58.8	107.7	111.2	62.3	55.3	559.7
Flow Below BB Pwr	cfs	543	442	350	350	349	350	350	956	1810	1808	1013	929	
Spring Inflow	kaf	3.7	3.6	3.7	3.7	3.3	3.7	3.6	3.7	3.6	3.7	3.7	3.6	43.6
Passing Cody Gage	kaf	37.1	29.9	25.2	25.2	22.7	25.2	28.0	78.2	129.3	133.5	84.6	70.1	689.0
Passing Cody Gage	cfs	603	502	410	410	409	410	471	1272	2173	2171	1376	1178	

Shoshone Power	2010	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Shoshone Release	kaf	6.1	6.0	6.1	6.1	3.8	6.1	6.0	6.1	11.3	11.2	10.9	6.0	85.7
Generation	gwh	1.131	1.107	1.123	1.119	0.695	1.111	1.092	1.121	2.159	2.223	2.147	1.141	16.169
Max Generation	gwh	2.232	2.160	2.232	2.232	0.685	2.232	2.160	2.232	2.160	2.232	2.232	2.160	24.949
% Max Generation		51	51	50	50	101	50	51	50	100	100	96	53	
Ave kwh/af		185	185	184	183	183	182	182	184	191	198	197	190	189
End-Month Power Cap	mw	3	3	3	3	1	3	3	3	3	3	3	3	

Buffalo Bill Power	2010	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Buffalo Bill Release	kaf	27.3	20.3	15.4	15.4	13.8	15.4	14.8	52.7	51.3	51.5	51.4	49.3	378.6
Generation	gwh	7.444	5.556	4.219	4.209	3.761	4.185	4.005	13.074	12.960	13.380	13.393	12.785	98.971
Max Generation	gwh	13.392	12.960	13.392	13.392	12.096	13.392	12.960	13.392	12.960	13.392	13.392	12.960	157.680
% Max Generation		56	43	32	31	31	31	31	98	100	100	100	99	
Ave kwh/af		273	274	274	273	273	272	271	248	253	260	261	259	261
End-Month Power Cap	mw	18	18	18	18	18	18	18	18	18	18	18	18	

Spirit Mtn Power	2010	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Spirit Mtn Release	kaf	8.0	0.0	0.0	0.0	0.0	0.0	10.6	34.4	33.3	34.4	34.4	33.3	188.4
Generation	gwh	0.838	0.000	0.000	0.000	0.000	0.000	1.079	2.791	2.888	3.238	3.240	3.090	17.164
Max Generation	gwh	1.674	0.000	0.000	0.000	0.000	0.000	1.620	3.348	3.240	3.348	3.348	3.240	19.818
% Max Generation		50	0	0	0	0	0	67	83	89	97	97	95	
Ave kwh/af		105						102	81	87	94	94	93	91
End-Month Power Cap	mw	1	0	0	0	0	0	2	4	5	5	5	4	

Heart Mtn Power	2010	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Heart Mtn Release	kaf	0.0	0.0	0.0	0.0	0.0	0.0	3.6	15.7	18.0	18.6	18.6	11.2	85.7
Generation	gwh	0.000	0.000	0.000	0.000	0.000	0.000	0.862	3.758	4.309	4.453	4.453	2.681	20.516
Max Generation	gwh	0.000	0.000	0.000	0.000	0.000	0.000	2.160	4.464	4.320	4.464	4.464	4.320	24.192
% Max Generation		0	0	0	0	0	0	40	84	100	100	100	62	
Ave kwh/af								239	239	239	239	239	239	239
End-Month Power Cap	mw	0	0	0	0	0	0	3	6	6	6	6	6	

Total Generation	2010	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Total Generation	gwh	9.413	6.663	5.342	5.328	4.456	5.296	7.038	20.744	22.316	23.294	23.233	19.697	152.820
End-month Power Cap	mw	22	21	21	21	19	21	26	31	32	32	32	31	

TABLE WYT12C

BUFFALO BILL RESERVOIR OPERATING PLAN
Based on October 1 Inflow Estimates
2011 Reasonable Maximum Inflow Estimates

Buffalo Bill Reservoir		Initial Cont		482.1 kaf			Maximum Cont		643.1 kaf			Minimum Cont		41.8 kaf	
			Elev	5372.53 ft				Elev	5393.59 ft				Elev	5259.64 ft	
	2010	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Monthly Inflow	kaf	29.0	24.3	19.8	16.5	14.7	20.9	51.8	205.3	442.0	286.3	73.2	34.4	1218.2
Shoshone Release	kaf	6.2	6.0	6.2	6.1	3.8	6.1	6.0	12.1	11.4	11.3	11.4	6.0	92.6
Non-Power Release	kaf	0.0	0.0	0.0	0.0	1.8	0.0	0.0	69.1	188.8	147.2	24.6	0.0	431.5
Total Flow Below Dam	kaf	6.2	6.0	6.2	6.1	5.6	6.1	6.0	81.2	200.2	158.5	36.0	6.0	524.1
Buffalo Bill Release	kaf	32.2	18.5	15.3	15.4	13.8	15.4	14.8	54.1	51.5	51.8	51.5	49.3	383.6
Municipal Delivery	kaf	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	3.6
Heart Mtn Release	kaf	0.0	0.0	0.0	0.0	0.0	0.0	3.6	18.6	18.0	18.6	18.6	12.6	90.0
Heart Mtn Delivery	kaf	8.0	0.0	0.0	0.0	0.0	0.0	7.0	36.0	42.0	48.0	41.0	32.0	214.0
Total Outflow	kaf	46.7	24.8	21.8	21.8	19.7	21.8	31.7	190.2	312.0	277.2	147.4	100.2	1215.3
Bypass/Spill	kaf	0.0	0.0	0.0	0.0	0.0	0.0	0.0	69.1	188.8	147.2	24.6	0.0	429.7
End-Month Targets	kaf		463.9								625.0		485.0	
End-Month Content	kaf	464.4	463.9	461.9	456.6	451.6	450.7	470.8	485.9	615.9	625.0	550.8	485.0	
Est Total Storage	kaf	467.8	467.3	465.3	460.0	455.0	454.1	474.2	489.3	619.3	628.4	554.2	488.4	
End-Month Elevation	ft	5370.07	5370.00	5369.72	5368.97	5368.27	5368.14	5370.96	5373.06	5390.21	5391.35	5381.80	5372.93	
Net Change Content	kaf	-17.7	-0.5	-2.0	-5.3	-5.0	-0.9	20.1	15.1	130.0	9.1	-74.2	-65.8	2.9
Flow Below BB Pwr	kaf	38.4	24.5	21.5	21.5	19.4	21.5	20.8	135.3	251.7	210.3	87.5	55.3	907.7
Flow Below BB Pwr	cfs	625	412	350	350	349	350	350	2200	4230	3420	1423	929	
Spring Inflow	kaf	3.7	3.6	3.7	3.7	3.3	3.7	3.6	3.7	3.6	3.7	3.7	3.6	43.6
Passing Cody Gage	kaf	42.1	28.1	25.2	25.2	22.7	25.2	28.0	157.6	273.3	232.6	109.8	71.5	1041.3
Passing Cody Gage	cfs	685	472	410	410	409	410	471	2563	4593	3783	1786	1202	

Shoshone Power	2010	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Shoshone Release	kaf	6.2	6.0	6.2	6.1	3.8	6.1	6.0	12.1	11.4	11.3	11.4	6.0	92.6
Generation	gwh	1.149	1.106	1.142	1.121	0.696	1.116	1.104	2.224	2.167	2.231	2.232	1.140	17.428
Max Generation	gwh	2.232	2.160	2.232	2.232	0.696	2.232	2.160	2.232	2.160	2.232	2.232	2.160	24.960
% Max Generation		51	51	51	50	100	50	51	100	100	100	100	53	
Ave kwh/af		185	184	184	184	183	183	184	184	190	197	196	190	188
End-Month Power Cap	mw	3	3	3	3	1	3	3	3	3	3	3	3	

Buffalo Bill Power	2010	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Buffalo Bill Release	kaf	32.2	18.5	15.3	15.4	13.8	15.4	14.8	54.1	51.5	51.8	51.5	49.3	383.6
Generation	gwh	8.736	5.064	4.194	4.214	3.767	4.198	4.038	13.381	12.967	13.397	13.383	12.743	100.082
Max Generation	gwh	13.392	12.960	13.392	13.392	12.096	13.392	12.960	13.392	12.960	13.392	13.392	12.960	157.680
% Max Generation		65	39	31	31	31	31	31	100	100	100	100	98	
Ave kwh/af		271	274	274	274	273	273	273	247	252	259	260	258	261
End-Month Power Cap	mw	18	18	18	18	18	18	18	18	18	18	18	18	

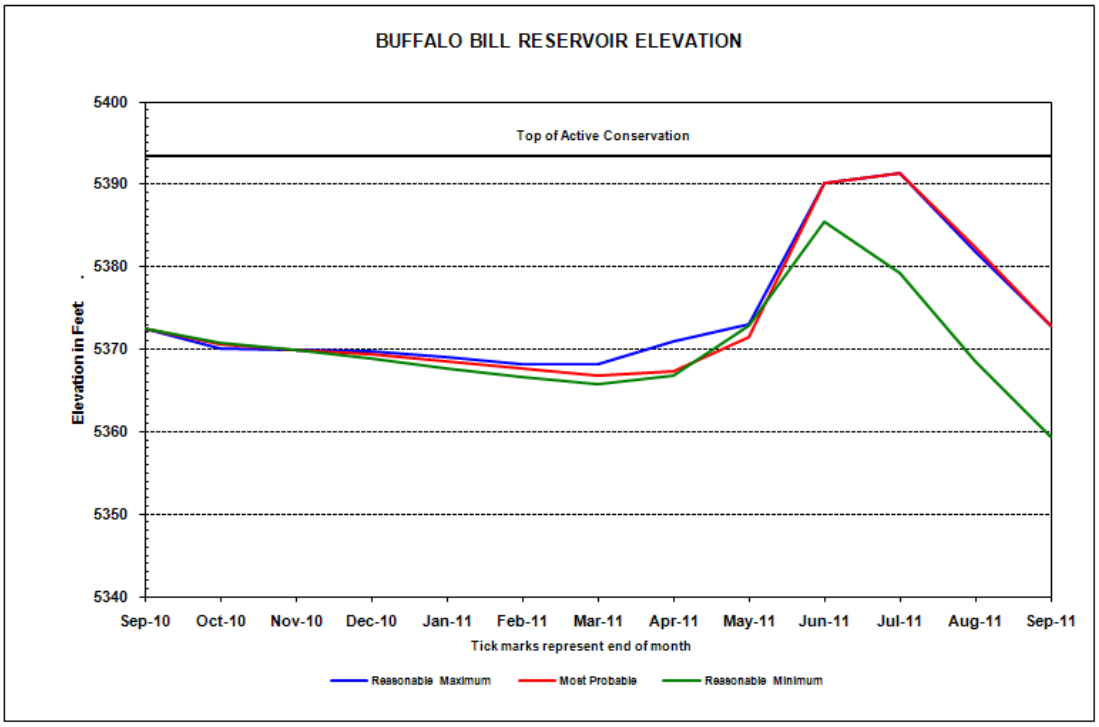
Spirit Mtn Power	2010	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Spirit Mtn Release	kaf	8.0	0.0	0.0	0.0	0.0	0.0	10.6	34.4	33.3	34.4	34.4	33.3	188.4
Generation	gwh	0.829	0.000	0.000	0.000	0.000	0.000	1.104	2.806	2.909	3.233	3.230	3.060	17.171
Max Generation	gwh	1.674	0.000	0.000	0.000	0.000	0.000	1.620	3.348	3.240	3.348	3.348	3.240	19.818
% Max Generation		50	0	0	0	0	0	68	84	90	97	96	94	
Ave kwh/af		104						104	82	87	94	94	92	91
End-Month Power Cap	mw	1	0	0	0	0	0	2	4	5	5	4	4	

Heart Mtn Power	2010	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Heart Mtn Release	kaf	0.0	0.0	0.0	0.0	0.0	0.0	3.6	18.6	18.0	18.6	18.6	12.6	90.0
Generation	gwh	0.000	0.000	0.000	0.000	0.000	0.000	0.862	4.453	4.309	4.453	4.453	3.016	21.546
Max Generation	gwh	0.000	0.000	0.000	0.000	0.000	0.000	2.160	4.464	4.320	4.464	4.464	4.320	24.192
% Max Generation		0	0	0	0	0	0	40	100	100	100	100	70	
Ave kwh/af								239	239	239	239	239	239	239
End-Month Power Cap	mw	0	0	0	0	0	0	3	6	6	6	6	6	

Total Generation	2010	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Total Generation	gwh	10.714	6.170	5.336	5.335	4.463	5.314	7.108	22.864	22.352	23.314	23.298	19.959	156.227
End-month Power Cap	mw	22	21	21	21	19	21	26	31	32	32	31	31	

FIGURE WYG8

BUFFALO BILL RESERVOIR



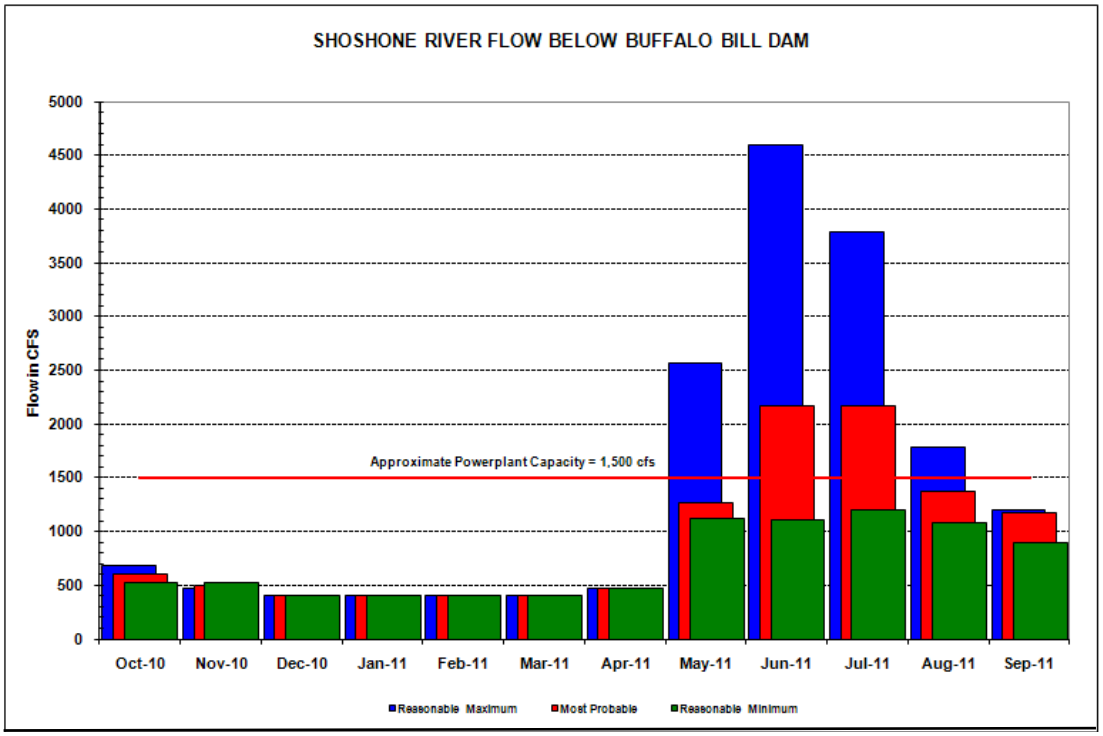


Table WYT13

WATER YEAR 2011 SCHEDULED OUTAGES FOR WYOMING POWERPLANTS

Facilities	Description of Work	Scheduled Dates
BOYSEN		
Unit 1	Stop Log Channel – Diver Inspection	10/26/10 - 10/26/10
Unit 1	Annual Maintenance / Hi-Pot Test K1A Cables and Bus Duct #1	01/10/11 - 01/24/11
Unit 2	Stop Log Channel – Diver Inspection	10/26/10 - 10/26/10
Unit 2	Annual Maintenance/Hi-Pot Test Alternate Station Station Service Feed Cables	11/01/10 - 11/23/10
Unit 2	Annual Maintenance / Hi-Pot Test K1A Cables and Bus Duct #1	01/10/11 - 01/24/11
BUFFALO BILL		
Buffalo Bill Powerplant		
Unit 1	Annual Maintenance	11/22/10 - 12/01/10
Unit 2	Annual Maintenance / Hi-Pot Test Unit #2 Stator	12/13/10 - 12/30/10
Unit 3	Annual Maintenance	01/10/11 - 02/03/11
Shoshone Powerplant		
Unit 3	Annual Maintenance	02/14/11 - 02/24/11
Unit 3	Tri-Annual Maintenance 6.9kV Bus #2 BB Breaker 518	02/18/11 - 02/23/11
Heart Mountain Powerplant		
Unit 1	Annual Maintenance	03/07/11 - 03/17/11
Spirit Mountain Powerplant		
Unit 1	Annual Maintenance / Hi-Pot Test Cables: Unit 1 To Breaker 918 and Breaker 918 to Breaker 418	10/18/10 - 11/10/10
Unit 1	Tri-Annual Maintenance 6.9kV Bus #1 BB Breaker 418	12/13/10 - 12/28/10

OPERATING PLANS FOR WATER YEAR 2011

Dickinson Reservoir

At the beginning of WY 2011, Dickinson Dam and E.A. Patterson Lake (Dickinson Reservoir) had storage of 7,769 acre-feet at elevation 2419.27 feet, which is 843 acre-feet and 0.73 feet below the top of the active conservation pool (Elevation 2,420.00 feet at 8,612 acre-feet). The reservoir is normally operated as full as possible at all times. Excess water will be released by spilling over the Bascule gate after the reservoir has filled, and by gated releases through the 24 inch river outlet valve. No releases are planned until irrigation water is required or if the spring runoff deems it necessary for flood protection.

Heart Butte Reservoir

At the beginning of WY 2011, Heart Butte Dam and Lake Tschida (Heart Butte Reservoir) had storage of 62,831 acre-feet at elevation 2063.17 feet, which is 4,311 acre-feet and 1.33 feet below the top of the active conservation pool (Elevation 2,064.50 feet at 67,142 acre-feet). Since there are no accurate inflow forecasts available, plans are to operate the reservoir as close to the top of the conservation pool as possible while regulating releases required, maintaining downstream conservation commitments, and preserving flood control space. During winter months, and when the reservoir level is below the spillway crest at elevation 2064.50 feet, the river releases will be maintained at about 10 cfs to ensure a live stream flow below Heart Butte Dam. This will continue through the winter until the spring runoff requires higher releases sometime in late March or early April. Excess water is released only when the reservoir is full or ensured of filling.

Jamestown Reservoir

At the beginning of WY 2011, Jamestown Reservoir had storage of 29,319 acre-feet at elevation 1430.00 feet, which is 3,962 acre-feet and 2.00 feet above the top of the active conservation pool (Elevation 1,428.00 feet at 25,357 acre-feet). Water releases were cut to 13 cfs in mid October and will be continued throughout the winter until spring runoff requires additional releases to be made for flood protection. The reservoir is normally operated under the following criteria and limitations set forth in the Field Working Agreement between the Corps and Reclamation that reads:

Flood Control Regulation of Joint-Use Pool - Jamestown Reservoir

The joint space between elevations 1428 feet and 1431 feet will be used for seasonal multipurpose regulation. For purposes of flood control storage, the reservoir water elevation will be no higher than 1429.8 feet at the beginning of spring runoff period. That portion of the joint-use pool between elevations 1429.8 feet and 1431.0 feet will be used for storage and regulation of the spring runoff and summer rainstorms. In addition, water stored in this zone may be used during the summer months for conservation purposes. Storage remaining in the joint-use pool above elevation 1429.8 feet, mean sea level (msl) after September 1 will be evacuated as directed by the Corps of Engineers.

The Bureau has the option of lowering the reservoir below elevation 1429.8 feet, msl should it be desirable based on water supply needs. There are no requirements for maintaining a specified minimum reservoir release.

SEASON: BEGINNING OF SPRING RUNOFF TO SEPTEMBER 1

El. 1429.80 (Base of flood control zone) to El. 1431.00 (Top of Joint Use Pool)

Release greater of:

a. Conservation releases

b. Based on inflows occurring at the time and the existing potential for further inflows, releases will be maintained as necessary to result in a pool elevation of 1431 feet at the time inflows cease.

SEASON: SEPTEMBER 1 TO NOVEMBER 1

Make releases necessary to evacuate reservoir to elevation 1429.80 feet prior to November 1.

SEASON: NOVEMBER 1 TO BEGINNING OF SPRING RUNOFF

Make releases necessary to maintain elevation 1429.80 feet.

Deerfield Reservoir

Deerfield Reservoir started WY2011 at elevation 5905.77 feet and storage of 14,734 acre-feet, which is 2.23 feet and 921 acre-feet below the top of conservation. The reservoir winter draw down will be about 14,700 acre-feet by December 1, 2010. This is close to our target of 15,000 acre-feet by December 1. A target of 15,000 acre-feet of storage by March 1 will usually dictate the winter release, which is set near December 1. The winter release for WY 2011 is set based on water usage from Deerfield by the Rapid Valley Water Conservancy District (District) and the storage target of 15,000 acre-feet by March 1. The goal is to be near full by May 1 which is the start of the irrigation season. No irrigation water was used by the District during the 2010 irrigation season.

A release of 12 cfs will be maintained until the spring runoff requires higher releases in late March or early April. Excess water is normally released only when the reservoir is full or assured of filling. Since no inflow forecasts are available, the reservoir is normally operated as full as possible. Two Snowtel sites (North Rapid Creek and Blind Park) are operated in the Pactola and Deerfield drainage basin. Deerfield storage may be required to meet District irrigation needs in water year 2011.

The jet flow gates will be used for winter releases and provide minimum stream flows of 6 cfs or more which will enhance winter fishery conditions in Castle Creek and improve fishery production conditions in the stream.

Storage at the end of water year will depend on the amount of inflow to the Pactola-Deerfield system and the need for project water deliveries from Deerfield Reservoir.

During average and above average inflow years, summer releases will be made to bring the reservoir storage to about 14,900 acre-feet by September 30. This is to accommodate minimum releases of 6 cfs into Castle Creek during the winter. The actual release will depend on runoff conditions and will take into account downstream ice conditions in Castle Creek.

Pactola Reservoir

Pactola Reservoir started WY 2011 at elevation 4577.33 feet and storage of 53,878 acre-feet (52,861 acre-feet active storage), which is 2.87 feet and 2,094 acre-feet below the top of conservation. Operating criteria established for the reservoir in the Definite Plan Report called for minimum winter conservation releases to be 7 cfs from October 1 to April 15 and 20 cfs from April 15 to April 30 when the reservoir content is below 29,000 acre-feet. Releases of 15 cfs from October 1 through March 1 and 20 cfs from March 1 through April 30 are established for reservoir content above 29,000 acre-feet. Minimum summer conservation releases are 20 cfs at all reservoir contents.

Pactola reservoir is operated as close to the top of the conservation pool as possible, while regulating releases required to maintain a downstream fishery and to preserve flood control space. The new long term storage contract, for Pactola, between Reclamation and the city of Rapid City was signed on July 31, 2007. New operating criteria for releases to Rapid Creek were established in the Standard Operating Plans. The following minimum releases will be made as long as water is available in the Fisheries, Wildlife, and Recreation Pool.

1. Reservoir content greater than 29,000 acre-feet

Year round	20 cfs

2. Reservoir content less than 29,000 acre-feet

October 1 to April 15	15 cfs
April 15 to October 1	20 cfs

The winter release for WY 2011 is approximately 37 cfs and has been coordinated with the city of Rapid City, South Dakota Department of Game, Fish, and Parks, local water users, Forest Service, and Corps of Engineers. With a reservoir content of 29,000 acre-feet and above, a release of 20 cfs has been specified in the Finding of No Significant Impact for the Environmental Assessment for the Pactola Reservoir Water Service Contract Renewal (FONSI No. DK600-00-03). Pactola Winter releases can be increased by 2 or 3 cfs during extremely cold weather to replace water that is lost in the formation of ice in the creek channel. Once the channel is covered with ice and snow, which provides insulation for the stream, the releases can be reduced if below average snow pack and inflow conditions indicate a need to conserve storage. During the flood control season, total releases will be controlled between 20 cfs and 1000 cfs. Releases in excess of 200 cfs when storage is below the top of the conservation pool at elevation 4580.20 feet will be cleared with the Corps of Engineers. The Corps will issue release orders on a current basis when storage is in the exclusive flood control pool. Contract negotiations with water users at Pactola Reservoir will provide the basis for future reservoir operations.

During the irrigation season of May 1 through October 30 sufficient natural flows to meet prior rights of the irrigators will be bypassed through the reservoir. Orders by water users will be released under the provisions of contracts with the water users. Drought conditions that have existed in past years have resulted in conservation measures being initiated by water users. Continuation of water conservation measures will assist in conserving reservoir storage and refilling of the reservoir.

Angostura Reservoir

Angostura Reservoir started WY 2011 at elevation 3181.32 feet and storage of 97,886 acre-feet (55,681 acre-feet active storage), which is 5.88 feet and 25,162 acre-feet below the top of conservation. Since Angostura Reservoir is the principle source of water for the Angostura Irrigation District and no accurate inflow forecasts are available for this reservoir, it is operated as full as possible at all times. Excess water is released through the spillway when the reservoir is full or assured of filling.

Keyhole Reservoir

Keyhole Reservoir started WY 2011 at elevation 4088.96 feet and storage of 109,315 acre-feet (102,723 acre-feet active storage), which is 10.34 feet and 79,356 acre-feet below the top of conservation. At the beginning of WY 2011, South Dakota storage for the Belle Fourche Irrigation District is 12,368 acre-feet and Wyoming storage for the Crook County Irrigation District is 11,382 acre-feet.

Releases from Keyhole Reservoir are made for either irrigation requirements or flood control. Releases are not anticipated from the reservoir from October through May. Flood control releases are not expected unless extreme precipitation events occur to fill the reservoir.

Discharges from toe drains of the dam and downstream inflows normally satisfy downstream requirements for stock water and other minor uses during this period. Releases from storage accounts will be made during the summer of 2011 in response to irrigation demand from the Belle Fourche Irrigation District in South Dakota and the Crook County Irrigation District in Wyoming. Each organization maintains a storage account in Keyhole Reservoir and the contract with the Belle Fourche Irrigation District also includes provisions for the annual purchase of additional unsold South Dakota storage. Peak irrigation demand is normally between 125 and 175 cfs.

The Belle Fourche Irrigation District has lands along the inlet canal that depend entirely on Keyhole Reservoir for storage. These lands will be served with flows from the Belle Fourche River and storage from Keyhole. Additional water from Keyhole Reservoir to supplement storage in Belle Fourche Reservoir may be necessary. Crook County Irrigation District also depends entirely on Keyhole Reservoir for storage and has adequate supplies of water in its account for use this year.

Shadehill Reservoir

Shadehill Reservoir started WY 2011 at elevation 2269.03 feet and storage of 105,860 acre-feet (61,991 acre-feet active storage), which is 2.97 feet and 14,312 acre-feet below the top of conservation. The winter release will be maintained at around 60 cfs to conserve storage and still maintain stream flow. This release rate will be maintained constant or reduced from the time the stream ices over until ice comes out of the channel in the spring to prevent ice jams at crossings. In the spring of 2011, after ice comes out of the channel, the release will be adjusted to draw the reservoir down to 2265.0b feet by mid-August, 2011 for the start of rip-rap repairs on Ketterling's Point. Releases for irrigation demands will be met by conservation releases.

Belle Fourche Reservoir

Belle Fourche Reservoir started WY 2011 at elevation 2964.98 feet and storage of 102,248 acre-feet (99,165 acre-feet active storage), which is 10.02 feet and 70,625 acre-feet below the top of conservation.

A bypass of 5 cfs will be made at the Belle Fourche Diversion Dam to provide flows for domestic use between the diversion dam and the Belle Fourche River confluence with Owl Creek. No releases from the reservoir are planned until irrigation begins in the spring of 2011.

When the volume of water supply available from the reservoir can be estimated in May or June, the Belle Fourche Irrigation District will establish allotments of water to each irrigator and the storage will be used accordingly. The Standing Operating Procedures for Belle Fourche Dam limit the maximum drawdown of the reservoir to 0.3 feet per day as established in the 1984 Safety Evaluation of Existing Dams Report.

Higher rates of drawdown are acceptable if the total drawdown is limited to 20 feet. This restriction will affect delivery rates to water users in the late summer if the reservoir does not fill. At low reservoir levels, the draw down rate becomes the governing factor for releases.

CORPS OF ENGINEERS MAIN STEM RESERVOIRS

The Missouri River main stem reservoir system consists of six reservoirs located on the Missouri River in Montana, North Dakota, South Dakota, and Nebraska. This reservoir system serves flood control, irrigation, navigation, power, municipal and industrial water supply, water quality control, fish and wildlife, and recreation. Based on information from the Corps' 2010 AOP, the capacity and storage allocations of the main stem system were updated to current values and are shown in downstream order as follows:

Reservoir Storage Allocation (1,000 Acre-Feet)

Dam	Permanent	Carryover Multiple Use	Annual Flood Control and Multiple Use	Exclusive Flood Control	Total Storage
Fort Peck	4,073	10,667	2,838	922	18,500
Garrison	4,980	13,130	4,222	1,489	23,821
Oahe	5,373	13,461	3,201	1,102	23,137
Big Bend	1,621	0	117	60	1,798
Fort Randall	1,517	1,607	1,309	985	5,418
Gavins Point	307	0	86	57	450
Totals	17,871	38,865	11,773	4,615	73,124

Each main stem facility serves a powerplant. The number of generating units and total nameplate capabilities are shown below:

Powerplant	Units	Capacity (Kilowatts)
Fort Peck	5	185,250
Garrison	5	583,300
Oahe	7	786,030
Big Bend	8	494,320
Fort Randall	8	320,000
Gavins Point	3	132,300
Totals	36	2,501,200

Main stem system releases are regulated to support the multiple use purposes of the reservoirs. The navigation season on the Missouri River below the dams normally is from late March to late November. Generally, releases from the system for navigation are higher during late summer and fall lowering the system storage. During that time, much of the system's hydropower is generated from the lower most projects. During closure of the navigation season, higher releases are made and more power is generated from the upstream Fort Peck and Garrison Reservoirs. This offsets the reduced release and generation from the downstream projects during winter closure of the river for navigation. The desired annual target system storage level is 56.8 million acre-feet on the first of March.

The regulation of Missouri River flows by the main stem storage provided benefits to nine water resource-related functions, including flood control, irrigation, navigation, power, municipal, industrial water supply, water quality control, fish and wildlife, and recreation. Table CET1 presents the regulation benefit for most of those functions as recorded in 2009-2010, 2008-2009, and the average. Benefits are defined as the tons of produce shipped, dollars of damages prevented, kilowatt hours of electricity produced, and reservoir elevation and river stages maintained. For the shipping information, estimates also were provided this year which included the sand, gravel, and waterway material shipped.

TABLE CET1
Main Stem Reservoir Water Regulation
Comparison with Past Regulations

Use of Regulated Water	Period of Use or Season	Totals	Totals	Long-Term
Navigation*	Apr. - Dec.[4]	0.300 million tons (2010)	0.270 million tons (2009)	1.85 million tons[1]
Flood Damages Prevented	Oct. – Sept.	$2,332.0 million (2010)	$3,308.5 million (2009)	$44.3 billion[2] (1938-2010)
Energy	Aug. - Jul.	6.9 billion KWH (Aug. 09-July 10)	5.7 billion KWH (Aug. 08-July 09)	9.4 billion KWH[3]

* Excludes sand, gravel, and waterway material (2010 estimated and 2009 preliminary)
2010 – 4.62 million tons sand, gravel, and waterway material
Total Tonnage including sand, gravel, and waterway material
5.04 million tons (2010)
5.22 million tons (2009)
6.97 million tons (44-year long-term average through 2010)

The main stem reservoirs also provide supplemental water for irrigation and municipal uses and improves water quality in the river system.

[1]Average for 44 years 1967-2010 with the peak shipments in 1977 (3.336 million tons)
[2]Total damages prevented (1937-2010)
[3]Average Annual 1968-2010
[4]End of navigation season shortened 0 days in 2009 and extended 10 days in 2010

A detailed description of the main stem system operations during 2010 is presented in annual operating reports prepared by and available for distribution from the U.S. Missouri River Basin Water Management Division, U.S. Army Corps of Engineers, Northwestern Division, Omaha, Nebraska.

ENERGY GENERATION

There are 14 Federal powerplants located in the Upper Missouri River Basin that are currently operating. Eight of the powerplants are operated and maintained by Reclamation and have a total capacity of 348,100 kilowatts. The other six have a total capacity of 2,501,200 kilowatts and are operated and maintained by the Corps. The Corps' powerplants are located on the main stem of the Missouri River. Generation from the 14 powerplants is marketed by the Department of Energy.

Total generation in the combined system in WY 2010 was 8852.974 million kilowatt hours, 1097.636 million kilowatt hours more than in WY 2009. A summary of the past 10 years of energy generation within the Upper Missouri River Basin is shown below.

USBR and COE Energy Generation Million KiloWatt Hours			
Year	USBR	COE	TOTAL
2010	1430.618	7422.356	8852.974
2009	1481.641	6273.697	7755.338
2008	1182.399	4775.900	5958.299
2007	794.348	5061.000	5855.348
2006	1088.603	6199.964	7288.567
2005	953.992	5553.800	6507.792
2004	688.367	7046.084	7734.451
2003	757.118	7783.378	8540.496
2002	708.594	7271.994	7980.588
2001	905.528	6521.944	7427.472

A comparison of 2009 and 2010 generation and other data from Missouri Basin Region powerplants is shown on Table CET2. Tables CET3, 4, and 5 shows the monthly generation, power releases, and total downstream releases, respectively, for all Federal plants in the Missouri Basin Region. The annual energy generation for each of the last several years for all Reclamation, Corps, and combined plants is shown graphically on Figures CEG1, 3, and 5, respectively, monthly generation for each month during the past several years is shown graphically on Figures CEG2, 4, and 6.

For a more detailed account of powerplants operation at Reclamation facilities during the year, refer to the 2010 operation summaries. Information on the Corps' powerplants operations can be obtained from the annual operating reports prepared by and available for distribution from the Reservoir Control Center, U.S. Army Corps of Engineers, Omaha, Nebraska.

TABLE CET2

ANNUAL ENERGY PRODUCTION DATA
WATER YEAR 2010

BUREAU PLANTS	INSTALLED CAPACITY (KW)	MILLION KILOWATT-HOURS GENERATED		WATER USED FOR GENERATION IN 2010			RIVER RELEASE	TOTAL RELEASE
		2009	2010	1,000 AF	PERCENT OF TOTAL RELEASE	KW-HOURS PER AF	1,000 AF	1,000 AF
Canyon Ferry	50,000	385.930	358.614	2,861.936	75.50	125.30	3,704.534	3,790.562
Pilot Butte[1]	1,600	0.000	0.000	0.000	0.00	N/A	171.868	171.868
Boysen	15,000	67.408	74.982	852.982	70.29	87.91	1,213.547	1,213.547
Buffalo Bill Reservoir Units								
Shoshone	3,000	22.595	22.845	121.208	14.33	188.48	See below for	total.
Buffalo Bill	18,000	84.268	66.719	309.310	36.56	215.70	See below for	total.
Heart Mountain	6,000	18.710	18.925	65.973	7.80	286.86	See below for	total.
Spirit Mountain [2]	4,500	16.689	15.933	155.533	18.38	102.44	See below for	total.
Total for Buffalo Bill Reservoir[3]	31,500	142.262	124.422	652.024	77.07	190.82	616.399	846.031
Yellowtail	250,000	886.041	872.600	2,381.391	89.06	366.42	2,635.195	2,673.806
Subtotal	**348,100**	**1,481.641**	**1,430.618**	**6,748.333**	**77.60**	**212.00**	**8,341.543**	**8,695.814**
CORPS PLANTS								
Fort Peck	185,250	592.102	554.545	3,623.00	100.00	153.06	3,623.000	3,623.000
Garrison	583,300	1,422.468	1,724.396	11,108.00	100.00	155.24	11,108.000	11,108.000
Oahe	786,030	1,769.198	2,074.785	13,444.00	98.87	154.33	13,598.000	13,598.000
Big Bend	494,320	667.800	749.939	13,396.00	100.00	55.98	13,396.000	13,396.000
Fort Randall	320,000	1,205.027	1,604.248	15,324.00	97.31	104.69	15,747.000	15,747.000
Gavins Point	132,300	617.102	714.443	16,879.00	93.68	42.33	18,017.000	18,017.000
Subtotal	**2,501,200**	**6,273.697**	**7,422.356**	**73,774.00**	**97.73**	**100.61**	**75,489.000**	**75,489.000**
TOTAL MISSOURI BASIN	**2,849,300**	**7,755.338**	**8,852.974**	**80,522.33**	**95.65**	**109.94**	**83,830.543**	**84,184.814**

[1] River Release and Total Release at Pilot Butte Reservoir is computed inflow to Pilot Butte Reservoir due to the location of the powerplant at inlet of supply canal.

[2] Spirit Mountain Powerplant is used to dissipate energy in the transition from the pressurized portion of the Shoshone Canyon Conduit to the free flow section of the conduit. Water used for generation at Spirit Mountain Powerplant is then routed to Heart Mountain Canal or used for generation at Heart Mountain Powerplant.

[3] This represents the total for the four separate powerplants at Buffalo Bill Dam.

TABLE CET3

MONTHLY ENERGY GENERATION (MILLION KILOWATT-HOURS)
WATER YEAR 2010

	BUREAU OF RECLAMATION PLANTS								
				BUFFALO BILL PLANTS					
MONTH	CANYON FERRY	PILOT BUTTE	BOYSEN	HEART MOUNTAIN	SPIRIT MOUNTAIN	BUFFALO BILL	SHOSHONE	YELLOWTAIL	TOTAL
October	26.637	0.000	4.185	1.261	0.679	8.348	2.095	68.130	**111.335**
November	28.293	0.000	5.035	0.000	0.000	3.212	2.020	56.291	**94.851**
December	37.707	0.000	5.185	0.000	0.000	2.118	2.093	56.586	**103.689**
January	31.743	0.000	5.118	0.000	0.000	2.165	2.089	54.857	**95.972**
February	26.576	0.000	4.365	0.000	0.000	3.063	0.706	44.719	**79.429**
March	27.155	0.000	4.126	0.000	0.000	2.251	2.063	34.334	**69.929**
April	25.765	0.000	4.077	0.490	0.311	4.575	2.012	32.718	**69.948**
May	24.314	0.000	10.491	3.570	2.476	7.625	1.941	114.926	**165.343**
June	37.178	0.000	11.019	3.401	2.853	9.906	1.925	156.310	**222.592**
July	36.710	0.000	9.929	3.524	3.232	11.855	2.135	126.135	**193.520**
August	28.487	0.000	6.846	3.562	3.244	7.766	2.060	68.108	**120.073**
September	28.049	0.000	4.606	3.117	3.138	3.835	1.706	59.486	**103.937**
TOTAL	**358.614**	**0.000**	**74.982**	**18.925**	**15.933**	**66.719**	**22.845**	**872.600**	**1,430.618**

	CORPS OF ENGINEERS PLANTS							
MONTH	FORT PECK	GARRISON	OAHE	BIG BEND	FORT RANDALL	GAVINS POINT	TOTAL	MISSOURI BASIN TOTAL
October	38.432	119.165	155.478	57.115	161.541	75.962	**607.693**	**719.028**
November	37.074	117.170	60.700	24.267	88.980	51.580	**379.771**	**474.622**
December	38.383	143.314	162.656	61.005	80.887	43.361	**529.606**	**633.295**
January	42.408	165.251	163.314	59.577	84.375	43.405	**558.330**	**654.302**
February	34.536	138.720	116.992	47.446	65.955	37.988	**441.637**	**521.066**
March	39.201	115.802	63.037	46.909	45.661	41.247	**351.857**	**421.786**
April	43.029	89.537	94.322	32.316	84.316	40.788	**384.308**	**454.256**
May	58.796	135.308	185.767	61.134	155.447	67.008	**663.460**	**828.803**
June	45.284	137.686	185.382	58.599	128.448	70.302	**625.701**	**848.293**
July	52.714	143.163	243.758	71.857	220.363	83.964	**815.819**	**1,009.339**
August	63.784	161.168	308.113	100.072	255.810	80.996	**969.943**	**1,090.016**
September	60.904	258.112	335.266	129.642	232.465	77.842	**1,094.231**	**1,198.168**
TOTAL	**554.545**	**1,724.396**	**2,074.785**	**749.939**	**1,604.248**	**714.443**	**7,422.356**	**8,852.974**

TABLE CET4

WATER USED FOR POWER GENERATION (1,000 ACRE-FEET)
WATER YEAR 2010

MONTH	CANYON FERRY	BOYSEN	PILOT BUTTE	BUFFALO BILL RESERVOIR UNITS				YELLOWTAIL	FORT PECK	GARRISON	OAHE	BIG BEND	FORT RANDALL	GAVINS POINT
				SHOSHONE	BUFF. BILL	HEART MTN.	SPIRIT MTN.[1]							
October	212.937	45.924	0.000	11.120	34.168	5.097	6.639	177.740	259.000	772.000	1,027.000	998.000	1,598.000	1,762.000
November	223.922	53.637	0.000	10.722	15.803	0.000	0.000	163.074	252.000	760.000	405.000	403.000	935.000	1,164.000
December	300.898	55.370	0.000	11.110	10.725	0.000	0.000	167.167	265.000	931.000	1,077.000	1,070.000	881.000	972.000
January	257.535	55.022	0.000	11.084	10.370	0.000	0.000	166.340	291.000	1,088.000	1,096.000	1,034.000	870.000	978.000
February	217.477	47.402	0.000	3.746	11.879	0.000	0.000	135.557	240.000	910.000	777.000	808.000	644.000	834.000
March	225.057	47.050	0.000	10.950	10.652	0.000	0.000	118.738	268.000	772.000	417.000	808.000	420.000	922.000
April	214.921	45.442	0.000	10.680	21.035	1.929	3.165	115.006	282.000	601.000	605.000	613.000	743.000	912.000
May	195.031	128.087	0.000	10.303	39.231	12.769	25.109	296.761	368.000	892.000	1,172.000	1,104.000	1,402.000	1,550.000
June	283.885	127.402	0.000	10.218	40.426	12.212	27.954	387.529	292.000	883.000	1,175.000	1,155.000	1,119.000	1,649.000
July	281.454	110.551	0.000	11.320	48.091	12.376	31.234	313.496	348.000	899.000	1,540.000	1,423.000	1,952.000	2,081.000
August	226.349	80.644	0.000	10.915	42.662	11.683	31.297	180.893	394.000	1,001.000	1,975.000	1,818.000	2,414.000	2,063.000
September	222.470	56.451	0.000	9.040	24.268	9.907	30.135	159.090	364.000	1,599.000	2,178.000	2,162.000	2,346.000	1,992.000
TOTAL	**2,861.936**	**852.982**	**0.000**	**121.208**	**309.310**	**65.973**	**155.533**	**2,381.391**	**3,623.000**	**11,108.000**	**13,444.000**	**13,396.000**	**15,324.000**	**16,879.000**

[1] Spirit Mountain Powerplant is used to dissipate energy in the transition from the pressurized portion of the Shoshone Canyon Conduit to the free flow section of the conduit. Water used for generation at Spirit Mountain Powerplant is then routed to Heart Mountain Canal or used for generation at Heart Mountain Powerplant.

TABLE CET5

TOTAL RELEASE (1,000 ACRE-FEET)
WATER YEAR 2010

MONTH	CANYON FERRY	BOYSEN	PILOT BUTTE	BUFFALO BILL	BULL LAKE	ANCHOR	YELLOWTAIL	FORT PECK	GARRISON	OAHE	BIG BEND	FORT RANDALL	GAVINS POINT
October	213.189	55.654	4.059	56.052	5.615	0.606	177.740	259.000	772.000	1,027.000	998.000	1,598.000	1,762.000
November	237.269	53.637	0.000	26.723	1.821	0.226	163.074	252.000	760.000	405.000	403.000	935.000	1,164.000
December	300.898	55.556	0.000	22.046	1.912	0.117	167.167	265.000	931.000	1,077.000	1,070.000	881.000	972.000
January	257.535	55.681	0.000	21.772	1.909	0.031	166.340	291.000	1,088.000	1,096.000	1,034.000	870.000	978.000
February	217.477	47.402	0.000	19.567	1.722	0.091	135.557	240.000	910.000	777.000	808.000	644.000	834.000
March	225.057	49.873	0.000	21.822	1.906	0.116	118.738	268.000	772.000	417.000	808.000	420.000	922.000
April	233.640	45.752	4.357	47.354	1.448	0.690	115.006	282.000	601.000	605.000	613.000	743.000	912.000
May	226.587	193.369	13.070	100.023	1.950	0.879	328.769	368.000	892.000	1,172.000	1,104.000	1,402.000	1,550.000
June	822.505	360.918	31.616	171.200	46.663	6.095	595.012	292.000	883.000	1,175.000	1,155.000	1,119.000	1,649.000
July	553.437	158.610	45.563	172.963	35.143	4.557	366.420	348.000	899.000	1,540.000	1,423.000	1,952.000	2,152.000
August	267.380	80.644	41.587	113.736	59.586	2.450	180.893	394.000	1,001.000	1,975.000	1,818.000	2,515.000	2,469.000
September	235.588	56.451	33.275	72.773	48.469	0.299	159.090	364.000	1,599.000	2,332.000	2,162.000	2,668.000	2,653.000
TOTAL	**3,790.562**	**1,213.547**	**173.527**	**846.031**	**208.144**	**16.157**	**2,673.806**	**3,623.000**	**11,108.000**	**13,598.000**	**13,396.000**	**15,747.000**	**18,017.000**

TABLE CET6

TOTAL RESERVOIR STORAGE CONTENTS (1,000 ACRE-FEET)
WATER YEARS 2009 AND 2010

BUREAU RESERVOIRS	TOP OF CONSERVATION CAPACITY [3]	DEAD AND INACTIVE CAPACITY	TOTAL STORAGE SEPTEMBER 30		END OF SEPTEMBER PERCENT OF AVERAGE	
			2009	2010	2009	2010
Clark Canyon	174.4	1.1	139.7	142.9	149	115
Canyon Ferry	1,891.9	396.0	1,679.6	1,766.5	104	103
Helena Valley	10.5	4.6	6.9	8.5	95	114
Gibson	96.5	0.0	5.6	16.2	23	58
Willow Creek	31.8	1.0	25.2	23.1	124	132
Pishkun	46.7	16.0	23.9	20.3	75	62
Lake Elwell	925.6	554.3	841.6	842.4	109	108
Sherburne	66.1	1.9	13.7	30.9	86	368
Fresno	92.9	0.4	41.1	76.3	91	191
Nelson	79.0	18.1	71.2	77.5	138	137
Bull Lake	152.5	0.7	79.8	65.8	105	87
Pilot Butte	33.7	3.8	19.1	17.4	106	91
Boysen	741.6	219.2	659.6	639.2	110	97
Anchor[1]	17.2	0.1	0.3	0.3	100	104
Buffalo Bill[2]	646.6	41.7	486.0	485.5	111	110
Bighorn Lake	1,070.0	493.6	1,060.8	960.9	111	94
E. A. Patterson	8.6	0.5	1.8	7.8	28	128
Lake Tschida	67.1	5.2	59.8	62.8	105	111
Jamestown Reservoir	31.5	0.8	29.2	29.3	101	102
Shadehill Reservoir	120.2	43.9	104.2	105.9	99	101
Angostura Reservoir	123.0	42.2	74.4	97.9	86	115
Deerfield Reservoir	15.7	0.2	14.8	14.7	111	110
Pactola Reservoir	56.0	1.0	54.7	53.9	118	117
Keyhole Reservoir	188.7	6.6	100.7	109.3	112	123
Belle Fourche Reservoir	172.9	3.1	117.9	142.9	171	200
Subtotal	**6,860.6**	**1,856.0**	**5,711.6**	**5,798.4**		
CORPS RESERVOIRS						
Fort Peck	17,578.0	4,073.0	10,435.0	15,184.0		
Garrison	22,332.0	4,980.0	14,705.0	21,706.0		
Oahe	22,035.0	5,373.0	14,731.0	19,862.0		
Big Bend	1,738.0	1,621.0	1,655.0	1,626.0		
Fort Randall	4,433.0	1,517.0	2,604.0	3,306.0		
Gavins Point	393.0	307.0	394.0	397.0		
Subtotal	**68,509.0**	**17,871.0**	**44,524.0**	**62,081.0**		
TOTAL UPPER MISSOURI BASIN	**75,369.6**	**19,727.0**	**50,235.6**	**67,879.4**		

[1] Percent of average content of Anchor Reservoir is based on an 19-year average, 1991-2009.
[2] Percent of average content of Buffalo Bill Reservoir is based on an 17-year average, 1993-2009; to reflect the operation of the reservoir since 1992 when the dam was raised and the capacity of the reservoir was increased to 646,565 acre-feet.
[3] Includes joint-use space.

TABLE CET7
WATER YEAR 2010
End-of-Month Reservoir Contents
(1,000 Acre-Feet)

RECLAMATION RESERVOIRS	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
CLARK CANYON RESERVOIR	146.6	152.5	154.0	156.5	161.4	168.6	177.5	171.1	189.1	170.7	149.6	142.9
% of Average	117	115	113	112	114	114	112	103	113	113	117	115
CANYON FERRY RESERVOIR	1,717.2	1,733.7	1,616.9	1,587.2	1,580.3	1,570.9	1,596.0	1,687.0	1,966.5	1,862.6	1,774.3	1,766.5
% of Average	99	99	97	101	104	108	109	103	104	102	103	103
HELENA VALLEY RESERVOIR	6.7	6.5	6.4	6.2	6.0	5.8	10.6	10.3	10.1	7.9	9.7	8.5
% of Average	97	97	99	102	105	103	115	113	113	107	119	114
GIBSON RESERVOIR	13.8	10.5	14.5	22.5	22.8	27.8	52.7	85.4	94.7	42.1	5.5	16.2
% of Average	46	30	38	54	51	58	99	100	107	72	17	58
WILLOW CREEK	25.2	25.2	25.3	25.6	25.8	27.0	29.6	29.8	31.1	26.7	23.1	23.1
% of Average	133	129	127	126	125	124	119	108	104	114	125	132
PISHKUN RESERVOIR	23.3	37.8	37.4	37.0	36.6	36.2	35.8	47.1	47.0	40.6	39.5	20.3
% of Average	69	110	109	108	108	106	88	103	111	109	112	62
LAKE ELWELL (TIBER DAM)	815.7	796.0	768.9	746.5	726.8	720.2	719.9	765.3	867.7	872.7	853.0	842.4
% of Average	109	109	109	109	109	107	103	96	94	96	101	108
SHERBURNE LAKE	18.2	24.7	27.1	29.0	30.0	27.7	15.0	29.9	65.6	60.4	35.5	30.9
% of Average	193	181	155	143	133	123	79	102	125	126	150	368
FRESNO RESERVOIR	42.2	41.7	39.4	38.1	35.7	49.8	87.9	103.7	100.5	89.5	87.4	76.3
% of Average	108	108	105	107	100	95	125	158	162	202	234	191
NELSON RESERVOIR	69.6	67.2	64.8	62.9	61.2	67.6	76.4	76.3	77.1	75.0	75.6	77.5
% of Average	118	115	114	114	114	124	127	126	129	137	140	137
BULL LAKE	80.3	81.5	81.5	81.2	81.0	81.2	84.4	97.0	138.2	147.0	107.9	65.8
% of Average	108	108	108	107	107	107	111	108	109	114	105	87
PILOT BUTTE RESERVOIR	29.4	29.2	29.1	29.0	29.0	29.0	30.9	31.0	30.5	23.6	21.6	17.4
% of Average	103	103	103	103	104	104	99	100	95	76	106	91
BOYSEN RESERVOIR	663.5	658.9	634.0	609.1	590.7	594.8	615.9	578.6	720.5	697.0	658.3	639.2
% of Average	107	105	103	101	99	101	102	94	94	98	96	97
ANCHOR RESERVOIR	0.3	0.4	0.3	0.3	0.3	0.3	0.3	2.3	7.0	2.6	0.4	0.3
% of Average[1]	92	117	86	66	61	45	32	70	111	63	34	104
BUFFALO BILL RESERVOIR	460.5	456.8	448.3	440.8	432.3	425.9	413.5	387.3	603.1	608.6	537.6	485.5
% of Average[2]	110	109	107	105	104	104	106	87	106	107	107	110
BIGHORN LAKE	1,063.8	1,042.1	986.8	955.2	940.5	959.4	965.8	978.3	1,144.6	1,058.9	1,000.4	960.9
% of Average	106	107	107	110	112	115	118	112	111	102	99	94
E. A. PATTERSON LAKE	1.1	1.1	1.2	1.2	1.5	9.4	8.8	9.0	8.9	8.3	7.7	7.8
% of Average	18	19	19	20	23	122	112	117	119	119	118	128
LAKE TSCHIDA	58.4	58.3	59.2	60.1	60.7	77.6	66.3	70.3	67.5	65.7	62.8	62.8
% of Average	102	101	103	104	102	115	101	108	103	106	108	111
JAMESTOWN RESERVOIR	29.0	27.9	27.9	27.9	27.7	67.7	108.9	67.9	41.9	30.0	29.5	29.3
% of Average	108	105	105	104	102	193	201	154	114	88	90	102
SHADEHILL RESERVOIR	101.6	99.0	96.6	94.5	92.3	108.5	121.8	125.5	120.7	120.0	110.5	105.9
% of Average	99	97	96	95	91	94	105	108	105	106	101	101
ANGOSTURA RESERVOIR	76.3	78.6	80.4	82.0	84.4	92.5	100.3	121.4	120.8	113.7	104.0	97.9
% of Average	87	88	89	88	87	89	94	111	111	115	117	115
DEERFIELD RESERVOIR	14.8	14.7	14.5	14.4	14.3	14.5	15.3	15.7	15.5	15.3	14.9	14.7
% of Average	111	109	106	103	101	101	107	108	108	108	109	110
PACTOLA RESERVOIR	55.0	55.2	55.0	54.8	54.4	54.7	55.9	58.1	55.7	55.3	54.6	53.9
% of Average	118	118	118	118	117	115	115	117	111	114	117	117
KEYHOLE RESERVOIR	100.8	100.5	101.0	101.3	111.6	105.2	107.0	112.7	116.1	114.5	111.6	109.3
% of Average	112	112	113	112	109	106	107	110	114	119	123	123
BELLE FOURCHE RESERVOIR	146.6	152.5	154.0	156.5	161.4	168.6	177.5	171.1	189.1	170.7	149.6	142.9
% of Average	183	170	155	144	137	128	124	112	129	149	182	200
CORPS RESERVOIRS	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**
FORT PECK RESERVOIR	12,144.0	12,221.0	12,266.0	12,392.0	12,513.0	12,838.0	12,973.0	13,456.0	14,647.0	15,172.0	15,140.0	15,184.0
GARRISON RESERVOIR	19,366.0	19,352.0	18,850.0	18,428.0	18,093.0	18,367.0	18,550.0	19,215.0	21,506.0	22,629.0	22,414.0	21,706.0
OAHE RESERVOIR	18,632.0	19,003.0	18,807.0	18,843.0	18,990.0	20,942.0	21,703.0	22,091.0	22,241.0	21,673.0	20,646.0	19,862.0
BIG BEND RESERVOIR	1,666.0	1,631.0	1,628.0	1,680.0	1,664.0	1,662.0	1,655.0	1,659.0	1,638.0	1,641.0	1,639.0	1,626.0
FORT RANDALL RESERVOIR	2,932.0	2,284.0	2,415.0	2,789.0	3,046.0	4,062.0	4,147.0	4,039.0	4,587.0	4,248.0	3,675.0	3,306.0
LEWIS AND CLARK LAKE	396.0	373.0	310.0	378.0	339.0	346.0	345.0	361.0	334.0	344.0	349.0	397.0

[1] Percent of average content of Anchor Reservoir is based on a 19-year average, 1991-2009; this is due to the availability of data for Anchor Reservoir.

[2] Percent of average content of Buffalo Bill Reservoir is based on an 17-year average, 1993-2009; to reflect the operation of the reservoir since 1992 when the dam was raised and the capacity of the reservoir was increased to 646,565 acre-feet.

TABLE CET8
WATER YEAR 2010
Monthly Inflow Amounts
(1,000 Acre-Feet)

RECLAMATION RESERVOIRS	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
CLARK CANYON RESERVOIR	24.0	18.0	14.0	13.9	11.7	13.6	17.0	10.9	41.2	25.3	21.3	19.7	230.5
% of Average	103	81	73	87	80	73	78	40	115	92	110	98	87
CANYON FERRY RESERVOIR	250.8	253.7	184.1	227.9	210.6	215.7	258.8	317.6	1,102.0	449.6	179.0	227.8	3,877.4
% of Average	88	85	76	103	95	80	74	55	143	133	105	107	98
HELENA VALLEY RESERVOIR	0.0	-0.2	-0.2	-0.1	-0.2	-0.2	7.2	10.8	10.0	12.1	16.8	7.7	63.8
% of Average [3]	N/A	N/A	N/A	N/A	N/A	N/A	133	94	71	80	103	93	75
GIBSON RESERVOIR	13.0	16.0	7.5	11.4	7.1	10.1	31.8	80.2	122.7	43.3	21.0	14.3	378.4
% of Average	69	93	48	83	58	70	79	47	62	63	80	75	61
WILLOW CREEK	0.5	0.0	0.1	0.3	0.2	1.2	2.6	0.2	1.3	-0.4	0.2	0.1	6.3
% of Average [3]	65	5	16	73	56	131	128	5	34	N/A	N/A	12	44
PISHKUN RESERVOIR	-0.6	14.5	-0.4	-0.4	-0.4	-0.4	-0.4	34.3	55.4	81.8	53.8	1.0	238.1
% of Average [3]	N/A	2061	N/A	N/A	N/A	N/A	N/A	94	95	117	129	8	104
LAKE ELWELL (TIBER DAM)	10.8	15.6	8.5	13.2	12.6	24.9	26.4	70.1	132.6	38.6	14.5	20.6	388.3
% of Average	48	70	46	82	58	50	42	42	69	62	75	129	58
SHERBURNE LAKE	4.5	6.5	2.4	1.9	1.1	1.6	10.1	19.5	44.6	18.6	9.5	12.7	132.9
% of Average	73	116	64	68	44	52	112	60	107	88	100	198	92
FRESNO RESERVOIR	4.5	1.9	0.3	1.2	-0.1	16.7	40.8	89.0	99.7	35.4	40.7	16.2	346.3
% of Average	60	92	30	241	N/A	55	103	203	218	100	124	62	129
NELSON RESERVOIR	-1.6	-2.4	-2.4	-1.9	-1.7	6.4	8.8	9.7	10.5	8.2	11.5	10.6	55.8
% of Average [3]	N/A	N/A	N/A	N/A	N/A	409	118	144	135	164	160	171	136
BULL LAKE	6.1	3.1	1.9	1.6	1.5	2.2	4.6	14.5	87.9	43.9	20.5	6.4	194.2
% of Average	112	100	78	72	94	119	124	50	144	94	99	68	104
PILOT BUTTE RESERVOIR[1]	14.4	-0.2	-0.1	-0.1	0.0	0.0	6.3	13.2	31.1	38.7	39.6	29.1	171.9
% of Average	135	N/A	N/A	N/A	N/A	N/A	84	55	83	93	123	124	95
BOYSEN RESERVOIR	59.6	49.0	30.7	30.7	29.1	53.9	66.9	156.1	502.8	135.1	42.0	37.3	1,193.2
% of Average	101	100	81	84	77	104	139	127	201	102	73	71	128
ANCHOR RESERVOIR	0.6	0.3	0.0	0.1	0.1	0.1	0.8	2.9	10.7	0.2	0.2	0.2	16.2
% of Average[2]	103	102	N/A	77	77	26	118	71	162	11	90	43	103
BUFFALO BILL RESERVOIR	30.5	23.1	13.5	14.3	11.1	15.4	34.9	73.8	387.1	178.4	42.4	20.7	845.2
% of Average	121	109	86	98	84	82	84	46	130	112	95	79	101
BIGHORN LAKE	180.7	141.4	111.8	134.8	120.8	137.7	121.4	340.9	761.3	280.8	122.3	119.6	2,573.5
% of Average	99	92	81	101	89	81	74	138	184	97	76	70	109
E. A. PATTERSON LAKE	0.7	0.2	0.0	0.0	0.3	9.5	5.5	3.0	2.2	0.0	-0.6	0.2	21.3
% of Average	198	93	32	18	19	151	173	292	126	3	-113	161	129
LAKE TSCHIDA	2.1	1.3	1.4	1.3	1.1	22.0	32.1	10.4	6.6	2.4	0.2	1.6	82.8
% of Average	150	88	151	164	23	77	203	205	89	67	16	757	115
JAMESTOWN RESERVOIR	6.4	3.2	1.3	0.8	0.4	51.9	109.9	16.9	13.3	10.8	2.0	7.0	223.8
% of Average	452	263	227	302	107	566	337	195	329	208	40	378	318
SHADEHILL RESERVOIR	1.8	0.9	0.6	0.8	0.4	19.1	19.9	20.9	10.1	10.6	2.1	1.8	89.3
% of Average	191	82	69	90	10	77	111	175	179	269	287	N/A	122
ANGOSTURA RESERVOIR	1.9	2.2	1.8	1.6	2.4	8.1	7.8	44.4	35.9	4.1	0.7	0.1	111.1
% of Average	81	71	93	70	44	71	94	374	248	134	40	10	166
DEERFIELD RESERVOIR	0.7	0.6	0.5	0.5	0.4	0.7	1.5	2.9	2.7	1.7	0.9	0.7	13.7
% of Average	91	83	68	69	68	71	117	199	199	173	113	95	124
PACTOLA RESERVOIR	2.5	2.2	1.8	1.9	1.6	2.6	4.3	14.2	13.1	6.6	3.8	2.4	56.8
% of Average	115	118	120	120	103	92	96	217	205	183	134	112	152
KEYHOLE RESERVOIR	0.1	-0.3	0.5	0.3	0.3	3.6	1.8	5.7	3.4	-1.6	-2.9	-2.3	8.6
% of Average	N/A	N/A	310	59	10	58	87	150	240	N/A	N/A	N/A	68
BELLE FOURCHE RESERVOIR	12.9	8.3	0.1	0.0	0.5	12.4	16.0	4.0	4.8	7.2	9.5	-2.0	73.7
% of Average	115	84	1	N/A	5	87	138	24	45	164	442	N/A	65

[1] Negative values are the result of calculated inflow based on reservoir release and change in reservoir content.

[2] Percent of average inflow for Anchor Reservoir is based on a 19-year average, 1991-2009, this is due to the availability of data for Anchor Reservoir.

[3] For 2010 percent of average used 1967-2010 for HVR, 1947-2010 for NELR, 1952-2010 for WCR, 1947-2010 for PSHR.

FIGURE CEG1

ANNUAL GENERATION AT USBR PLANTS

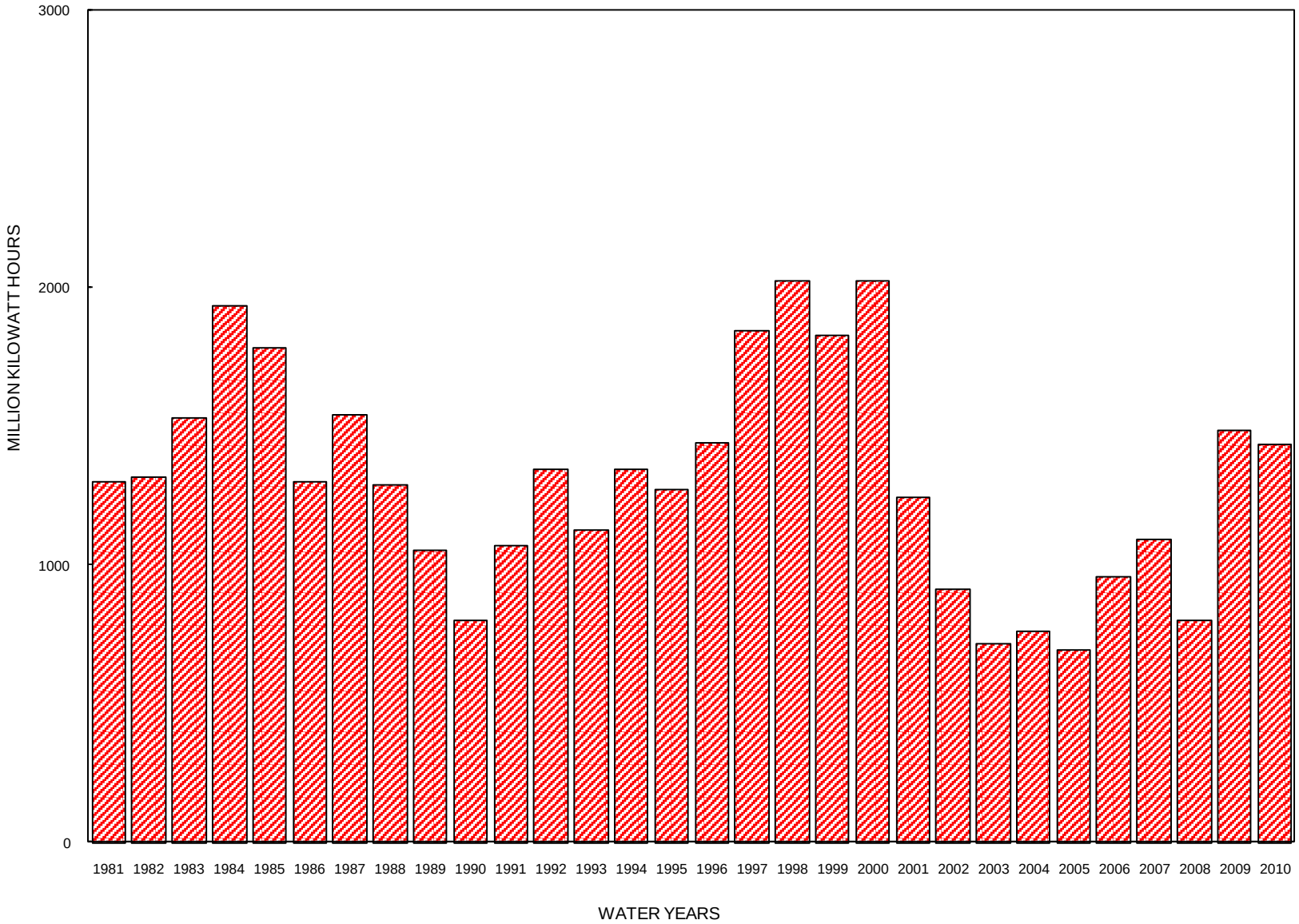


FIGURE CEG2

MONTHLY GENERATION AT USBR PLANTS

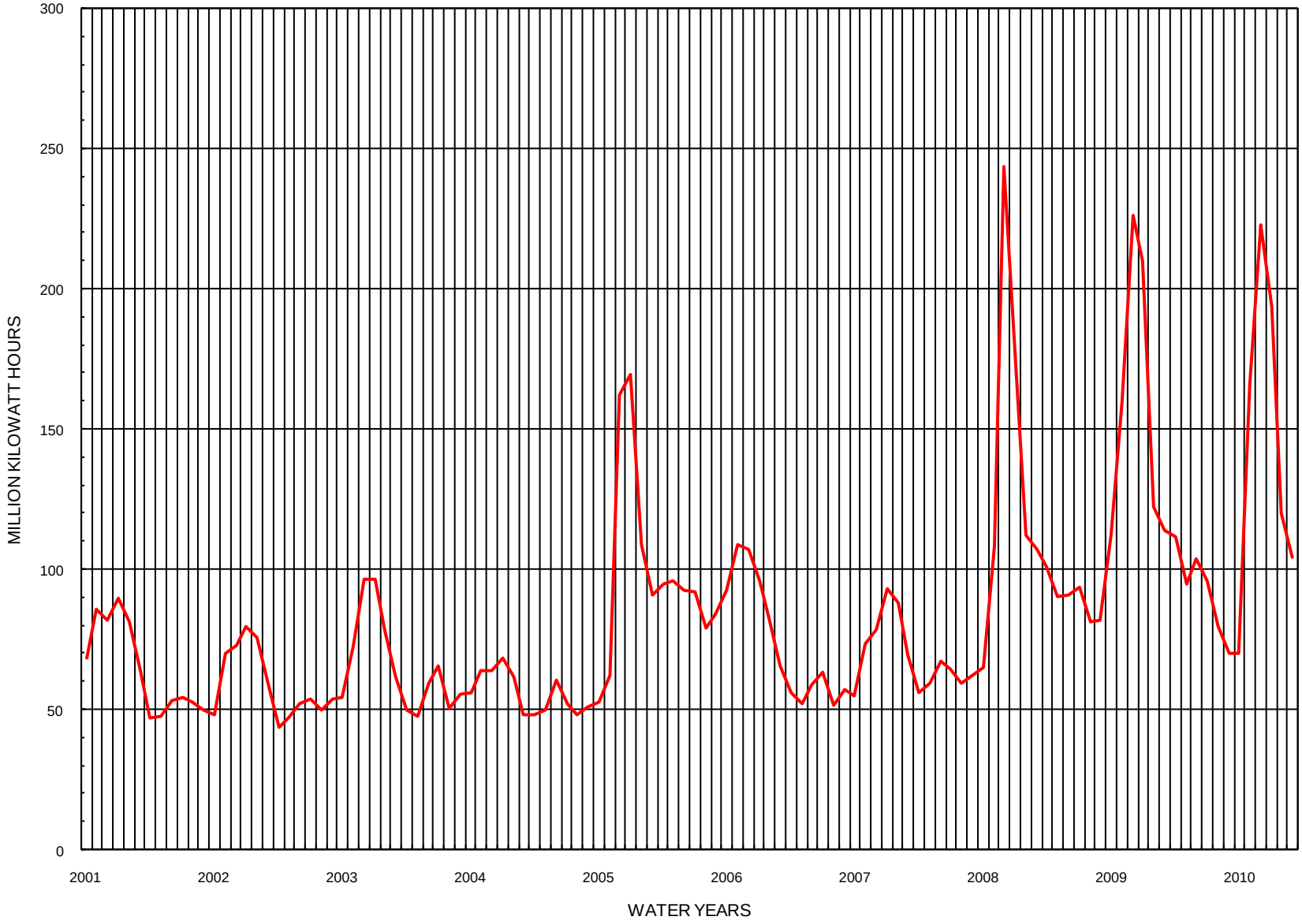


FIGURE CEG3

ANNUAL GENERATION AT COE PLANTS

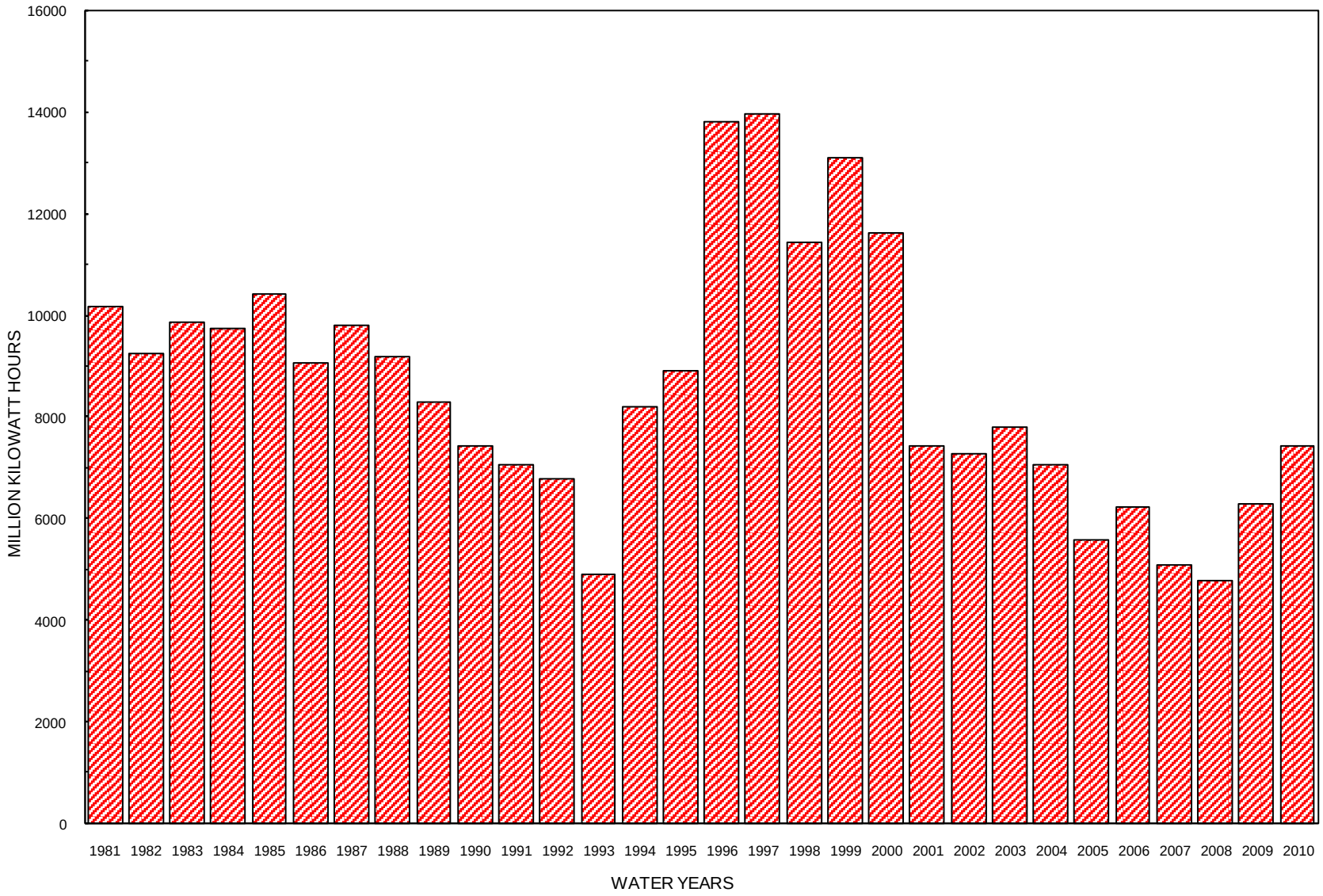


FIGURE CEG4

MONTHLY GENERATION AT COE PLANTS

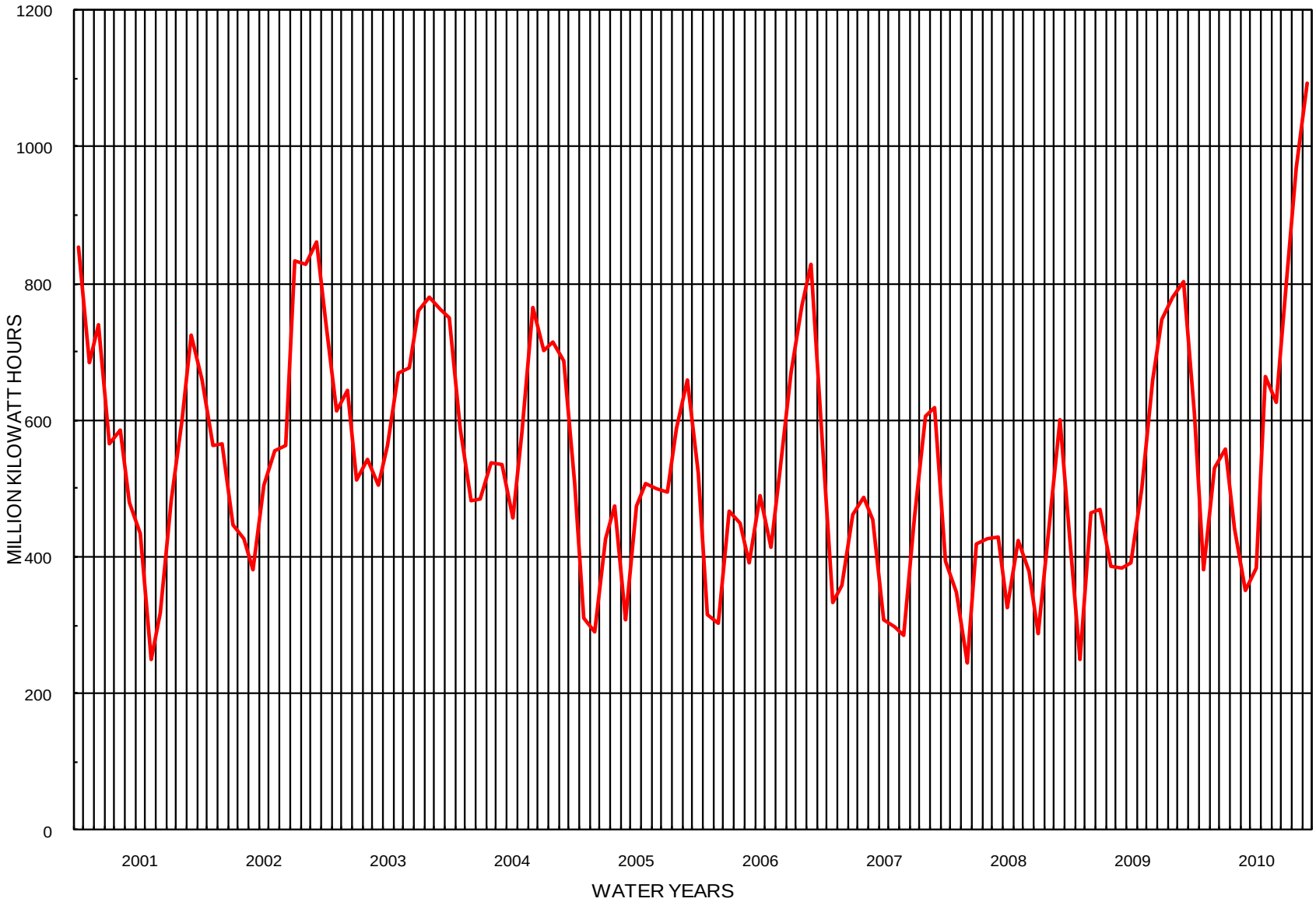


FIGURE CEG5

ANNUAL GENERATION - USBR & COE PLANTS

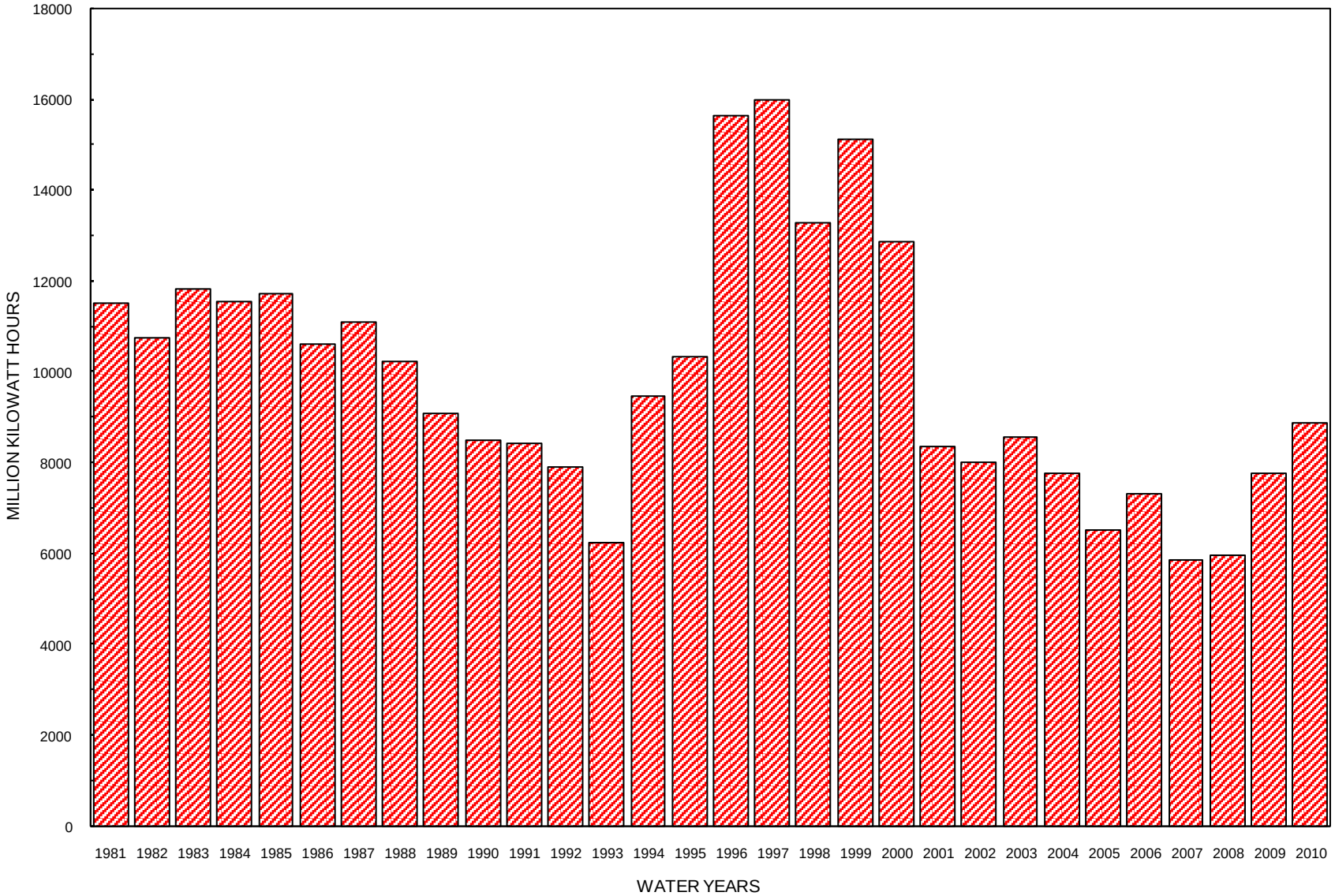
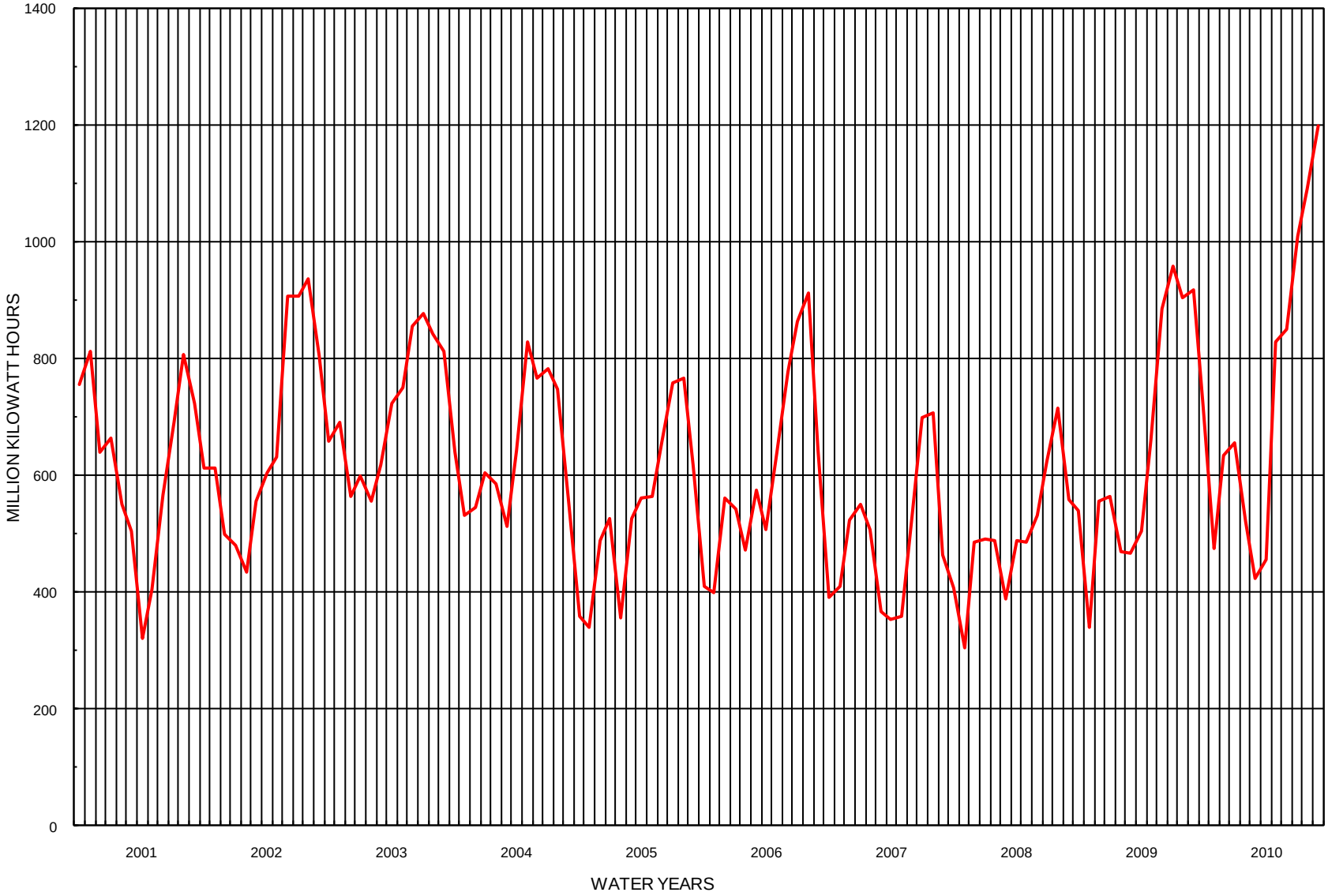


FIGURE CEG6

MONTHLY GENERATION - USBR & COE PLANTS