BUREAU OF RECLAMATION

Annual Operating Plans

Upper Missouri River Basin

Summary of Actual Operations
Water Year 2019

Lake Sherburne, Glacier National Park

Montana, Wyoming, and Dakotas Area Offices
Missouri Basin Region

U.S. Department of the Interior

13 March 2020

Mission Statements

The Department of the Interior (DOI) conserves and manages the Nation's natural resources and cultural heritage for the benefit and enjoyment of the American people, provides scientific and other information about natural resources and natural hazards to address societal challenges and create opportunities for the American people, and honors the Nation's trust responsibilities or special commitments to American Indians, Alaska Natives, and affiliated island communities to help them prosper.

The mission of the Bureau of Reclamation is to manage, develop, and protect water and related resources in an environmentally and economically sound manner in the interest of the American public.

Contents

Annual Operating Plans for Water Year (WY) 2019 for Bighorn Basin Units Under Responsibility of the Wyoming Area Office (WYAO)

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 irrigation water to approximately 73,000 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

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 upstream of 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 flood control benefit is provided by normal operation for other purposes. However, when the Bull Lake Spillway is not operational the peak releases are limited to that of the outlet works (approximately 2,400 cubic feet per second). The status of the spillway requires adaptation of normal flood control operations as it is necessary to increase outflow as the inflows increase.

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. The agreement was approved for 2019 and the non-irrigation season releases were maintained above the required minimum flow rate of 20 cubic feet per second (cfs). As outlined in the agreement, a steady 20 cfs of the reservoir releases were accounted for as Boysen water being released from Bull Lake.

Bull Lake Reservoir carried 81,665 AF of storage into Water Year 2019, which is 54 percent of the reservoir's active storage capacity. The reservoir operations during the dam's spillway construction required Reclamation to have Bull Lake Reservoir down to elevation 5,783.00 feet on or before September 30, 2018 and maintain that elevation until April 1, 2019. Table WYT1 below shows the monthly inflows, outflows, storage, and forebay elevation at Bull Lake Reservoir. Snow-water equivalent (SWE) values, as represented by SNOw TELemetry (SNOTEL) sites within/near the basin above Bull Lake, are also shown. For each monthly inflow, outflow, storage, and SWE value the corresponding percentage of average (30 years of historical data) are also shown.

	Inflow		Outflow		Storage		Elevation	Snow	
Month	KAF	% of Avg	KAF	% of Avg	KAF	% of Avg	ft	in	% of Avg
Oct-18	4.3	(67%)	1.9	(27%)	84.1	(109%)	5781.07	0.0	(0%)
Nov-18	1.8	(53%)	1.9	(76%)	84.0	(108%)	5781.03	0.8	(68%)
Dec-18	1.0	(40%)	1.9	(95%)	83.0	(106%)	5780.65	2.6	(92%)
Jan-19	0.9	(41%)	1.9	(95%)	82.0	(104%)	5780.25	3.6	(78%)
Feb-19	1.2	(71%)	1.7	(100%)	81.4	(103%)	5780.03	5.1	(83%)
Mar-19	1.5	(75%)	1.9	(106%)	81.0	(103%)	5779.87	7.9	(100%)
Apr-19	6.9	(160%)	2.0	(56%)	84.8	(107%)	5781.35	9.7	(99%)
May-19	20.7	(71%)	5.2	(34%)	100.2	(107%)	5787.22	12.1	(130%)
Jun-19	78.0	(121%)	67.1	(230%)	111.1	(86%)	5791.17	10.4	(321%)
Jul-19	55.0	(120%)	16.0	(38%)	150.1	(113%)	5804.26	0.0	(0%)
Aug-19	19.1	(97%)	45.3	(95%)	123.9	(119%)	5795.63	0.0	(0%)
Sep-19	11.9	(120%)	49.8	(134%)	86.1	(112%)	5781.85	0.0	(0%)
WY2019	202.3	(106%)	196.6	(102%)					

Table WYT 1: Monthly inflow, outflow, storage, forebay elevation, and snow data for Bull Lake Reservoir. Percentages in parentheses is a comparison of each value to 30 years of historical data. Inflow and outflow values are summed for the entire month, storage and elevation values are from the end of the month, and snow values are from the beginning of the month.

Using hydrological data (snowpack, streamflows, etc) forecasts of the April through July inflow volume are made each month between January and June. Table WYT2 shows the forecast amounts that were made in WY 2019. For each forecast, Table WYT2 shows the percent of average of the forecast compared to 30 years of historical inflow data.

Month Forecast Issued	April-July Inflow Forecast, KAF	% of Avg
Jan-19	110	(76%)
Feb-19	110	(76%)
Mar-19	135	(94%)
Apr-19	130	(90%)
May-19	140	(97%)
Jun-19	165	(115%)

Table WYT 2: Forecasts of the April-July inflow volumes made into Bull Lake Reservoir each month starting in January and ending in June. Percentages in parentheses is a comparison of each forecast value to 30 years of historical inflow data.

Midvale began diverting water into the Wyoming Canal on April 12th to flush the canal system and finish filling Pilot Butte and other storage locations within the district. Diversions into the Wyoming Canal continued through October 11th. The peak diversion of 792 cfs occurred on September 12th.

There was a dam safety issue in mid-June that caused abnormal reservoir operations for several weeks after that time. During construction at Bull Lake dam, material was observed coming out of one of the drains at the bottom of the spillway from gate leakage. Due to this observation, the district was instructed to evacuate water from the reservoir until the water surface elevation was below the crest of the spillway to stop the leakage from occurring. After that time, the gates were sealed per the directions of the Technical Service Center (TSC) Dam Safety office. At the end of June, the reservoir began filling again and normal operations resumed in July.

Additional hydrologic and statistical information pertaining to Bull Lake operations during WY 19 can be found in Table WYT4 and Figure 1.

Pilot Butte Reservoir

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

Pilot Butte Reservoir began WY 2019 with a total storage content of approximately 16,537 AF, which is a pool elevation of 5,437.9 feet above sea level. Irrigation deliveries for the Wyoming Canal and Pilot Canal ended the WY 2018 irrigation season on October 16th, 2018. During October of Water Year 2018, the annual Bull Lake exchange agreement took place. The agreement allows Midvale irrigation district to divert and store an additional 10,000 AF of water from Bull Lake to Pilot Butte Reservoir via the Wyoming Canal. The agreement simultaneously transfers an equal amount of Boysen storage into Bull Lake Reservoir. The purpose of the agreement is to maintain a flow of no less than 20 cfs in Bull Lake Creek during the winter months. Bull Lake Creek is a prized fishery and the agreement insures its production. With the 10,000 AF of exchange water, and additional storage operations, Pilot Butte Reservoir ended the month of October with a storage content of 28,309 AF, which is 104 percent of average.

Table WYT3 below shows the monthly inflows, outflows, storage, and forebay elevation at Pilot Butte Reservoir. For each monthly inflow, outflow, and storage value the corresponding percentage of average (30 years of historical data) are also shown.

	Inflow		Outflow		Storage		Elevation
Month	KAF	% of Avg	KAF	% of Avg	KAF	% of Avg	Ft
Oct-18	11.9	(88%)	0	(0%)	28.3	(104%)	5453.76
Nov-18	0	(0%)	0	N/A	28	(100%)	5453.42
Dec-18	0	N/A	0	N/A	27.9	(100%)	5453.29
Jan-19	0	(0%)	0	N/A	27.9	(99%)	5453.22
Feb-19	0	(0%)	0	N/A	27.8	(98%)	5453.14
Mar-19	0	(0%)	0	N/A	27.8	(97%)	5453.11
Apr-19	2.5	(43%)	1.2	(24%)	30	(101%)	5455.80
May-19	1.1	(5%)	9.4	(38%)	29.9	(114%)	5455.64
Jun-19	1.6	(5%)	26.9	(84%)	29	(99%)	5454.58
Jul-19	10.1	(27%)	40.8	(95%)	26.5	(110%)	5451.56
Aug-19	25.8	(81%)	38.3	(109%)	13.9	(71%)	5433.71
Sep-19	33.2	(146%)	31.1	(122%)	16.1	(99%)	5437.20
WY 2019	86.2	(51%)	147.7	(88%)			

Table WYT 3: Monthly inflow, outflow, storage, forebay elevation, and snow data for Pilot Butte Reservoir. Percentages in parentheses is a comparison of each value to 30 years of historical data. Inflow and outflow values are summed for the entire month, and storage and elevation values are from the end of the month.

Additional hydrologic and statistical information pertaining to Pilot Butte Reservoir during Water Year 2019 can be found in Table WYT5 and Figure 2.

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	5780.14	81,716	Oct 1, 2018
END OF YEAR	5781.85	86,068	SEP 30, 2019
ANNUAL LOW	5779.83	80,936	Apr 9, 2019
HISTORIC LOW*	5743.03	6,228	Sep 2, 1950
ANNUAL HIGH	5804.27	150,162	Jul 27, 2019
HISTORIC HIGH	5805.70	154,677	Aug 10, 1965

INFLOW-OUTFLOW DATA	INFLOW	DATE	OUTFLOW	DATE
ANNUAL TOTAL (AF)	202,232	Oct 18-Sep 19	196,707	Oct 18-Sep 19
DAILY PEAK (cfs)	3,172.17	Jun 8, 2019	2,791.89	Jun 18, 2019
DAILY MINIMUM (cfs)	0.00	Feb 25, 2019	31	Apr 9, 2019
PEAK SPILLWAY FLOW (cfs)			0	
TOTAL SPILLWAY FLOW (AF)			0	

Table WYT 4: Hydrologic data for Water Year 2019 for Bull Lake Reservoir. *Prior to 1952 daily records are not available. End of month data was used to determine the historic low.

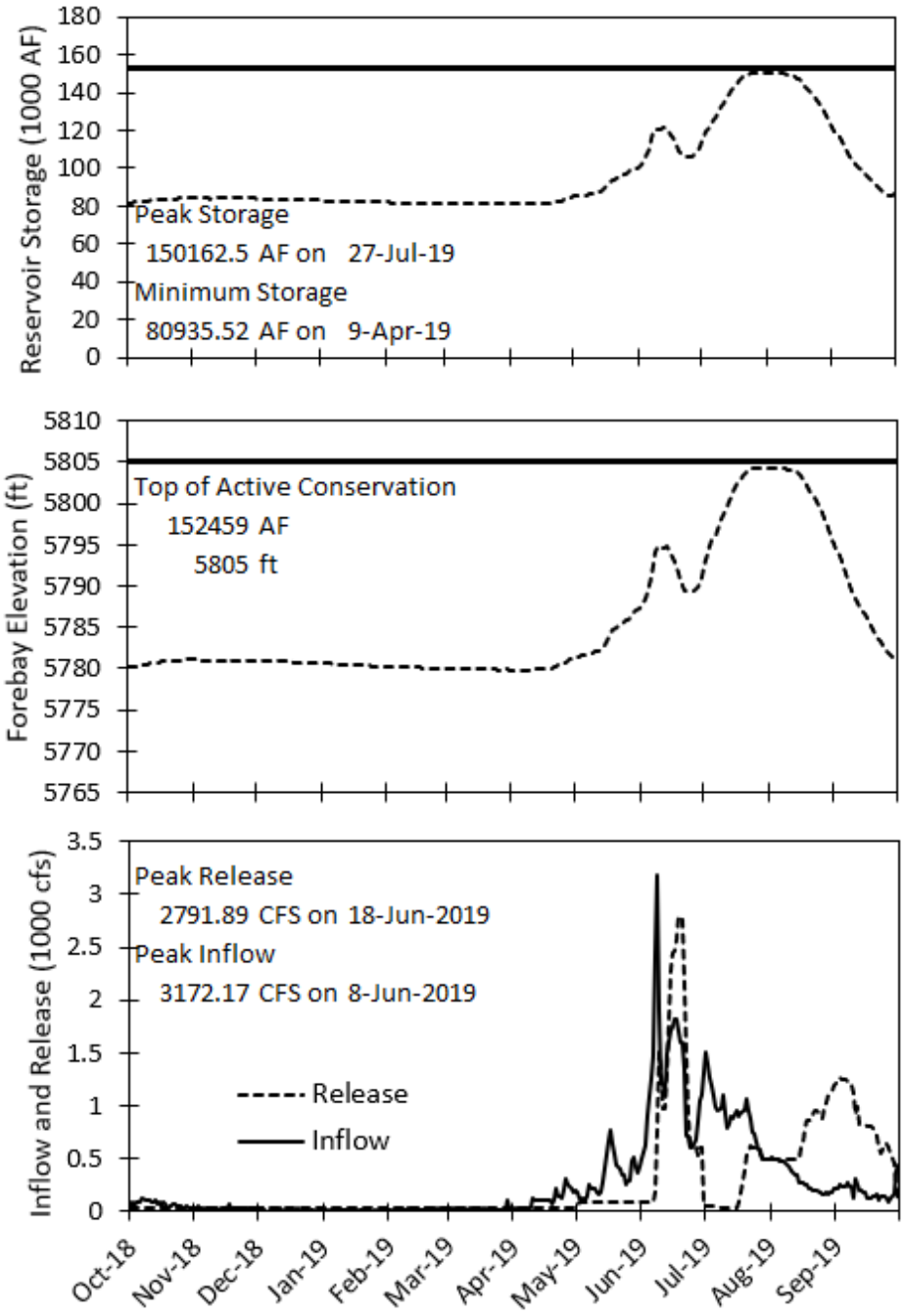

Figure 1: Water Year 2019 storage, forebay elevation, inflow, and release at Bull Lake Reservoir.

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	5438.16	16,706	Oct 1, 2018
END OF YEAR	5437.20	16,088	Sep 30, 2019
ANNUAL LOW	5433.03	13,528	Sep 6, 2019
HISTORIC LOW	5409.80	3,748	Dec 01, 2007
ANNUAL HIGH	5456.06	30,255	Apr 24, 2019
HISTORIC HIGH	5460.60	37,465	Apr 20, 1988

INFLOW-OUTFLOW DATA	INFLOW	DATE	OUTFLOW	DATE
ANNUAL TOTAL (AF)	86,156	Oct 18-Sep 19	147,782	Oct 18-Sep 19
DAILY PEAK (cfs)	792.12	Sep 12, 2019	745.46	Jul 29, 2019
DAILY MINIMUM (cfs)	0	WINTER MONTHS	0	WINTER MONTHS
PEAK SPILLWAY FLOW (cfs)			0	
TOTAL SPILLWAY FLOW (AF)			0	

Table WYT 5: Hydrological data for Water Year 2019 Pilot Butte Reservoir.

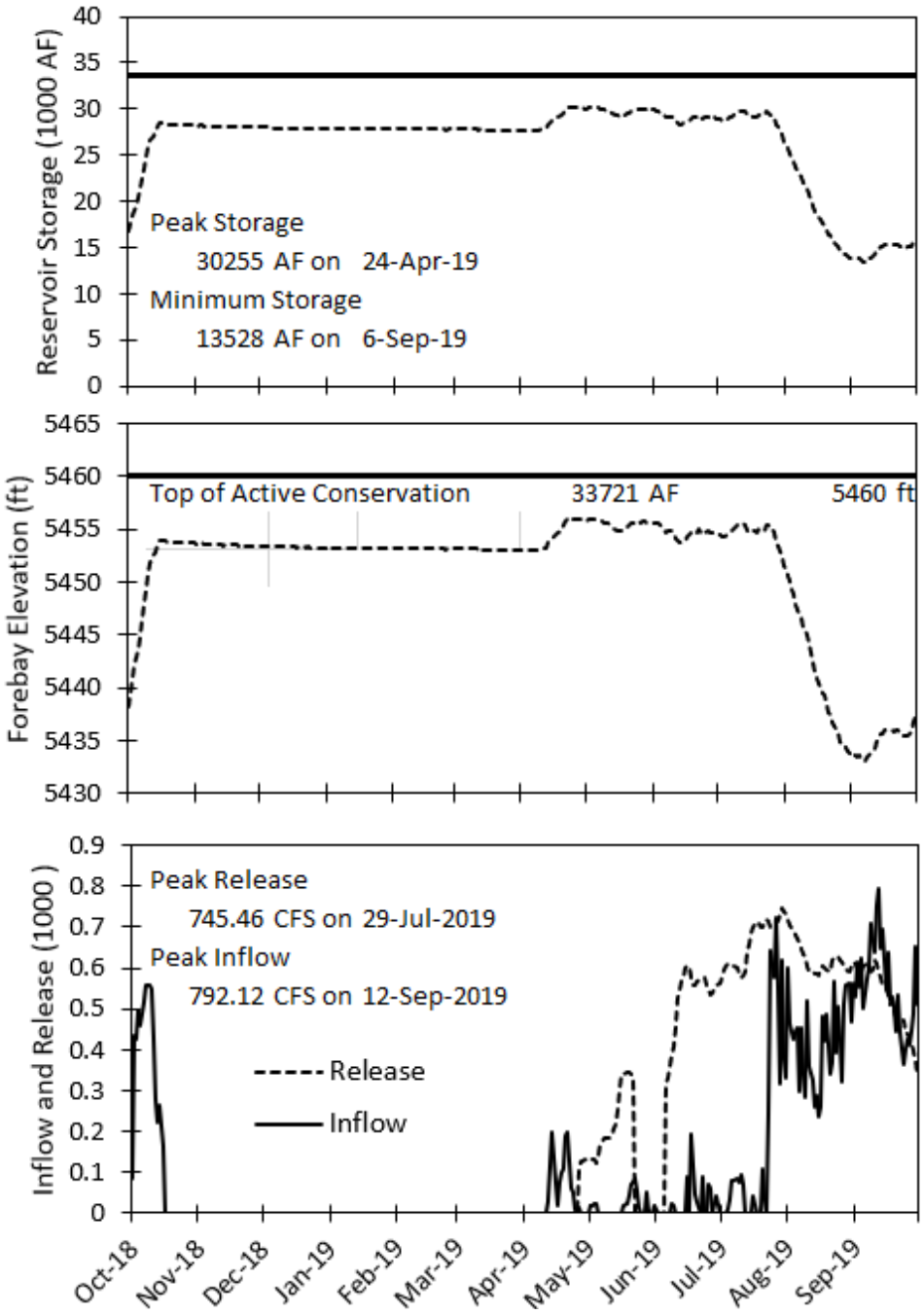

Figure 2: Water Year 2019 storage, forebay elevation, inflow, and release at Pilot Butte Reservoir.

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 are allocated for inactive and dead storage, 522,413 AF is for active conservation storage, and 150,632

AF is for exclusive flood control storage. Of the amount allocated for active conservation, 144,229 AF are specifically allocated for joint use flood control storage. All of the joint-use space is located between elevation 4,717.00 feet and elevation 4,725.00 feet, which is the top of the spillway gates when closed. The exclusive flood control space is located between elevation 4,725.00 feet and elevation 4,732.20 feet. When the reservoir rises above elevation 4,724.50 feet, the spillway gates are operated to maintain 6 inches (0.5 feet) of clearance above the reservoir level for prevention of over-topping the gates. When all flood control space is filled, releases cannot be controlled to less than 14,000 cfs due to the required gate clearance.

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 furnished to other irrigation districts and to a number of individual water users below the dam. The Bighorn Canal and Hanover Irrigation Districts, receive water under long-term contracts with Reclamation. Depending on availability, water is provided to Bluff Irrigation District, Kirby Ditch Irrigation District, Lower Hanover Canal Association, Bighorn Canal Irrigation District, and Hanover Irrigation District utilizing temporary water service contracts.

2019 Summary of Operations

Boysen Reservoir storage at the beginning of WY 2019 was 654,392 AF. Table WYT6 below shows the monthly inflows, outflows, storage, and forebay elevation at Boysen Reservoir. Snow-water equivalent (SWE) values, as represented by the SNOTEL's sites within/near the basin above Boysen Reservoir, are also shown. For each monthly inflow, outflow, storage, and SWE value the corresponding percentage of average (30 years of historical data) are also shown.

	Inflow		Outflow		Storage		Elevation	Snow	
Month	KAF	% of Avg	KAF	% of Avg	KAF	% of Avg	ft	in	% of Avg
Oct-18	50.0	(90%)	61.6	(116%)	641.3	(110%)	4719.60	0.0	(0%)
Nov-18	50.8	(103%)	59.2	(126%)	633.0	(108%)	4719.12	0.7	(50%)
Dec-18	42.4	(110%)	61.5	(126%)	613.7	(107%)	4717.99	3.1	(87%)
Jan-19	41.0	(109%)	61.9	(128%)	592.8	(105%)	4716.72	4.2	(71%)
Feb-19	37.4	(97%)	55.7	(129%)	574.5	(103%)	4715.57	5.9	(75%)
Mar-19	58.9	(112%)	61.8	(110%)	571.6	(103%)	4715.38	9.5	(94%)
Apr-19	65.1	(128%)	60.3	(86%)	576.4	(108%)	4715.69	11.0	(88%)
May-19	151.3	(107%)	122.6	(103%)	605.1	(109%)	4717.47	11.7	(94%)
Jun-19	442.9	(153%)	284.6	(149%)	763.4	(117%)	4726.10	9.1	(170%)
Jul-19	163.8	(121%)	208.1	(135%)	719.1	(113%)	4723.84	0.0	(0%)
Aug-19	58.3	(114%)	115.2	(129%)	662.3	(111%)	4720.78	0.0	(0%)
Sep-19	59.9	(126%)	74.5	(114%)	647.6	(112%)	4719.96	0.6	(461%)
WY 2019	1221.8	(124%)	1227.0	(124%)					

Table WYT 6: Monthly inflow, outflow, storage, forebay elevation, and snow data for Boysen Reservoir. Percentages in parentheses is a comparison of each value to 30 years of historical data. Inflow and outflow values are summed for the entire month, storage and elevation values are from the end of the month, and snow values are from the beginning of the month.

Using hydrological data (snowpack, streamflows, etc) forecasts of the April through July inflow volume are made each month between January and June. Table WYT7 shows the forecast amounts that were made in WY 2019. For each forecast, Table WYT7 shows the percent of average of the forecast compared to 30 years of historical inflow data.

Month Forecast Issued	April-July Inflow Forecast	
	KAF	% of Avg
Jan-19	400	(65%)
Feb-19	450	(73%)
Mar-19	500	(81%)
Apr-19	600	(97%)
May-19	575	(93%)
Jun-19	775	(126%)

Table WYT 7: Forecasts of the April-July inflow volumes into Boysen Reservoir made each month starting in January and ending in June. Percentages in parentheses is a comparison of each forecast value to 30 years of historical inflow data.

During WY 2019, the powerplants associated with Boysen Reservoir had a gross generation of approximately 70,300 megawatt hours (MWh).

Important Events (WY 2019)

October 5, 2018: Winter flow rate was set at 1,000 cfs.

May 1, 2019: Reservoir releases begin to be increased to evacuate storage for run-off.

June 16, 2019: Boysen Reservoir entered the designated flood control pool (Reservoir surface elevation greater than 4,725 ft).

June 21, 2019: Reservoir releases peak at 7,041.89 cfs.

June 22, 2019: Peak end of day forebay elevation observed with a pool elevation of 4,727.47 feet.

July 21, 2019: Boysen Reservoir exited the reservoirs designated flood control pool.

Additional hydrologic and statistical information pertaining to the operation of Boysen Reservoir can be found in Table WYT8 and Figure 3.

The operation of entering the flood pool was a coordinated effort with the Army Corps of Engineers (USACE). Due to extreme flooding on the mainstem Missouri system during the spring and summer of 2019, USACE – Omaha District instructed WYAO to store water in the flood pool at Boysen to alleviate the situation downstream. MTAO did the same with Big Horn 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	4720.34	654,392	Oct 1, 2018
END OF YEAR	4719.96	647,649	Sep 30, 2019
ANNUAL LOW	4715.02	565,994	Mar 19, 2019
HISTORIC LOW ELEVATION *	4684.18		Mar 18, 1956
HISTORIC LOW CONTENT *		235,737	Sep 24, 2002
ANNUAL HIGH	4727.47	791,143	Jun 22, 2019
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)	1,221,897	Oct 18-Sep 19	1,227,082	Oct 18-Sep 19
DAILY PEAK (cfs)	12,782.49	Jun 9, 2019	7,041.89	Jun 21, 2019
DAILY MINIMUM (cfs)	104.35	Oct 5, 2018	973.47	Apr 30, 2019
PEAK SPILLWAY FLOW (cfs)			6,096	Jun 23, 2019
TOTAL SPILLWAY FLOW (AF)			297,413	Oct 18-Sep 19

Table WYT 8: Hydrological data for Water Year 2019 at Boysen Reservoir.

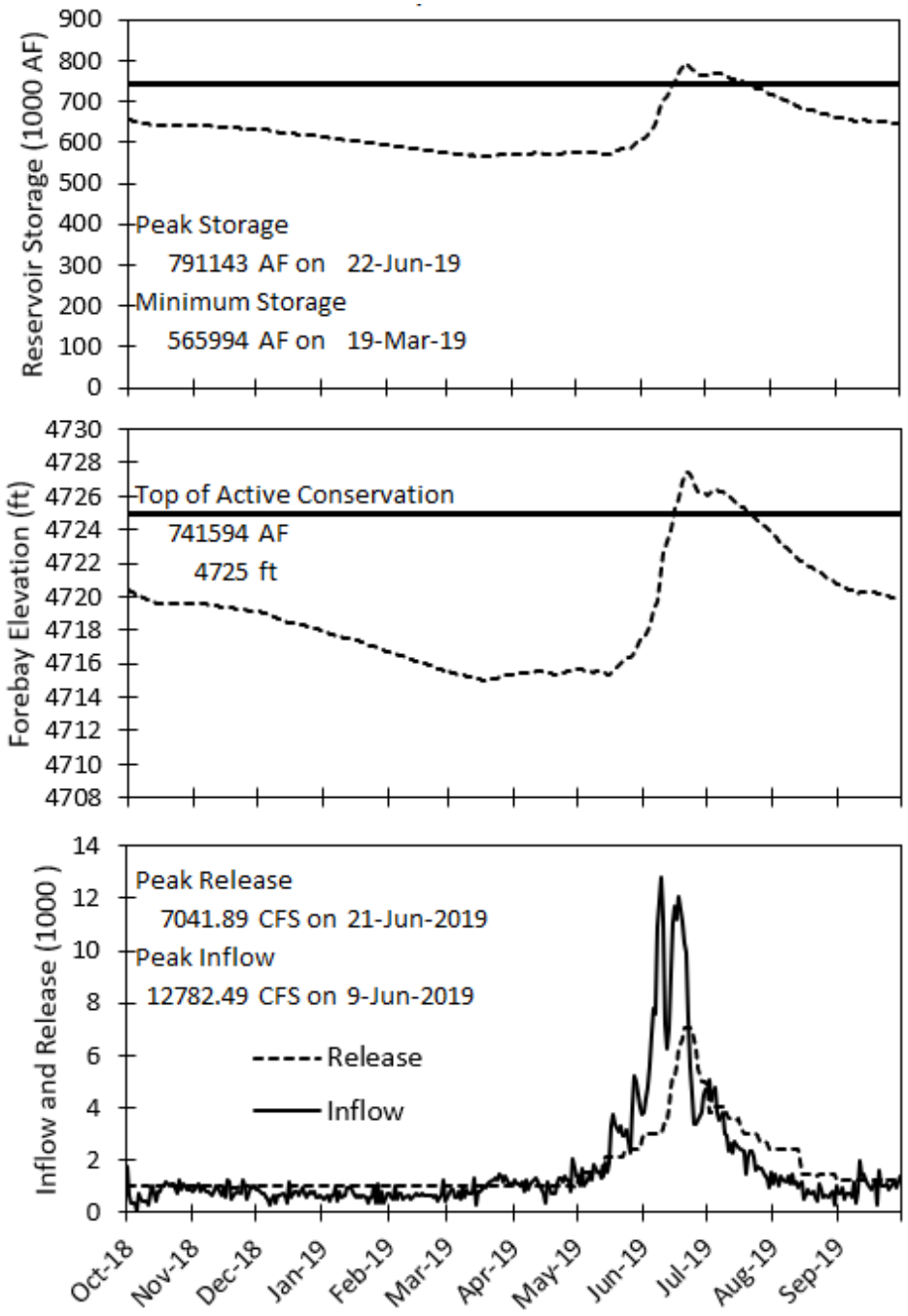

Figure 3: Water Year 2019 storage, forebay elevation, inflow, and release at Boysen Reservoir.

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. Construction of the dam provides 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 6,415.00 feet. However, when the reservoir rises above elevation 6,412.80 feet, water flows through a notch in one of the dikes into the sinkhole area. The reservoir is operated to not exceed an elevation of 6,412.80 feet. Operation and maintenance of Anchor Dam is performed by Owl Creek Irrigation District under contract with Reclamation. Reclamation requires notification from the irrigation district any time the reservoir level is expected to exceed elevation 6,400.00 feet. Operation above 6,400.00 feet will be directed by WYAO staff to avoid overtopping of the dikes.

The storage content of Anchor Reservoir at the beginning of WY 2019 was 506.19 AF. Storage in the reservoir peaked on July 12 at a storage content of 7,113 AF. From that point forward, the reservoir was operated to manage the reservoir level and deliver water supply to irrigators. Table WYT9 below shows the monthly inflows, outflows, storage, and forebay elevation at Anchor Reservoir. The negative inflows displayed in Table WYT9 are the result of the calculated inflow, which is subject to the wind influencing the pool elevation reading in addition to the normal seepage from the reservoir. For each monthly inflow, outflow, and storage value the corresponding percentage of average (30 years of historical data) are also shown.

	Inflow		Outflow		Storage		Elevation
Month	KAF	% of Avg	KAF	% of Avg	KAF	% of Avg	ft
Oct-18	0.3	(50%)	0.1	(20%)	0.6	(150%)	6365.20
Nov-18	-0.2	(0%)	0	(0%)	0.4	(133%)	6360.21
Dec-18	0	(0%)	0	(0%)	0.5	(167%)	6361.33
Jan-19	0	(0%)	0	(0%)	0.5	(167%)	6361.63
Feb-19	0	(0%)	0	(0%)	0.5	(167%)	6361.61
Mar-19	0	(0%)	0	(0%)	0.5	(125%)	6361.66
Apr-19	0.4	(67%)	0.1	(20%)	0.8	(133%)	6368.47
May-19	1.1	(28%)	0	(0%)	1.9	(100%)	6381.67
Jun-19	9.3	(129%)	4.8	(89%)	6.4	(173%)	6409.51
Jul-19	1.8	(86%)	3.4	(100%)	4.8	(200%)	6401.82
Aug-19	-0.8	(0%)	3.6	(171%)	0.4	(67%)	6360.59
Sep-19	0.5	(83%)	0.5	(63%)	0.5	(125%)	6361.28
WY 2019	12.4	(77%)	12.5	(79%)			

Table WYT 9: Monthly inflow, outflow, storage, forebay elevation for Anchor Reservoir. Percentages in parentheses is a comparison of each value to 30 years of historical data. Inflow and outflow values are summed for the entire month, and storage and elevation values are from the end of the month.

Additional hydrologic and statistical data pertaining to Anchor Reservoir operations during WY 2019 can be found in Table WYT10 and Figure 4.

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 6,400.00 feet or less to prevent damage to the dikes and to minimize the chance of creating new sinkholes. Operations above elevation 6,400.00 feet are directed by Reclamation.

STORAGE-ELEVATION DATA	ELEVATION (FEET)	STORAGE (AF)	DATE
BEGINNING OF YEAR	6362.33	506	Oct 1, 2018
END OF YEAR	6361.28	463	Sep 30, 2019
ANNUAL LOW	6359.46	395	Nov 28, 2018
HISTORIC LOW			
ANNUAL HIGH	6411.61	7,113	Jul 12, 2019
HISTORIC HIGH	6418.52	9,252	Jul 3, 1967

INFLOW-OUTFLOW DATA	INFLOW	DATE	OUTFLOW*	DATE
ANNUAL TOTAL (AF)	12,434	Oct 18-Sep 19	12,477	Oct 18-Sep 19
DAILY PEAK (cfs)	300	Jun 7, 2019	179	Jun 18, 2019
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 6,412.80 feet, water flows through a notch in one of the dikes into the sinkhole area. This water is neither measured nor accounted for.

Table WYT 10: Hydrological data for Water Year 2019 at Anchor Reservoir.

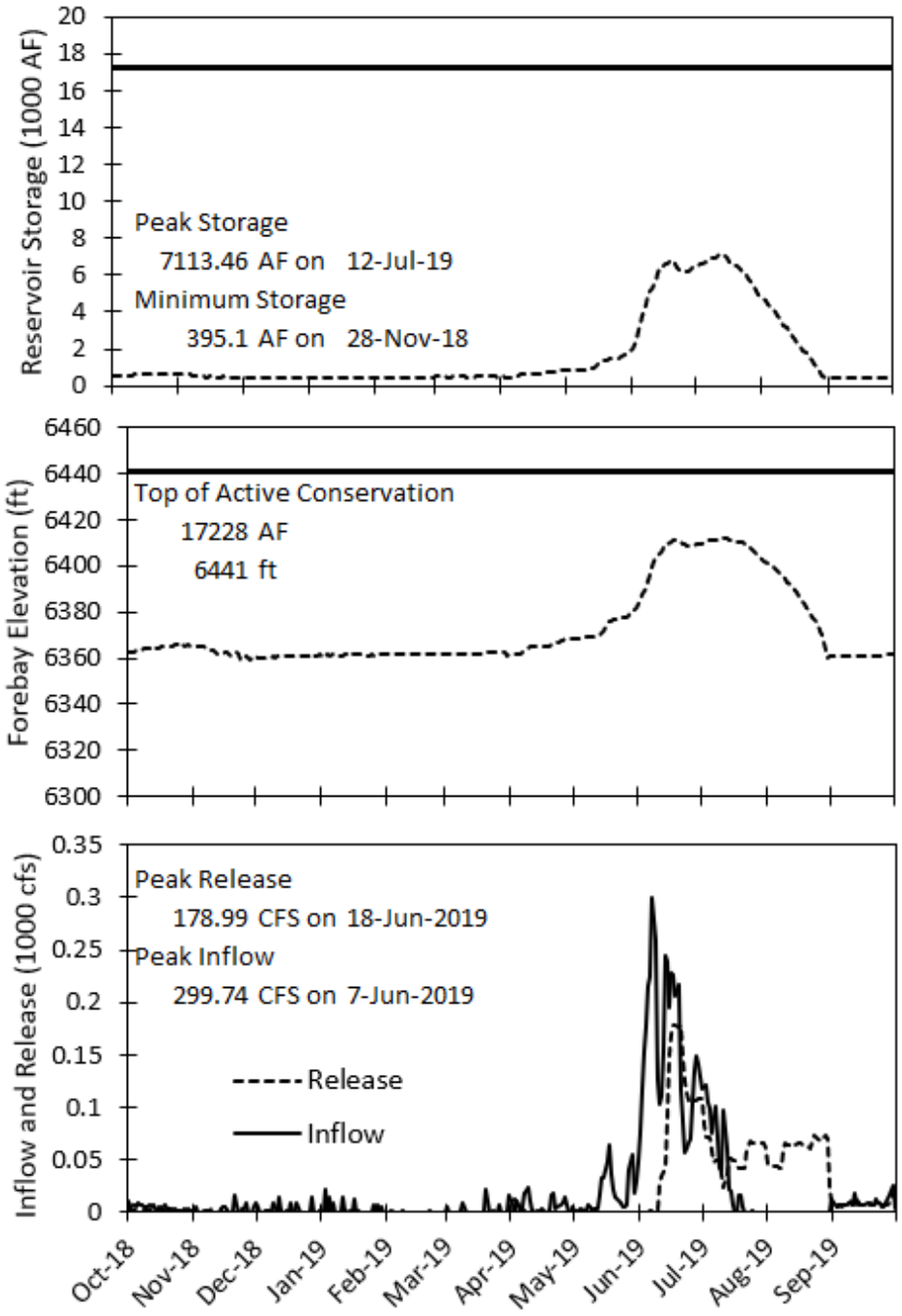

Figure 4: Water Year 2019 storage, forebay elevation, inflow, and release at Anchor Reservoir.

Shoshone Project and 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 (jet-flow 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.

Heart Mountain Powerplant

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 5,233.00 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.

Shoshone Powerplant

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.

Buffalo Bill Powerplant

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

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 dissipater 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

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 5,393.50 feet, the top of the active conservation pool.

Buffalo Bill storage carried over into WY 2019 amounted to 489,384 AF, which is 119 percent of the thirty-year average. Operations to evacuate storage and deliver irrigation supply were maintained through the end of October. Table WYT11 below shows the monthly inflows, outflows, storage, and forebay elevation at Buffalo Bill Reservoir. Snow-water equivalent (SWE) values, as represented by the SNOTEL's sites within the basin above Buffalo Bill Reservoir, are also shown. For each monthly inflow, outflow, storage, and SWE value the corresponding percentage of average (30 years of historical data) are also shown.

	Inflow		Outflow		Storage		Elevation	Snow	
Month	KAF	% of Avg	KAF	% of Avg	KAF	% of Avg	ft	in	% of Avg
Oct-18	30.8	(111%)	58.2	(140%)	462.0	(113%)	5369.14	0.0	(15%)
Nov-18	27.2	(116%)	32.1	(165%)	457.0	(111%)	5368.45	1.4	(82%)
Dec-18	19.1	(114%)	22.3	(123%)	453.8	(110%)	5368.01	5.4	(112%)
Jan-19	18.1	(116%)	21.9	(130%)	450.1	(110%)	5367.47	7.2	(90%)
Feb-19	13.2	(99%)	19.8	(117%)	443.4	(109%)	5366.52	9.5	(86%)
Mar-19	21.7	(100%)	34.1	(132%)	431.0	(107%)	5364.73	14.2	(103%)
Apr-19	56.2	(120%)	90.4	(133%)	396.8	(104%)	5359.51	15.5	(93%)
May-19	157.0	(84%)	152.2	(110%)	401.6	(94%)	5360.22	15.5	(90%)
Jun-19	417.7	(126%)	210.2	(107%)	609.0	(108%)	5388.81	13.8	(153%)
Jul-19	270.3	(153%)	269.8	(151%)	609.6	(108%)	5388.88	0.8	(115%)
Aug-19	52.0	(117%)	138.6	(122%)	523.0	(106%)	5377.53	0.0	(0%)
Sep-19	43.0	(166%)	78.9	(90%)	487.0	(113%)	5372.62	0.0	(0%)
WY 2019	1126.3	(121%)	1128.5	(122%)					

Table WYT 11: Monthly inflow, outflow, storage, forebay elevation, and snow data for Buffalo Bill Reservoir. Percentages in parentheses is a comparison of each value to 30 years of historical data. Inflow

and outflow values are summed for the entire month, storage and elevation values are from the end of the month, and snow values are from the beginning of the month.

Using hydrological data (snowpack, streamflows, etc) forecasts of the April through July inflow volume are made each month between January and June. Table WYT12 shows the forecast amounts that were made in WY 2019. For each forecast, Table WYT12 shows the percent of average of the forecast compared to 30 years of historical inflow data.

Month Forecast Issued	April-July Inflow Forecast KAF	% of Avg
Jan-19	650	(88%)
Feb-19	650	(88%)
Mar-19	775	(104%)
Apr-19	720	(97%)
May-19	770	(104%)
Jun-19	850	(114%)

Table WYT 12: Forecasts of the April-July inflow volumes made into Buffalo Bill Reservoir each month starting in January and ending in June. Percentages in parentheses is a comparison of each forecast value to 30 years of historical inflow data.

During Water Year 2019, the powerplants associated with Buffalo Bill Reservoir had a gross generation of approximately 148,900 MWh.

Important Events (WY 2019)

December 4, 2018: Releases to the Shoshone River reduced to the winter outflow rate of 360 cfs.

April 11, 2019: Irrigation diversions by the Shoshone Project were initiated for the 2019 irrigation season.

July 8, 2019: Buffalo Bill Reservoir reached a peak pool elevation for the water year of 5,391.75 ft.

October 17, 2019: End of 2019 irrigation diversions by the Shoshone Projects.

Additional hydrologic and statistical information pertaining to the operations of Buffalo Bill Reservoir during Water Year 2019 can be found in Table WYT13 and Figure 5.

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	5372.72	487,736	Oct 1, 2018
END OF YEAR	5372.62	487,014	Sep 30, 2019
ANNUAL LOW	5355.03	368,250	May 12, 2019
HISTORIC LOW*		19,080	Jan 31, 1941
ANNUAL HIGH	5391.75	632,563	Jul 8, 2019
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)	1,126,288	Oct 18-Sep 19	1,128,658	Oct 18-Sep 19
DAILY PEAK (cfs)	9,977.89	Jun 6, 2019	6,033	Jul 6, 2019
DAILY MINIMUM (cfs)	105*	Jan 27, 2019	343	Dec 19, 2018
PEAK SPILLWAY FLOW (cfs)			1600	Jul 10, 2019
TOTAL SPILLWAY FLOW (AF)			43,435	Oct 18-Sep 19

*High winds in the area can result in a false forebay reading.

Table WYT 13: Hydrological data for Water Year 2019 at Buffalo Bill Reservoir.

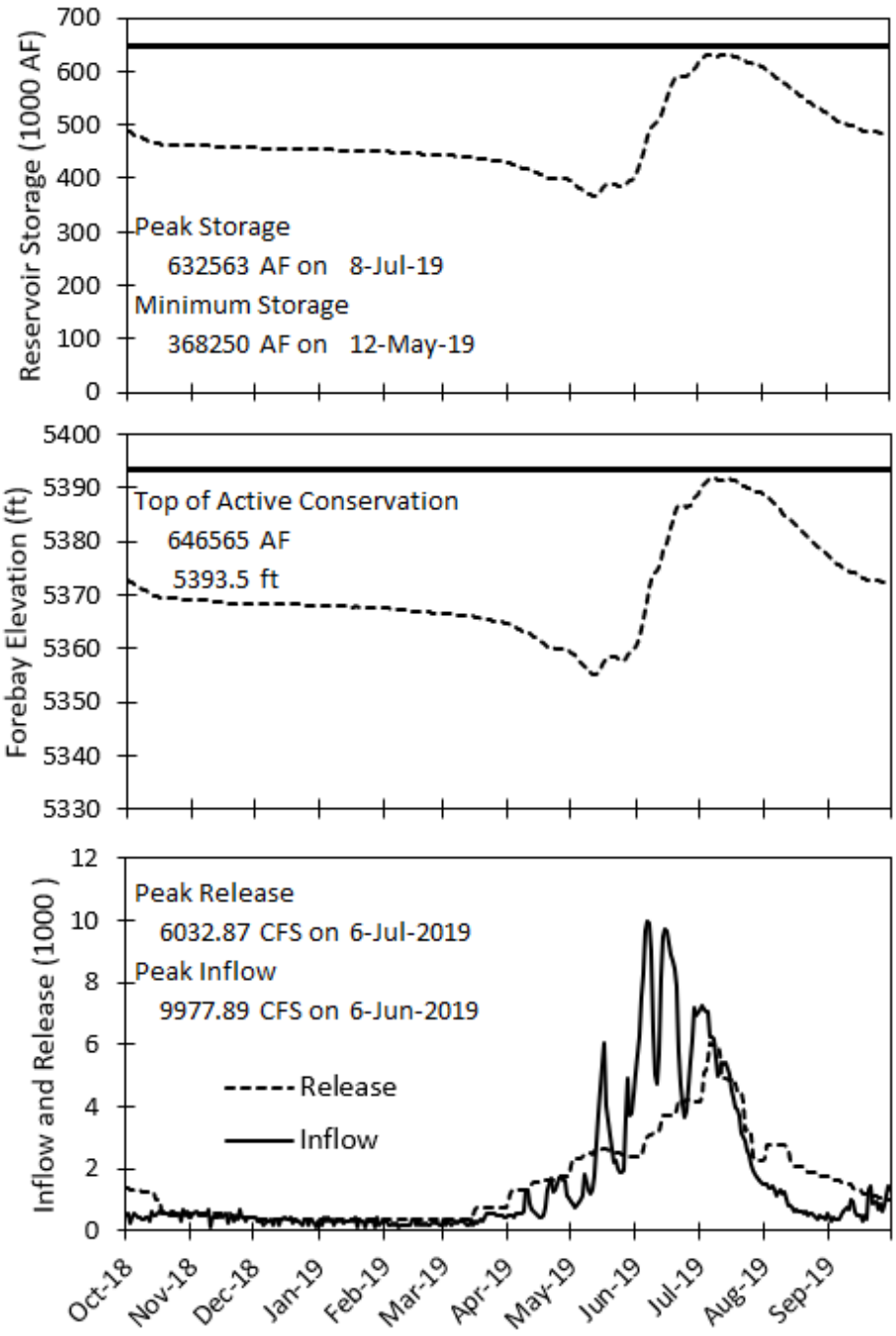

Figure 5: Water Year 2019 storage, forebay elevation, inflow, and release at Buffalo Bill Reservoir.

Summary of Reservoir Operations for the Benefit of Fish and Wildlife, Environment, and Recreation

Flushing flow from Boysen Reservoir are often performed in the Spring (when possible given other demands) to support the downstream fisheries. The Wyoming Game and Fish Department (WGF) did request a flushing flow but at the time the forecasts showed lower runoff volumes, and therefore no flushing flow was conducted.

Winter releases from Buffalo Bill Dam are set to support fisheries downstream as well as mitigate ice jams. Normally the non-irrigation season releases are determined by the criteria outlined in the Buffalo Bill Reservoir Enlargement Winter Release Operation Agreement. The criteria include: the previous year's annual inflow, end of year reservoir content, and State of Wyoming account ownership. Based on those conditions, a winter release of 100 cfs, 150 cfs, 200 cfs, or 350 cfs will be provided below Buffalo Bill Powerplant. The agreement serves to ensure a minimum release of 100 cfs is always maintained below the dam. Reclamation continues to support the WGF Reservoir Research Branch in its efforts to assess fish population and species distribution in the enlarged reservoir using 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.

As Buffalo Bill 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. The top of the North Fork Dike is approximately 5,370 Feet. When the reservoir pool elevation drops below 5,370 ft, the North Fork Dike helps to minimize the amount of lakebed exposure. The number of stop logs at the outlet control structure on the South Fork Dike are used to maintain a nearly static water level above the dike of approximately 5,393.23 feet at the end of the water year. The stop logs provide a larger impoundment behind the dike, which benefits waterfowl habitat and fishery conditions.

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 that lies at the base of the dike. This water is then pumped into Buffalo Bill Reservoir to maintain the elevation of Diamond Creek Reservoir between a maximum of 5,340.40 feet and a minimum of 5,339.50 feet. The normal water surface elevation is typically 5,340.00 feet.

Reservoir levels during all of Water Year 2019 were adequate for recreational activities on Buffalo Bill Reservoir.

Outlook and Annual Operating Plans for Water Year 2020 for Bighorn Basin Reservoirs Under the Responsibility of the Wyoming Area Office

Bull Lake Reservoir

Three operating plans were prepared in October 2019 to project operations under various run-off conditions for Water Year 2020. The projected operations for three inflow scenarios are shown in Tables WYT14, WYT15, and WYT16, and Figure 6. The plans are prepared 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 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 151,000 AF at elevation 5,804.50 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 cfs.

(4) The reservoir pool level will be kept below elevation 5,783.00 feet during the winter to accommodate the Bull Lake Dam Spillway Modification construction for Water Years 2019-2020. If not for the modification to the spillway, normal operations of the reservoir would be to maintain the reservoir below elevation 5,794.00 feet through the winter 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 (elevation 5,787.13 feet) and to also provide fishery habitat.

2020 Operating Plans

Operating plans have been generated for three scenarios for all months of the upcoming water year:

• Most probable inflow conditions are based on the historical median flows.

• Reasonable minimum inflow conditions are estimated to be lower decile flows. Lower decile flows are flows that have historically been exceeded 90 percent of the time.

• Reasonable maximum inflow conditions are estimated to be upper decile flows. Upper decile flows are flows that have historically been exceeded 10 percent of the time.

Under all inflow scenarios, releases in October following the end of irrigation season and continuing through the fall and winter will be adjusted to reach and maintain the targeted winter pool elevation. 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.

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Based on October 2019 Expected Probable Inflow Estimates

RIVERTON PROJECT OPERATING PLAN
Year Beginning Oct 2019

Bull Lake Reservoir Operations — Initial Content 86.1 Kaf — Operating Limits: Max 151.7 Kaf, 5804.76 Ft. Min 73.9 Kaf, 5776.99 Ft.

		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Reservoir Inflow	kaf	6.2	3.4	2.6	2.6	1.7	2.0	2.9	29.4	64.2	47.4	20.2	10.5	193.1
Total Dam Release	kaf	1.5	1.5	1.5	1.5	1.4	1.5	1.5	13.3	57.2	16.4	37.1	70.7	205.3
Total Dam Release	cfs	25.	25.	25.	25.	25.	25.	25.	217.	961.	267.	603.	1188.	
Excess Release	kaf	0.0	0.0	0.0	0.0	0.0	0.0	0.0	11.8	55.7	14.9	0.9	23.2	106.4
End-month Content	kaf	90.8	92.7	93.7	94.8	95.1	95.5	96.9	113.0	120.0	151.0	134.1	73.9	
End-month Elevation	ft	5783.7	5784.4	5784.8	5785.2	5785.3	5785.5	5786.0	5791.8	5794.3	5804.5	5799.1	5777.0	
BLR Net Change	kaf	4.7	1.9	1.1	1.1	0.3	0.5	1.4	16.1	7.0	31.0	-16.9	-60.2	-12.2

Wind River		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Flow abv BL Creek	kaf	34.8	25.0	18.9	16.4	15.3	17.7	29.1	105.4	175.3	117.1	52.2	36.1	643.3
Crowheart Gage Flow	kaf	36.3	26.5	20.4	17.9	16.7	19.2	30.6	118.7	232.5	133.5	89.3	106.8	848.6
Flow Below Div Dam	kaf	24.2	26.5	20.4	17.9	16.7	19.2	13.2	64.0	167.8	52.6	30.6	46.2	499.5
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	0.0	0.0	0.0	0.0	0.0	0.0	1.8	6.1	6.0	6.1	5.5	4.5	30.0
LeClair/Riverton	kaf	0.0	0.0	0.0	0.0	0.0	0.0	3.5	18.8	24.2	27.2	21.1	15.0	109.8
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	394.2	445.1	332.4	291.7	291.0	312.9	212.8	755.7	2433.3	433.1	164.5	539.3	

Wyoming Canal		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Total Diversion	kaf	12.1	0.0	0.0	0.0	0.0	0.0	17.4	54.7	64.7	80.9	58.7	60.6	349.1
North Canal Flow	kaf	0.0	0.0	0.0	0.0	0.0	0.0	9.8	26.4	31.2	36.5	30.9	27.0	161.8
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 16.1 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	12.1	0.0	0.0	0.0	0.0	0.0	7.6	28.3	33.5	44.4	27.8	33.6	187.3
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	0.0	0.0	0.0	0.0	0.0	0.0	6.7	28.0	33.1	43.9	37.4	33.3	182.4
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	28.0	28.0	28.0	28.0	18.0	18.0	
PBR Net Change	kaf	11.9	-0.2	-0.1	-0.1	-0.1	-0.2	0.7	0.0	0.0	0.0	-10.0	0.0	1.9
End-month Elevation	ft	5457.8	5457.6	5457.5	5457.4	5457.3	5457.0	5457.8	5457.8	5457.8	5457.8	5445.5	5445.5	

Table WYT 14: Bull Lake Reservoir Most Probable Inflow Scenario Operating Plans

RIVERTON PROJECT OPERATING PLAN
Year Beginning Oct 2019

Bull Lake Reservoir Operations — Initial Content 86.1 Kaf — Operating Limits: Max 151.9 Kaf, 5804.82 Ft. / Min 73.9 Kaf, 5776.99 Ft.

		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Reservoir Inflow	kaf	4.3	2.2	1.6	1.7	1.3	1.7	3.7	26.3	38.6	30.7	15.0	7.5	134.6
Total Dam Release	kaf	1.5	1.5	1.5	1.5	1.4	1.5	1.5	1.5	6.4	42.3	54.3	31.7	146.8
Total Dam Release	cfs	25.	25.	25.	25.	25.	25.	25.	25.	107.	688.	883.	533.	
Excess Release	kaf	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.9	0.0	0.0	0.0	4.9
End-month Content	kaf	88.9	89.6	89.6	89.8	89.7	89.8	92.0	116.8	149.0	137.4	98.1	73.9	
End-month Elevation	ft	5782.9	5783.2	5783.2	5783.3	5783.2	5783.3	5784.1	5793.2	5803.9	5800.2	5786.4	5777.0	
BLR Net Change	kaf	2.8	0.7	0.1	0.2	-0.1	0.2	2.2	24.8	32.2	-11.6	-39.3	-24.2	-12.2

Wind River		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Flow abv BL Creek	kaf	29.0	21.4	17.2	15.0	13.7	16.5	24.0	74.8	102.8	58.9	36.1	29.2	438.6
Crowheart Gage Flow	kaf	30.5	22.9	18.7	16.5	15.1	18.0	25.5	76.3	109.2	101.2	90.4	60.9	585.4
Flow Below Div Dam	kaf	18.4	22.9	18.7	16.5	15.1	18.0	8.1	21.9	44.3	30.3	21.7	15.6	251.6
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	0.0	0.0	0.0	0.0	0.0	0.0	1.8	6.1	6.0	6.1	2.5	1.8	24.3
LeClair/Riverton	kaf	0.0	0.0	0.0	0.0	0.0	0.0	3.5	18.8	24.2	27.2	21.1	15.0	109.8
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	299.9	384.6	304.7	269.0	263.2	293.3	127.1	70.0	357.0	70.0	70.0	70.0	

Wyoming Canal		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Total Diversion	kaf	12.1	0.0	0.0	0.0	0.0	0.0	17.4	54.5	64.9	70.9	68.7	45.3	333.8
North Canal Flow	kaf	0.0	0.0	0.0	0.0	0.0	0.0	9.8	26.4	31.2	36.5	30.9	23.6	158.4
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	3.4	3.4

Pilot Butte Reservoir Operations — Initial Content 16.1 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	12.1	0.0	0.0	0.0	0.0	0.0	7.6	28.1	33.7	34.4	37.8	21.7	175.4
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	0.0	0.0	0.0	0.0	0.0	0.0	6.7	28.0	33.1	43.9	37.4	29.4	178.5
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	3.2	3.2
End-month Content	kaf	28.0	27.8	27.7	27.6	27.5	27.3	28.0	27.8	28.0	18.0	18.0	10.0	
PBR Net Change	kaf	11.9	-0.2	-0.1	-0.1	-0.1	-0.2	0.7	-0.2	0.2	-10.0	0.0	-8.0	-6.1
End-month Elevation	ft	5457.8	5457.6	5457.5	5457.4	5457.3	5457.0	5457.8	5457.6	5457.8	5445.5	5445.5	5433.5	

Table WYT 15: Bull Lake Reservoir Minimum Expected Inflow Scenario Operating Plans

RIVERTON PROJECT OPERATING PLAN
Year Beginning Oct 2019

Bull Lake Reservoir Operations — Initial Content 86.1 Kaf — Operating Limits: Max 151.7 Kaf, 5804.76 Ft. / Min 73.9 Kaf, 5776.99 Ft.

		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Reservoir Inflow	kaf	6.5	3.6	3.0	2.4	1.9	2.4	4.3	27.6	89.9	75.1	31.1	12.8	260.6
Total Dam Release	kaf	1.5	1.5	1.5	1.5	1.4	1.5	1.5	27.2	69.9	44.1	48.0	73.0	272.8
Total Dam Release	cfs	25.	25.	25.	25.	25.	25.	25.	443.	1175.	717.	781.	1227.	
Excess Release	kaf	0.0	0.0	0.0	0.0	0.0	0.0	0.0	25.7	68.4	42.6	36.9	33.0	206.5
End-month Content	kaf	91.1	93.2	94.6	95.5	96.0	96.8	99.6	100.0	120.0	151.0	134.1	73.9	
End-month Elevation	ft	5783.8	5784.6	5785.1	5785.5	5785.6	5786.0	5787.0	5787.1	5794.3	5804.5	5799.1	5777.0	
BLR Net Change	kaf	5.0	2.1	1.5	0.9	0.5	0.9	2.8	0.4	20.0	31.0	-16.9	-60.2	-12.2

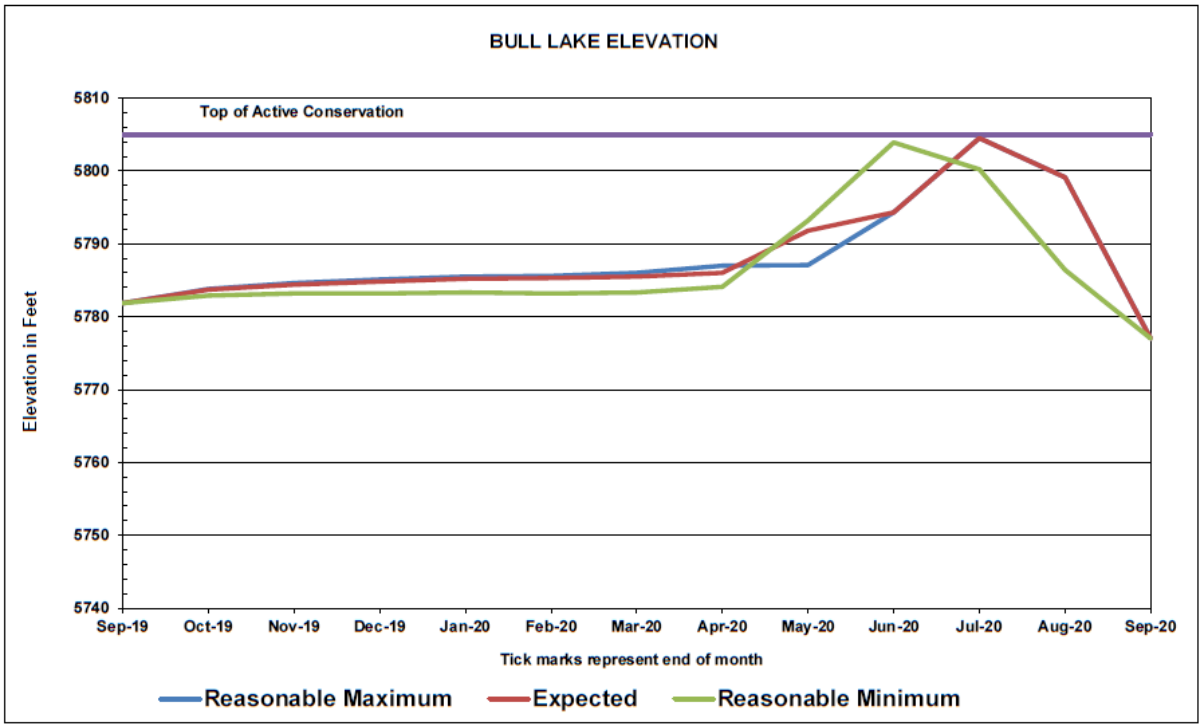
Wind River		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Flow abv BL Creek	kaf	35.8	25.7	21.3	18.7	15.6	21.5	27.0	132.0	323.8	196.6	77.3	43.6	938.9
Crowheart Gage Flow	kaf	37.3	27.2	22.8	20.2	17.0	23.0	28.5	159.2	393.7	240.7	125.3	116.6	1211.7
Flow Below Div Dam	kaf	21.8	27.2	22.8	20.2	17.0	23.0	11.1	104.5	329.0	159.8	66.6	56.0	859.2
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	0.0	0.0	0.0	0.0	0.0	0.0	1.8	6.1	6.0	6.1	5.5	4.5	30.0
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	273.8	456.9	371.4	329.1	296.2	374.7	177.5	1414.4	5142.3	2176.5	750.0	704.0	

Wyoming Canal		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Total Diversion	kaf	15.5	0.0	0.0	0.0	0.0	0.0	17.4	54.7	64.7	80.9	58.7	60.6	352.5
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 16.1 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	12.1	0.0	0.0	0.0	0.0	0.0	7.6	28.3	33.5	44.4	27.8	33.6	187.3
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	0.0	0.0	0.0	0.0	0.0	0.0	6.7	28.0	33.1	43.9	37.4	33.3	182.4
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	28.0	28.0	28.0	28.0	18.0	18.0	
PBR Net Change	kaf	11.9	-0.2	-0.1	-0.1	-0.1	-0.2	0.7	0.0	0.0	0.0	-10.0	0.0	1.9
End-month Elevation	ft	5457.8	5457.6	5457.5	5457.4	5457.3	5457.0	5457.8	5457.8	5457.8	5457.8	5445.5	5445.5	

Table WYT 16: Bull Lake Reservoir Maximum Expected Inflow Scenario Operating Plans



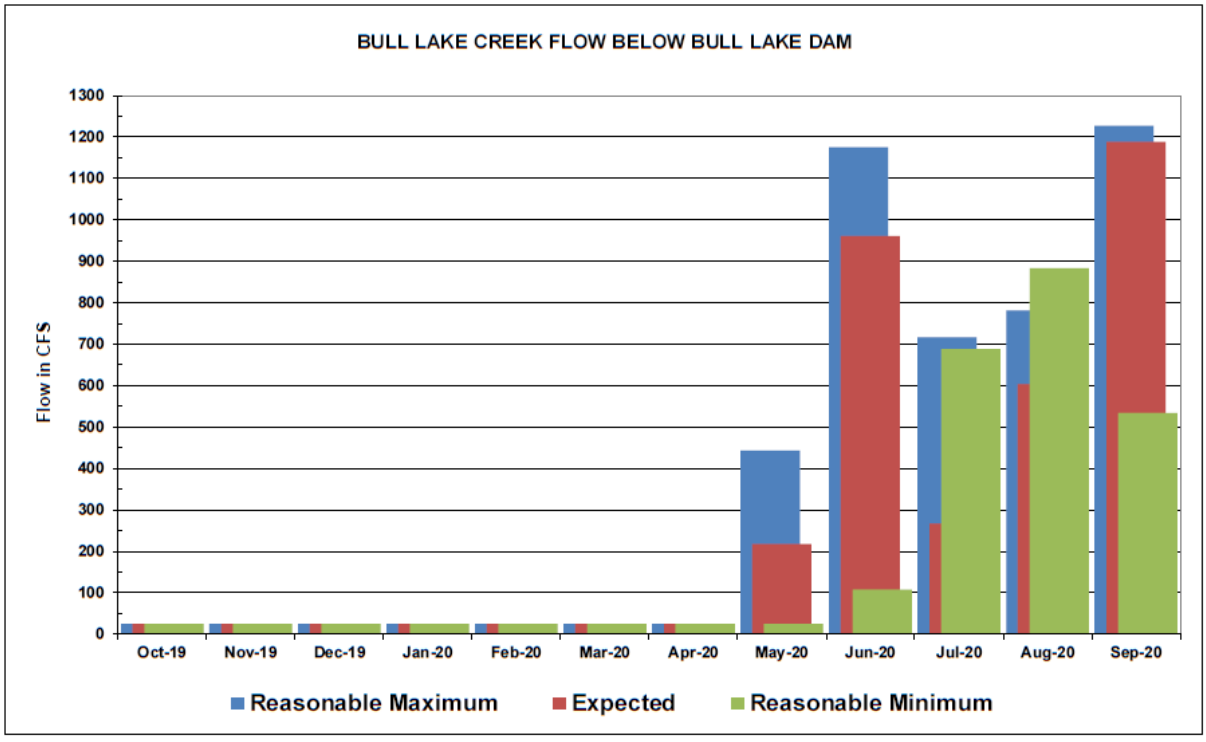


Figure 6: Water Year 2020 forebay elevation and inflow at Bull Lake Reservoir under a low-, expected-, and maximum-forecast.

Boysen Reservoir and Powerplant

Three operating plans were prepared in October 2019 to project water operations under various inflow conditions during Water Year 2020. The operations for the three-runoff conditions are shown in Tables WYT17, WYT18, and WYT19, and Figure 7. 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 Releases

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 Releases

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 - 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 - February to reduce the risk of ice jams, which may cause flooding or damage to bridges and other structures.

(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 4,724.50 feet (elevation 731,841 AF) by the end of July. Depending on inflows, attempts will be made to provide a reservoir level of at least elevation 4,707.00 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.

Water Year 2020 Operating Plans

Operating plans have been generated for three scenarios for all months of the upcoming water year:

• Most probable inflow conditions are based on the historical median flows.

• Reasonable minimum inflow conditions are estimated to be lower decile flows. Lower decile flows are flows that have historically been exceeded 90 percent of the time.

• Reasonable maximum inflow conditions are estimated to be upper decile flows. Upper decile flows are flows that have historically been exceeded 10 percent of the time.

Annual operating plans are found in Tables WYT17, WYT18, and WYT19, and Figure 7. Turbine unit outage schedules are found in Table WYT23.

Based on Expected April-July inflow of 647.7 kaf

BOYSEN RESERVOIR MONTHLY OPERATIONS

Boysen Reservoir		Initial Cont Elev	647.6 kaf 4719.96 ft			Maximum Cont Elev	892.2 kaf 4732.20 ft			Minimum Cont Elev	219.2 kaf 4685.00 ft		
	2019	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Monthly Inflow	kaf	56.8	47.2	36.5	33.1	35.5	50.3	56.8	164.7	295.6	130.7	66.8	55.5	1029.5
Monthly Inflow	cfs	924	793	594	538	617	818	955	2679	4968	2126	1086	933	
Turbine Release	kaf	70.7	59.5	61.5	61.5	57.5	61.5	59.5	138.4	134.0	118.8	103.7	75.5	1002.1
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	70.7	59.5	61.5	61.5	57.5	61.5	59.5	138.4	134.0	118.8	103.7	75.5	1002.1
Total Release	cfs	1150	1000	1000	1000	1000	1000	1000	2251	2252	1932	1687	1269	
End-Month Content	kaf	633.7	621.4	596.4	568.0	546.0	534.8	532.1	558.4	720.0	731.9	695.0	675.0	
End-Month Elevation	ft	4719.16	4718.44	4716.94	4715.15	4713.70	4712.95	4712.76	4714.52	4723.89	4724.50	4722.56	4721.48	
Net Change Content	kaf	-13.9	-12.3	-25.0	-28.4	-22.0	-11.2	-2.7	26.3	161.6	11.9	-36.9	-20.0	27.4

Boysen Power Plant	2019	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Turbine Release	kaf	70.7	59.5	61.5	61.5	57.5	61.5	59.5	138.4	134.0	118.8	103.7	75.5	1002.1
Turbine Release	cfs	1150	1000	1000	1000	1000	1000	1000	2251	2252	1932	1687	1269	
Generation	gwh	6.154	5.155	5.273	5.190	4.776	5.052	4.865	11.208	11.492	10.685	9.298	6.713	85.861
Max Generation	gwh	11.904	11.520	11.904	11.904	11.136	11.904	11.520	11.904	11.520	11.904	11.904	11.520	140.544
% Max Generation	%	52	45	44	44	43	42	42	94	100	90	78	58	
Ave kwh/af		87	87	86	84	83	82	82	81	86	90	90	89	86
End-Month Power Cap	mw	16	16	16	16	16	16	16	16	16	16	16	16	

Table WYT 17: Boysen Reservoir Most Probable Inflow Scenario Operating Plans.

BOYAOP V1.48 Run: 01-Oct-2019 13:34
Based on reasonable minimum April-July inflow of 223 kaf

BOYSEN RESERVOIR MONTHLY OPERATIONS

Boysen Reservoir		Initial Cont Elev	647.6 kaf 4719.96 ft			Maximum Cont Elev	892.2 kaf 4732.20 ft			Minimum Cont Elev	219.2 kaf 4685.00 ft		
	2019	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Monthly Inflow	kaf	47.9	42.4	35.4	33.0	31.7	45.8	41.5	66.6	76.5	38.1	25.5	32.0	516.4
Monthly Inflow	cfs	779	713	576	537	551	745	697	1083	1286	620	415	538	
Turbine Release	kaf	70.7	35.7	36.9	36.9	34.5	36.9	59.5	76.9	74.4	76.9	76.9	68.4	684.6
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	70.7	35.7	36.9	36.9	34.5	36.9	59.5	76.9	74.4	76.9	76.9	68.4	684.6
Total Release	cfs	1150	600	600	600	600	600	1000	1251	1250	1251	1251	1150	
End-Month Content	kaf	624.8	631.5	630.0	626.1	623.3	632.2	614.2	603.9	606.0	567.2	515.8	479.4	
End-Month Elevation	ft	4718.64	4719.03	4718.95	4718.72	4718.55	4719.07	4718.02	4717.40	4717.52	4715.10	4711.64	4709.03	
Net Change Content	kaf	-22.8	6.7	-1.5	-3.9	-2.8	8.9	-18.0	-10.3	2.1	-38.8	-51.4	-36.4	-168.2

Boysen Power Plant	2019	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Turbine Release	kaf	70.7	35.7	36.9	36.9	34.5	36.9	59.5	76.9	74.4	76.9	76.9	68.4	684.6
Turbine Release	cfs	1150	600	600	600	600	600	1000	1251	1250	1251	1251	1150	
Generation	gwh	6.139	3.119	3.228	3.223	3.008	3.223	5.143	6.567	6.338	6.480	6.295	5.436	58.199
Max Generation	gwh	11.904	11.520	11.904	11.904	11.136	11.904	11.520	11.904	11.520	11.904	11.904	11.520	140.544
% Max Generation	%	52	27	27	27	27	27	45	55	55	54	53	47	
Ave kwh/af		87	87	87	87	87	87	86	85	85	84	82	79	85
End-Month Power Cap	mw	16	16	16	16	16	16	16	16	16	16	15	15	

Table WYT 18: Boysen Reservoir Minimum Expected Inflow Scenario Operating Plans

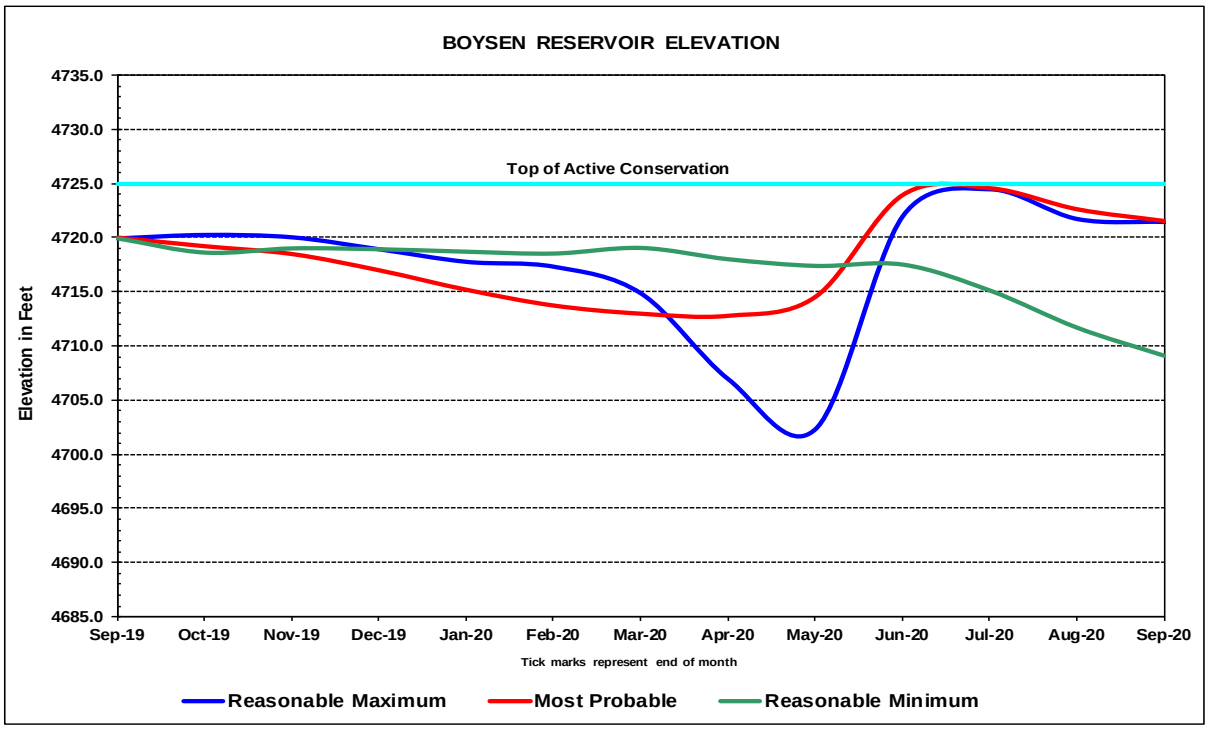
Based on reasonable maximum April-July inflow of 1,091 kaf

BOYSEN RESERVOIR MONTHLY OPERATIONS

Boysen Reservoir		Initial Cont Elev	647.6 kaf 4719.96 ft			Maximum Cont Elev	892.2 kaf 4732.20 ft			Minimum Cont Elev	219.2 kaf 4685.00 ft		
	2019	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Monthly Inflow	kaf	76.4	55.6	42.1	42.0	50.0	60.8	67.2	202.6	540.4	280.8	88.9	70.5	1577.3
Monthly Inflow	cfs	1243	934	685	683	869	989	1129	3295	9082	4567	1446	1185	
Turbine Release	kaf	70.7	59.5	61.5	61.5	57.5	100.3	134.8	133.8	135.7	135.8	134.1	75.5	1160.7
Bypass/Spill/Waste	kaf	0.0	0.0	0.0	0.0	0.0	0.0	44.3	125.2	114.9	98.1	6.7	0.0	389.2
Total Release	kaf	70.7	59.5	61.5	61.5	57.5	100.3	179.1	259.0	250.6	233.9	140.8	75.5	1549.9
Total Release	cfs	1150	1000	1000	1000	1000	1631	3010	4212	4211	3804	2290	1269	
End-Month Content	kaf	653.3	649.4	630.0	610.5	603.0	563.5	451.6	395.2	685.0	731.9	680.0	675.0	
End-Month Elevation	ft	4720.28	4720.06	4718.95	4717.79	4717.34	4714.86	4706.93	4702.34	4722.03	4724.50	4721.75	4721.48	
Net Change Content	kaf	5.7	-3.9	-19.4	-19.5	-7.5	-39.5	-111.9	-56.4	289.8	46.9	-51.9	-5.0	27.4

Boysen Power Plant	2019	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Turbine Release	kaf	70.7	59.5	61.5	61.5	57.5	100.3	134.8	133.8	135.7	135.8	134.1	75.5	1160.7
Turbine Release	cfs	1150	1000	1000	1000	1000	1631	2265	2176	2281	2209	2181	1269	
Generation	gwh	6.187	5.222	5.364	5.307	4.924	8.389	10.467	9.253	10.733	11.906	11.900	6.687	96.339
Max Generation	gwh	11.904	11.520	11.904	11.904	11.136	11.904	11.520	11.904	11.520	11.904	11.904	11.520	140.544
% Max Generation	%	52	45	45	45	44	70	91	78	93	100	100	58	
Ave kwh/af		88	88	87	86	86	84	78	69	79	88	89	89	83
End-Month Power Cap	mw	16	16	16	16	16	16	13	12	16	16	16	16	

Table WYT 19: Boysen Reservoir Maximum Expected Inflow Scenario Operating Plans



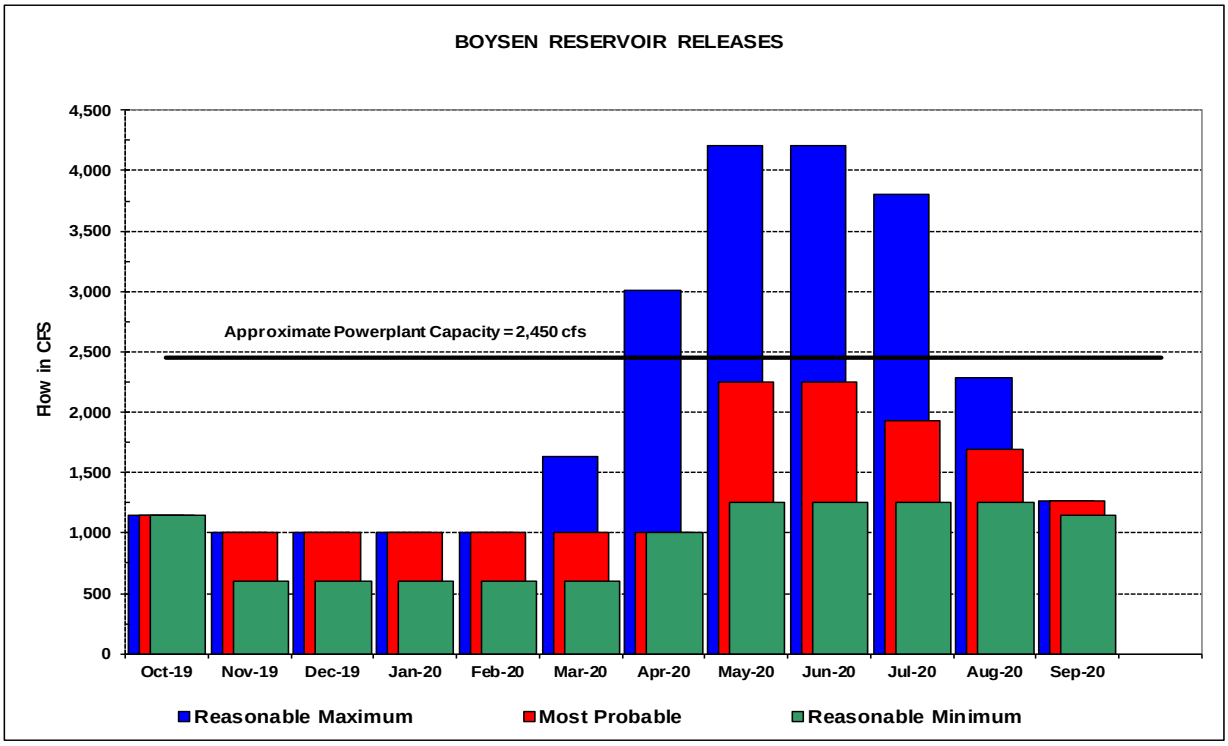


Figure 7: Water Year 2020 forebay elevation and inflow at Boysen Reservoir under a low-, expected-, and maximum-forecast.

Buffalo Bill Reservoir and Powerplants

Three operating plans were prepared for Water Year 2020 to show the operations of Buffalo Bill Reservoir that could occur under various runoff conditions. The operations for the three-runoff conditions are shown in Tables WYT20, WYT21, and WYT22, and Figure 8. 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 5,393.50 feet (elevation 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 ensure 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 jet flow valve at the Buffalo Bill 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 assures that outflow is less than inflow at all times of flood rate inflow.

Water Year 2020 Operating Plans

Under most probable inflow conditions, projected inflows for October, November, and December of Water Year 2020 have been adjusted to reflect the recent trends for the basin. Inflows for January through September of Water Year 2020 are median flows; or flows that have historically been exceeded 50 percent of the time.

The reasonable minimum volumes are determined from historical lower decile flows for all months of Water Year 2020. A lower decile flow is a flow that has historically been exceeded 90 percent of the time.

Upper decile volumes are determined from flows that have historically been exceeded 10 percent of the time. These values are projected for January through September of Water Year 2020 in the reasonable maximum inflows operating plan.

At the beginning of Water Year 2020, storage in Buffalo Bill Reservoir was 487,736 AF. Winter releases under all three scenarios are the same as defined by the AOP. Based on the criteria set forth in the Buffalo Bill Reservoir Enlargement Winter Release Operation Agreement, the 2019 winter

release would be 350 cfs. Ice in the Shoshone River can limit Reclamation's ability to change releases during the winter months due to the potential of ice jams near Lovell, Wyoming.

The Shoshone, Buffalo Bill, Heart Mountain, and Spirit Mountain Powerplants will all be available for power generation in Water Year 2020. 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.

BBRAOP V1.04 Run: 02-Oct-2018 10:51
Based on Most Expected April - July inflow of 690 kaf

BUFFALO BILL RESERVOIR MONTHLY OPERATIONS

Buffalo Bill Reservoir		Initial Cont		486.0 kaf		Maximum Cont		643.1 kaf		Minimum Cont		41.8 kaf		
		Elev		5373.07 ft		Elev		5393.59 ft		Elev		5259.64 ft		
2018		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Monthly Inflow	kaf	27.6	22.5	17.7	15.7	13.9	16.9	35.9	144.0	324.6	185.8	51.3	28.3	884.2
Shoshone Release	kaf	6.1	6.0	6.1	6.1	5.6	6.1	6.0	8.2	10.7	11.2	8.0	6.5	86.6
Non-Power Release	kaf	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	26.4	0.0	0.0	26.4
Total Flow Below Dam	kaf	6.1	6.0	6.1	6.1	5.6	6.1	6.0	8.2	10.7	37.6	8.0	6.5	113.0
Buffalo Bill Release	kaf	29.4	14.8	15.4	15.4	13.8	29.2	40.2	57.0	52.4	51.6	51.2	50.8	421.2
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	7.3	0.0	0.0	0.0	0.1	18.6	18.0	18.6	18.0	18.6	18.6	18.0	135.8
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	33.0	215.0
Total Outflow	kaf	51.1	21.1	21.8	21.8	19.8	54.2	71.5	120.1	123.4	156.1	119.1	108.6	888.6
Spill/Waste	kaf	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	26.4	0.0	0.0	26.4
End-Month Targets	kaf	462.5	463.9			450.0				600.0	629.7		481.6	
End-Month Content	kaf	462.5	463.9	459.8	453.7	447.8	410.5	374.9	398.8	600.0	629.7	561.9	481.6	
Est Total Storage	kaf	465.9	467.3	463.2	457.1	451.2	413.9	378.3	402.2	603.4	633.1	565.3	485.0	
End-Month Elevation	ft	5369.80	5370.00	5369.42	5368.56	5367.73	5362.23	5356.73	5360.45	5388.19	5391.93	5383.26	5372.46	
Net Change Content	kaf	-23.5	1.4	-4.1	-6.1	-5.9	-37.3	-35.6	23.9	201.2	29.7	-67.8	-80.3	-4.4
Flow Below BB Pwr	kaf	35.5	20.8	21.5	21.5	19.4	35.3	46.2	65.2	63.1	89.2	59.2	57.3	534.2
Flow Below BB Pwr	cfs	577	350	350	350	349	574	776	1060	1060	1451	963	963	
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	46.5	24.4	25.2	25.2	22.8	57.6	67.8	87.5	84.7	111.5	81.5	78.9	713.6
Passing Cody Gage	cfs	756	410	410	410	411	937	1139	1423	1423	1813	1325	1326	

Shoshone Power	2018	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Shoshone Release	kaf	6.1	6.0	6.1	6.1	5.6	6.1	6.0	8.2	10.7	11.2	8.0	6.5	86.6
Generation	gwh	1.131	1.105	1.123	1.119	1.024	1.101	1.057	1.438	2.009	2.222	1.582	1.237	16.148
Max Generation	gwh	2.232	2.160	2.232	2.232	1.290	1.451	2.160	2.232	2.160	2.232	2.232	2.160	24.773
% Max Generation		51	51	50	50	79	76	49	64	93	100	71	57	
Ave kwh/af		185	184	184	183	183	180	176	175	188	198	198	190	186
End-Month Power Cap	mw	3	3	3	3	2	2	3	3	3	3	3	3	

Buffalo Bill Power	2018	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Buffalo Bill Release	kaf	29.4	14.8	15.4	15.4	13.8	29.2	40.2	57.0	52.4	51.6	51.2	50.8	421.2
Generation	gwh	7.962	4.057	4.219	4.209	3.761	7.726	10.207	13.387	12.956	13.385	13.381	12.968	108.218
Max Generation	gwh	13.392	10.368	10.312	10.312	10.886	9.910	12.960	13.392	12.960	13.392	13.392	12.960	144.236
% Max Generation		59	39	41	41	35	78	79	100	100	100	100	100	
Ave kwh/af		271	274	274	273	273	265	254	235	247	259	261	255	257
End-Month Power Cap	mw	18	14	14	14	16	13	18	18	18	18	18	18	

Spirit Mtn Power	2018	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Spirit Mtn Release	kaf	15.3	0.0	0.0	0.0	0.1	18.6	25.0	34.4	33.3	34.4	34.4	33.3	228.8
Generation	gwh	1.575	0.000	0.000	0.000	0.010	1.793	2.156	2.331	2.681	3.214	3.267	2.953	19.980
Max Generation	gwh	1.607	3.143	3.348	3.348	3.024	3.248	3.013	3.348	3.240	3.348	3.348	3.240	37.255
% Max Generation		98	0	0	0	0	55	72	70	83	96	98	91	
Ave kwh/af		103				100	96	86	68	81	93	95	89	87
End-Month Power Cap	mw	2	3	3	1	1	2	3	4	5	5	5	4	

Heart Mtn Power	2018	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Heart Mtn Release	kaf	7.3	0.0	0.0	0.0	0.1	18.6	18.0	18.6	18.0	18.6	18.6	18.0	135.8
Generation	gwh	1.748	0.000	0.000	0.000	0.024	4.453	4.309	4.453	4.309	4.453	4.453	4.309	32.511
Max Generation	gwh	2.143	4.190	4.464	1.875	1.572	4.464	4.320	4.464	4.320	4.464	4.464	4.320	45.060
% Max Generation		82	0	0	0	2	100	100	100	100	100	100	100	
Ave kwh/af		239				240	239	239	239	239	239	239	239	239
End-Month Power Cap	mw	3	6	6	3	2	6	6	6	6	6	6	6	

Total Generation	2018	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Total Generation	gwh	12.416	5.162	5.342	5.328	4.819	15.073	17.729	21.609	21.955	23.274	22.683	21.467	176.857
End-month Power Cap	mw	26	26	26	21	21	23	30	31	32	32	32	31	

Table WYT 20: Buffalo Bill Reservoir Most Probable Inflow Scenario Operating Plans

BBRAOP V1.04 Run: 02-Oct-2018 10:51
Based on reasonable minimum April-July inflow of 455 kaf

BUFFALO BILL RESERVOIR MONTHLY OPERATIONS

Buffalo Bill Reservoir		Initial Cont		486.0 kaf		Maximum Cont		643.1 kaf		Minimum Cont		41.8 kaf		
				Elev 5373.07 ft				Elev 5393.59 ft				Elev 5259.64 ft		
2018		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Monthly Inflow	kaf	25.2	22.2	14.4	12.8	11.7	15.8	38.7	145.3	199.1	71.4	25.3	20.6	602.5
Shoshone Release	kaf	6.1	6.0	6.1	6.1	1.8	6.1	6.0	6.1	6.0	6.2	6.2	6.0	68.7
Non-Power Release	kaf	0.0	0.0	0.0	0.0	3.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.8
Total Flow Below Dam	kaf	6.1	6.0	6.1	6.1	5.6	6.1	6.0	6.1	6.0	6.2	6.2	6.0	72.5
Buffalo Bill Release	kaf	29.4	14.8	15.4	15.4	13.8	15.4	14.8	53.0	50.3	51.9	53.0	53.1	380.3
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	7.3	0.0	0.0	0.0	0.1	0.0	11.3	16.9	12.5	12.3	7.8	1.6	69.8
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	33.0	215.0
Total Outflow	kaf	51.1	21.1	21.8	21.8	19.8	21.8	39.4	112.3	111.1	118.7	108.3	94.0	741.2
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
End-Month Targets	kaf	460.1	463.9				430.7	430.0	463.0	551.0	628.0		481.6	
End-Month Content	kaf	460.1	461.2	453.8	444.8	436.7	430.7	430.0	463.0	551.0	503.7	420.7	347.3	
Est Total Storage	kaf	463.5	464.6	457.2	448.2	440.1	434.1	433.4	466.4	554.4	507.1	424.1	350.7	
End-Month Elevation	ft	5369.47	5369.62	5368.58	5367.30	5366.13	5365.27	5365.17	5369.87	5381.82	5375.49	5363.78	5352.31	
Net Change Content	kaf	-25.9	1.1	-7.4	-9.0	-8.1	-6.0	-0.7	33.0	88.0	-47.3	-83.0	-73.4	-138.7
Flow Below BB Pwr	kaf	35.5	20.8	21.5	21.5	19.4	21.5	20.8	59.1	56.3	58.1	59.2	59.1	452.8
Flow Below BB Pwr	cfs	577	350	350	350	349	350	350	961	946	945	963	993	
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	46.5	24.4	25.2	25.2	22.8	25.2	35.7	79.7	72.4	74.1	70.7	64.3	566.2
Passing Cody Gage	cfs	756	410	410	410	411	410	600	1296	1217	1205	1150	1081	

Shoshone Power 2018		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Shoshone Release	kaf	6.1	6.0	6.1	6.1	1.8	6.1	6.0	6.1	6.0	6.2	6.2	6.0	68.7
Generation	gwh	1.130	1.103	1.120	1.114	0.327	1.104	1.084	1.113	1.133	1.184	1.141	1.051	12.604
Max Generation	gwh	2.232	2.160	2.232	2.232	0.331	1.451	2.160	2.232	2.160	2.232	2.232	2.160	23.814
% Max Generation		51	51	50	50	99	76	50	50	52	53	51	49	
Ave kwh/af		185	184	184	183	182	181	181	182	189	191	184	175	183
End-Month Power Cap	mw	3	3	3	3	0	2	3	3	3	3	3	3	

Buffalo Bill Power 2018		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Buffalo Bill Release	kaf	29.4	14.8	15.4	15.4	13.8	15.4	14.8	53.0	50.3	51.9	53.0	53.1	380.3
Generation	gwh	7.958	4.052	4.210	4.195	3.744	4.164	3.966	13.027	12.685	13.119	13.226	12.942	97.288
Max Generation	gwh	13.392	10.368	10.312	10.312	10.886	9.910	12.960	13.392	12.960	13.392	13.392	12.960	144.236
% Max Generation		59	39	41	41	34	42	31	97	98	98	99	100	
Ave kwh/af		271	274	273	272	271	270	268	246	252	253	250	244	256
End-Month Power Cap	mw	18	14	14	14	16	13	18	18	18	18	18	18	

Spirit Mtn Power 2018		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Spirit Mtn Release	kaf	15.3	0.0	0.0	0.0	0.1	0.0	18.3	34.4	33.3	34.4	34.4	33.3	203.5
Generation	gwh	1.572	0.000	0.000	0.000	0.010	0.000	1.812	2.710	2.843	2.958	2.846	2.557	17.308
Max Generation	gwh	1.607	3.143	3.348	3.348	3.024	3.248	3.013	3.348	3.240	3.348	3.348	3.240	37.255
% Max Generation		98	0	0	0	0	0	60	81	88	88	85	79	
Ave kwh/af		103				100		99	79	85	86	83	77	85
End-Month Power Cap	mw	2	3	3	1	1	2	3	4	4	4	4	3	

Heart Mtn Power 2018		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Heart Mtn Release	kaf	7.3	0.0	0.0	0.0	0.1	0.0	11.3	16.9	12.5	12.3	7.8	1.6	69.8
Generation	gwh	1.748	0.000	0.000	0.000	0.024	0.000	2.705	4.046	2.992	2.944	1.867	0.383	16.709
Max Generation	gwh	2.143	4.190	4.464	1.875	1.572	4.464	4.320	4.464	4.320	4.464	4.464	4.320	45.060
% Max Generation		82	0	0	0	2	0	63	91	69	66	42	9	
Ave kwh/af		239				240		239	239	239	239	239	239	239
End-Month Power Cap	mw	3	6	6	3	2	6	6	6	6	6	6	6	

Total Generation 2018		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Total Generation	gwh	12.408	5.155	5.330	5.309	4.105	5.268	9.567	20.896	19.653	20.205	19.080	16.933	143.909
End-month Power Cap	mw	26	26	26	21	19	23	30	31	31	31	31	30	

Table WYT 21: Buffalo Bill Reservoir Minimum Expected Inflow Scenario Operating Plans

BBRAOP V1.04 Run: 02-Oct-2018 10:51
Based on reasonable maximum April-July inflow of 1,049 kaf

BUFFALO BILL RESERVOIR MONTHLY OPERATIONS

Buffalo Bill Reservoir		Initial Cont Elev	486.0 kaf 5373.07 ft			Maximum Cont Elev	643.1 kaf 5393.59 ft			Minimum Cont Elev	41.8 kaf 5259.64 ft		
2018		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Monthly Inflow	kaf	32.1	27.0	20.6	17.4	15.6	23.7	57.6	226.8	458.6	306.2	76.9	36.2	1298.7
Shoshone Release	kaf	6.2	6.0	6.2	6.1	5.6	7.6	12.5	13.2	11.8	11.3	11.3	11.4	109.2
Non-Power Release	kaf	0.0	0.0	0.0	0.0	0.0	0.0	32.6	91.7	91.7	145.9	13.7	11.7	387.3
Total Flow Below Dam	kaf	6.2	6.0	6.2	6.1	5.6	7.6	45.1	104.9	103.5	157.2	25.0	23.1	496.5
Buffalo Bill Release	kaf	38.3	14.8	15.3	15.4	13.8	37.7	52.6	57.2	53.3	51.9	51.2	50.7	452.2
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	7.3	0.0	0.0	0.0	0.1	18.6	18.0	18.6	18.0	18.6	18.6	18.0	135.8
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	33.0	215.0
Total Outflow	kaf	60.1	21.1	21.8	21.8	19.8	64.2	123.0	217.0	217.1	276.0	136.1	125.1	1303.1
Spill/Waste	kaf	0.0	0.0	0.0	0.0	0.0	0.0	32.6	91.7	91.7	145.9	13.7	11.7	387.3
End-Month Targets	kaf	458.0	463.9			454.1				599.5	629.7		481.6	
End-Month Content	kaf	458.0	463.9	462.7	458.3	454.1	413.6	348.2	358.0	599.5	629.7	570.5	481.6	
Est Total Storage	kaf	461.4	467.3	466.1	461.7	457.5	417.0	351.6	361.4	602.9	633.1	573.9	485.0	
End-Month Elevation	ft	5369.17	5370.00	5369.83	5369.21	5368.62	5362.71	5352.46	5354.04	5388.13	5391.93	5384.38	5372.46	
Net Change Content	kaf	-28.0	5.9	-1.2	-4.4	-4.2	-40.5	-65.4	9.8	241.5	30.2	-59.2	-88.9	-4.4
Flow Below BB Pwr	kaf	44.5	20.8	21.5	21.5	19.4	45.3	97.7	162.1	156.8	209.1	76.2	73.8	948.7
Flow Below BB Pwr	cfs	724	350	350	350	349	737	1642	2636	2635	3401	1239	1240	
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	55.5	24.4	25.2	25.2	22.8	67.6	119.3	184.4	178.4	231.4	98.5	95.4	1128.1
Passing Cody Gage	cfs	903	410	410	410	411	1099	2005	2999	2998	3763	1602	1603	

Shoshone Power	2018	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Shoshone Release	kaf	6.2	6.0	6.2	6.1	5.6	7.6	12.5	13.2	11.8	11.3	11.3	11.4	109.2
Generation	gwh	1.148	1.104	1.142	1.122	1.027	1.375	2.166	2.232	2.166	2.224	2.229	2.165	20.100
Max Generation	gwh	2.232	2.160	2.232	2.232	1.290	1.451	2.160	2.232	2.160	2.232	2.232	2.160	24.773
% Max Generation		51	51	51	50	80	95	100	100	100	100	100	100	
Ave kwh/af		185	184	184	184	183	181	173	169	184	197	197	190	184
End-Month Power Cap	mw	3	3	3	3	2	2	3	3	3	3	3	3	

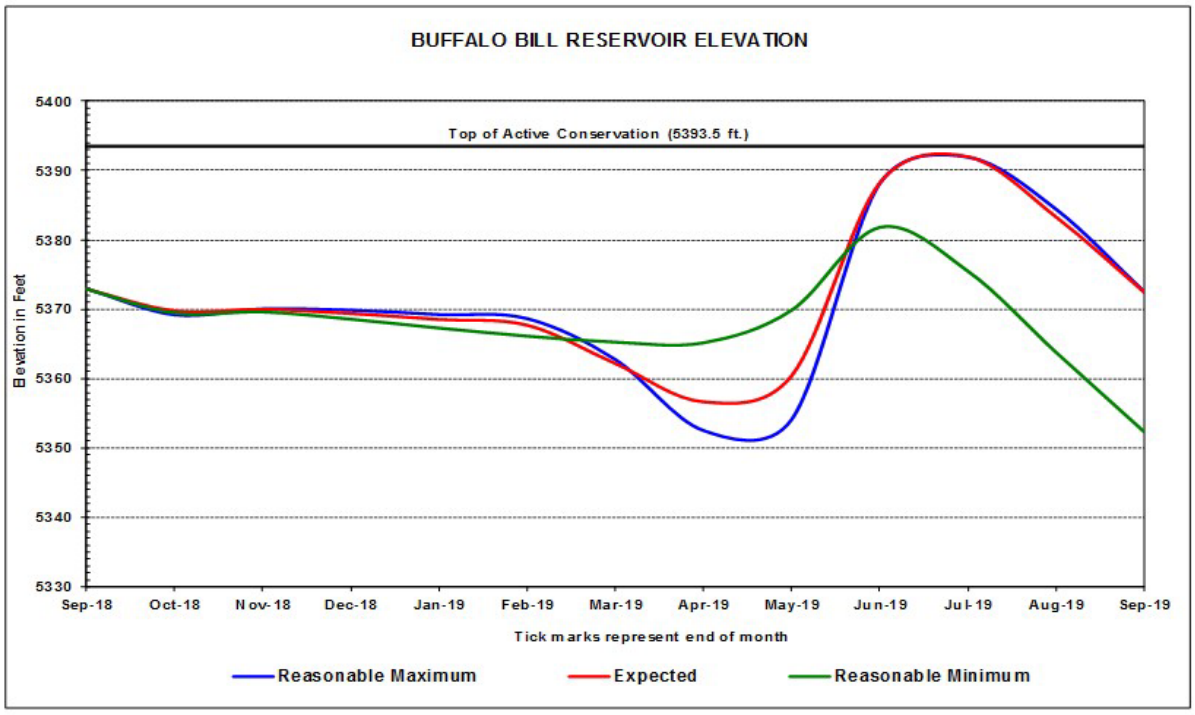
Buffalo Bill Power	2018	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Buffalo Bill Release	kaf	38.3	14.8	15.3	15.4	13.8	37.7	52.6	57.2	53.3	51.9	51.2	50.7	452.2
Generation	gwh	10.263	4.053	4.194	4.216	3.771	9.900	12.968	13.090	12.952	13.386	13.392	12.957	115.142
Max Generation	gwh	13.392	10.368	10.312	10.312	10.886	9.910	12.960	13.392	12.960	13.392	13.392	12.960	144.236
% Max Generation		77	39	41	41	35	100	100	98	100	100	100	100	
Ave kwh/af		268	274	274	274	273	263	247	229	243	258	262	256	255
End-Month Power Cap	mw	18	14	14	14	16	13	18	18	18	18	18	18	

Spirit Mtn Power	2018	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Spirit Mtn Release	kaf	15.3	0.0	0.0	0.0	0.1	18.6	25.0	34.4	33.3	34.4	34.4	33.3	228.8
Generation	gwh	1.540	0.000	0.000	0.000	0.010	1.767	2.008	2.158	2.577	3.207	3.284	2.973	19.524
Max Generation	gwh	1.607	3.143	3.348	3.348	3.024	3.248	3.013	3.348	3.240	3.348	3.348	3.240	37.255
% Max Generation		96	0	0	0	0	54	67	64	80	96	98	92	
Ave kwh/af		101				100	95	80	63	77	93	95	89	85
End-Month Power Cap	mw	2	3	3	1	1	2	3	3	5	5	5	4	

Heart Mtn Power	2018	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Heart Mtn Release	kaf	7.3	0.0	0.0	0.0	0.1	18.6	18.0	18.6	18.0	18.6	18.6	18.0	135.8
Generation	gwh	1.748	0.000	0.000	0.000	0.024	4.453	4.309	4.453	4.309	4.453	4.453	4.309	32.511
Max Generation	gwh	2.143	4.190	4.464	1.875	1.572	4.464	4.320	4.464	4.320	4.464	4.464	4.320	45.060
% Max Generation		82	0	0	0	2	100	100	100	100	100	100	100	
Ave kwh/af		239				240	239	239	239	239	239	239	239	239
End-Month Power Cap	mw	3	6	6	3	2	6	6	6	6	6	6	6	

Total Generation	2018	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Total Generation	gwh	14.699	5.157	5.336	5.338	4.832	17.495	21.451	21.933	22.004	23.270	23.358	22.404	187.277
End-month Power Cap	mw	26	26	26	21	21	23	30	30	32	32	32	31	

Table WYT 22: Buffalo Bill Reservoir Maximum Expected Inflow Scenario Operating Plans



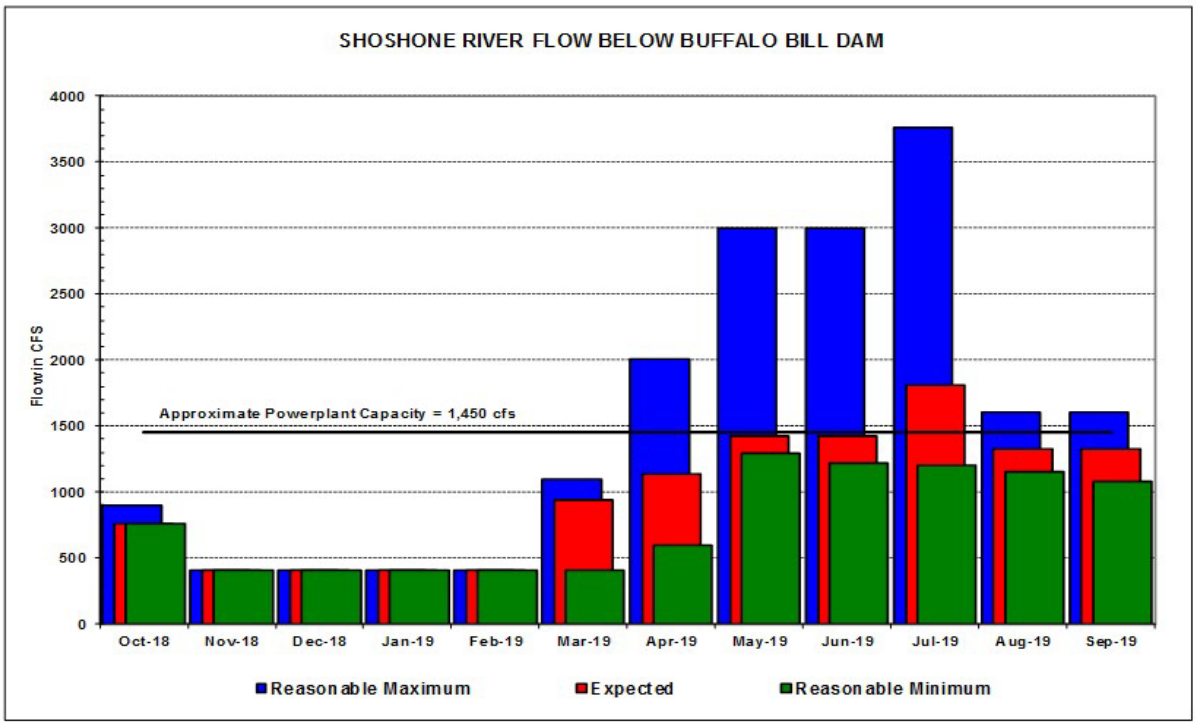


Figure 8: Water Year 2020 forebay elevation and inflow at Buffalo Bill Reservoir under a low-, expected-, and maximum-forecast.

ID	Task Name	Start	Finish	Outage Hours	Total Unit Outage Hours	Planned Availability
1	Wyoming Area Office					
2	North Platte					
3	Seminoe					
4	Seminoe Unit One				1356	85%
10	Annual	10/28/2019	12/19/2019	1260		
	Switching for Unit 3	1/20/2020	1/20/2020	12		
5	Station Service Bus	3/9/2020	3/12/2020	84		
23	Seminoe Unit Two				852	90%
24	Annual	10/1/2019	10/31/2019	732		
41	Black Start Testing	11/27/2019	11/27/2019	12		
42	D2A Breaker Maintenance	12/16/2019	12/16/2019	12		
	Switching for Unit 3	1/20/2020	1/20/2020	12		
84	Station Service Bus	3/9/2020	3/12/2020	84		
43	Seminoe Unit Three				1188	86%
45	Black Start Testing	11/27/2019	11/27/2019	12		
47	Annual	12/16/2019	1/23/2020	1092		
44	Station Service Bus	3/9/2020	3/12/2020	84		
72	Kortes					
73	Kortes Unit One				1104	87%
74	Annual	11/4/2019	12/17/2019	1044		
41	D2A1 MCCB Testing	2/10/2020	2/11/2020	36		
	Switching for Unit 2	3/30/2020	3/30/2020	12		
	WAPA Trip to Unit Breakers	4/1/2020	4/1/2020	12		
86	Kortes Unit Two				1128	87%
41	Black Start Testing	11/27/2019	11/27/2019	12		
	Black Plant Day	12/9/2019	12/9/2019	12		
	D2A1 MCCB Testing	2/10/2019	2/11/2019	36		
87	Annual	2/20/2020	4/2/2020	1068		
	WAPA Trip to Unit Breakers	4/1/2020	4/1/2020	0		
100	Kortes Unit Three				984	89%
41	Black Start Testing	11/27/2019	11/27/2019	36		
	Black Plant Day	12/9/2019	12/9/2019	12		
87	Annual	1/6/2020	2/16/2020	924		
	WAPA Trip to Unit Breakers	4/1/2020	4/1/2020	12		
115	Fremont Canyon					
125	Fremont Canyon Unit One				1116	87%
136	Annual Maintenance	10/1/2019	11/15/2019	1116		
140	Fremont Canyon Unit Two				1116	87%
142	CO2 Odorizer Install	10/29/2019	10/29/2019	12		
149	Annual Maintenance	11/18/2019	1/2/2020	1092		
	WAPA Trip to Unit Breakers	4/1/2020	4/1/2020	12		
158	Alcova					
165	Alcova Unit One				1296	85%
	WAPA Trip to Unit Breakers	1/6/2020	1/6/2020	0		
168	Annual Maintenance	1/6/2020	2/28/2020	1284		
177	Change Butterfly Oil	4/6/2020	4/6/2020	12		
179	Alcova Unit Two				852	90%
	WAPA Trip to Unit Breakers	1/6/2020	1/6/2020	12		
142	CO2 Odorizer Install	1/14/2020	1/14/2020	12		
182	Annual Maintenance	3/3/2020	4/6/2020	828		
177	Change Butterfly Oil	4/6/2020	4/6/2020	0		
189	Glendo					
196	Glendo Unit One				840	90%
199	Annual	11/4/2001	11/28/2019	588		
197	KY1A Annual	4/20/1930	4/30/2020	252		
199	Annual RTS Testing	4/20/2020	4/30/2020	0		
207	Glendo Unit Two				1176	87%
210	Annual	1/6/2020	1/30/2020	588		
208	KY1B Annual	4/6/2020	4/16/2020	0		
209	Station Service Maintenance	4/6/2020	4/30/2020	588		
199	Annual RTS Testing	4/20/2020	4/30/2020	0		
231	Guernsey Unit One				1464	83%
226	KX1A Annual	12/2/2019	12/19/2019	0		
233	Annual	12/2/2019	1/23/2020	1260		
199	Annual RTS Testing	4/27/2020	5/5/2020	204		
235	Guernsey Unit Two				1392	84%
230	KX2A Annual	12/2/2019	12/19/2019	0		
237	Annual	12/2/2019	1/16/2020	1092		

Table WYT 23: Water Year 2020 Scheduled Outages for Bighorn Powerplants

Annual Operating Plans for Water Year (WY) 2019 for Reservoirs Under Responsibility of the Montana Area Office (MTAO)

Water Year 2018 Review

Water year 2018 started with varying storage levels. Lake Sherburne was at 37 percent of average while Clark Canyon was 186 percent of average. The Reclamation reservoir that ended the year fullest was Nelson Reservoir at 96 percent of normal full capacity. Total inflows into Reclamation facilities in Montana east of the Continental Divide ranged from 104 percent of average at Lake Sherburne to 173 percent of average at Bighorn Lake. Temperatures were near normal in the southern part of Montana and northern Wyoming and below normal in central and eastern Montana. Above average precipitation occurred throughout Montana and Wyoming with the exception in northeastern Montana during September 2018.

Water Year 2019 Summary of Hydrologic Conditions and Flood Benefits

October through December

Water year 2019 began in October 2018 with normal temperatures across most of the state of Montana. Precipitation amounts were mixed, with below normal values across much of western and southeast Montana and above normal amounts fell across the northeast. Precipitation was heaviest over the northern Rockies with 3.35 inches falling at St Mary and a monthly snow amount of 21.0 inches at East Glacier.

November temperature anomalies ranged from almost four degrees below normal over scattered sections of the state of Montana from the northeast through the southwest to approximately three degrees above normal over northern portions of the state. The warmest, Yellowtail Dam had an average temperature of 36.8°F, while the coolest was 18.5°F at West Yellowstone. Precipitation was scattered throughout the state of Montana with the heaviest precipitation occurring along the Rocky Mountain front. The heaviest monthly snow amounts were 47 inches at Mystic Lake and 29.7 inches at Hebgen Dam.

December temperature anomalies ranged from slightly below normal in the southwest part of Montana to 8°F above normal over northeastern portion of Montana. Precipitation amounts were much above normal along the eastern border with below normal conditions for the remainder of the state. The year-to-date mountain precipitation from October through December ranged from 80 percent of average in the Madison drainage to 111 percent of average in the Gallatin drainage. The valley precipitation ranged from 87 percent of average in the Beaverhead Basin to 126 percent of average in the Sun -Teton Basin. Additional monthly data on valley and mountain precipitation per basin during water year 2019 can be found in Tables MTT1 and MTT2.

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 Average Precip	0.98		0.69		0.60		0.61		0.51		0.79		1.21		2.11		2.11		1.25		1.13		0.95	
Monthly Precip and % of Average	1.07	109	0.49	72	0.41	68	0.29	47	1.30	254	0.86	108	1.39	115	1.40	66	1.32	63	1.23	98	0.79	70	1.25	132
Year-to-Date Precip and % of Average	1.07	109	1.57	94	1.97	87	2.26	79	3.56	105	4.42	106	5.81	108	7.21	96	8.53	89	9.75	90	10.54	88	11.79	91
Jefferson																								
Monthly Average Precip	0.88		0.57		0.45		0.40		0.38		0.63		1.04		1.91		2.05		1.26		1.15		0.94	
Monthly Precip and % of Average	0.93	106	0.42	74	0.40	87	0.25	63	1.31	350	0.82	129	1.34	129	1.34	70	1.20	59	1.21	96	0.81	71	1.47	155
Year-to-Date Precip and % of Average	0.93	106	1.35	94	1.75	92	2.00	87	3.31	124	4.13	125	5.47	126	6.80	109	8.01	97	9.22	96	10.03	94	11.50	99
Madison																								
Monthly Average Precip	1.59		1.69		1.76		1.56		1.35		1.73		2.01		2.73		2.60		1.63		1.32		1.27	
Monthly Precip and % of Average	1.76	111	1.59	94	1.20	68	1.46	94	4.77	353	1.33	77	2.92	145	1.99	73	2.06	79	1.76	108	0.89	67	2.59	204
Year-to-Date Precip and % of Average	1.76	111	3.35	102	4.54	90	6.00	91	10.76	135	12.10	125	15.02	128	17.00	118	19.06	112	20.82	112	21.71	109	24.30	114
Gallatin																								
Monthly Average Precip	1.28		0.85		0.59		0.56		0.53		1.01		1.73		2.63		2.66		1.38		1.18		1.23	
Monthly Precip and % of Average	1.35	106	1.07	126	0.57	96	0.75	134	1.78	333	0.70	69	3.04	175	1.66	63	2.09	79	1.78	130	0.79	67	3.26	265
Year-to-Date Precip and % of Average	1.35	106	2.42	114	2.99	110	3.75	114	5.52	145	6.22	129	9.26	141	10.92	119	13.01	110	14.79	112	15.58	108	18.84	120
Missouri Above Toston																								
Monthly Precip Average	1.13		0.91		0.81		0.74		0.65		0.99		1.42		2.29		2.34		1.40		1.21		1.09	
Monthly Precip and % of Average	1.20	106	0.85	93	0.62	76	0.68	92	2.27	347	0.92	92	2.05	144	1.60	70	1.60	68	1.47	105	0.86	71	2.08	191
Year-to-Date Precip and % of Average	1.20	106	2.04	100	2.66	94	3.34	93	5.61	132	6.53	125	8.58	129	10.18	114	11.78	104	13.25	104	14.11	102	16.19	108
Sun-Teton																								
Monthly Average Precip	0.81		0.47		0.41		0.39		0.39		0.79		1.33		2.19		2.54		1.33		1.43		1.41	
Monthly Precip and % of Average	1.14	141	0.65	139	0.35	84	0.73	190	1.75	448	0.59	75	2.16	163	2.74	125	1.44	57	1.42	107	1.40	98	2.63	187
Year-to-Date Precip and % of Average	1.14	141	1.79	140	2.13	126	2.87	138	4.62	187	5.21	160	7.37	161	10.10	149	11.54	124	12.96	122	14.36	119	16.99	126
Marias																								
Monthly Average Precip	0.67		0.75		0.64		0.62		0.57		0.85		1.11		1.96		2.55		1.38		1.19		1.20	
Monthly Precip and % of Average	0.79	118	0.76	101	0.50	78	0.85	137	1.48	261	0.33	39	1.85	167	2.81	144	1.62	64	1.22	89	1.46	122	2.56	214
Year-to-Date Precip and % of Average	0.79	118	1.55	109	2.05	99	2.90	108	4.38	135	4.71	115	6.56	126	9.37	131	10.99	113	12.21	110	13.67	111	16.23	120
Milk																								
Monthly Average Precip	0.72		0.46		0.39		0.38		0.28		0.52		0.90		2.05		2.52		1.56		1.17		1.26	
Monthly Precip and % of Average	0.77	106	0.62	133	0.21	55	0.38	101	1.01	355	0.28	54	0.79	88	1.59	77	3.64	145	1.05	67	1.74	148	3.39	269
Year-to-Date Precip and % of Average	0.77	106	1.39	117	1.60	101	1.98	101	2.99	134	3.28	119	4.07	111	5.65	99	9.30	113	10.35	106	12.09	110	15.47	127
St. Mary																								
Monthly Average Precip	1.87		2.80		2.30		2.27		2.15		2.47		2.24		2.80		3.54		1.72		1.43		1.80	
Monthly Precip and % of Average	2.84	152	2.08	74	1.53	66	1.49	65	2.45	114	0.74	30	3.17	142	5.39	192	2.01	57	1.07	62	1.36	95	2.14	119
Year-to-Date Precip and % of Average	2.84	152	4.92	106	6.45	93	7.93	86	10.38	91	11.12	80	14.29	89	19.67	104	21.68	97	22.75	94	24.11	94	26.25	96
Bighorn Above Yellowtail																								
Monthly Average Precip	0.93		0.55		0.42		0.36		0.39		0.67		1.16		1.81		1.43		0.88		0.60		1.06	
Monthly Precip and % of Average	0.61	66	0.82	149	0.38	90	0.37	102	0.46	116	0.64	95	1.30	112	4.78	263	1.01	71	0.98	112	0.64	108	2.55	241
Year-to-Date Precip and % of Average	0.61	66	1.44	97	1.82	95	2.19	96	2.64	99	3.28	98	4.58	102	9.36	148	10.38	134	11.35	132	12.00	130	14.55	142

The following National Weather Service station locations were input into PRISM to compute the data in Table MTT1A:

Beaverhead.....**Dillon 18 WSW, Dillon Airport, Grant 5 SE, Lima, Polaris 3.7 NNE and Wisdom**

Jefferson.....**Alder 19 S, Boulder 0.3 E, Diloon 18 WSW, Dillon Airport, Glen 0.2 SE, Grant 5 SE, Laurin 2 NE, Lima, Sheridan 1.4 ENE, Twin Bridges, Wisdom and Wise River 3 WNW**

Madison.....**Bozeman Montana State University, Ennis, Hebgen Dam, Norris Madison Power House, Old Faithful and West Yellowstone Gateway**

Gallatin.....**Bozeman 6 W Experimental Farm, Bozeman 1.5 SSE, Bozeman Gallatin Field Airport and Logan Landfill**

Missouri Above Toston....**Alder 19 S, Boulder 0.3 E, Bozeman 1.5 SSE, Bozeman 6 W Experimental Farm, Bozeman Gallatin Airport and Bozeman Montana State University, Dillon 18 WSW, Dillon Airport, Ennis, Glen 0.2 SE, Grant 5 SE, Hebgen Dam, Laurin, Lima, Logan Landfill, Norris Madison Power House, Old Faithful, Polaris 3.7 NNE, Sheridan 1.4 ENE, Townsend, Trident, Twin Bridges, West Yellowstone Gateway, Wisdom and Wise River 3 WNW**

Sun-Teton.....**Cascade 5 S, Choteau 8 NE, Choteau, Dutton 3.3 ENE, Fairfield, Great Falls Weather Forecast Office, Rogers Pass 9 NNE and Sun River 4 S**

Marias.....**Chester, Conrad, Cut Bank Airport, Dunkirk 19 NNE, East Glacier, Galata 16 SW and Shelby**

Milk.....**Chinook, Fort Belknap 2 SW, Gildford, Glasgow Weather Forecast Office, Goldbutte 7 N, Harlem 20 S, Havre Airport ASOS, Hingham 12 N, Hinsdale 4 SW, Hogeland 7.0 SSE, Malta, Rudyard 21 N, Saco 1 NNW and Simpson 6 N Wildhorse**

St. Mary.....**East Glacier and St Mary 1 SSW**

Bighorn.....**Basin, Black Mountain, Boysen Dam, Buffalo Bill Dam, Burris, Cody 12 SE, Cody 7.6 NNW, Deaver, Dubois, Emblem, Fort Smith 0.5 ENE, Greybull South Big Horn Co Airport, Lander 11 SSE, Lander 7.3 WNW, Lander Airport, Lovell, Pahaske, Pavillion, Powell Field Station, Rairden 2 WSW, Riverton Regional Airport, Shell 9.5 NNW, Shell, Shoshoni, Sunshine 3 NE, Ten Sleep 0.3 SSW, Tensleep 16 SSE, Thermopolis, Thermopolis 9 NE, Worland 14.4 SW and Worland Municipal Airport**

Table MTT 1: Precipitation in inches and percent of average 2019 valley precipitation.

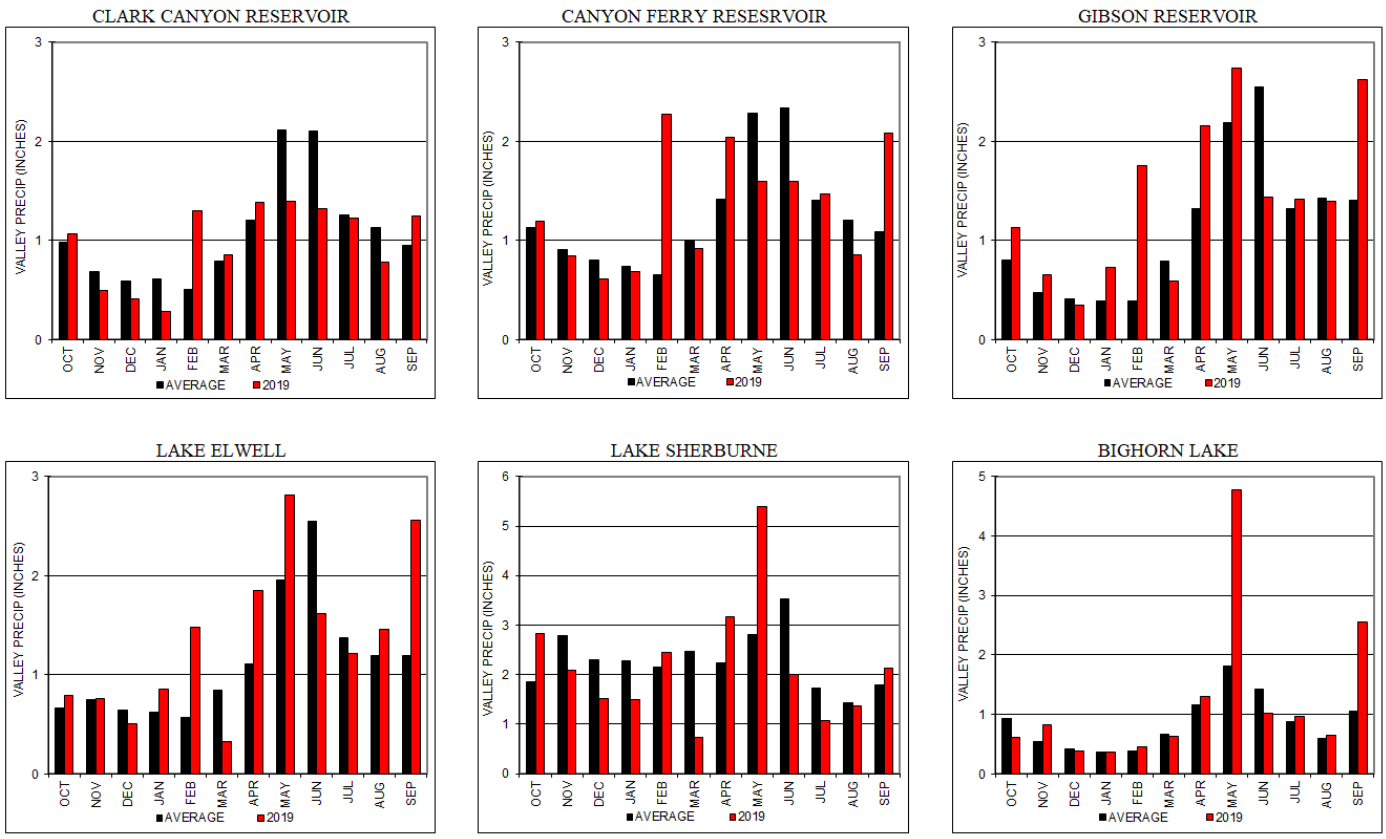


Figure 9: Precipitation in inches and percent of average 2019 valley precipitation.

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.	%
Lima Reservoir																								
Monthly Average Precip	2.04		2.42		2.70		2.58		2.18		2.54		2.54		3.06		2.84		1.64		1.32		1.54	
Monthly Precip and % of Average	2.58	126	1.92	79	1.32	49	2.60	101	6.96	319	1.36	54	2.28	90	2.32	76	2.54	89	1.10	67	1.16	88	3.12	203
Year-to-Date Precip and % of Average	2.58	126	4.50	101	5.82	81	8.42	86	15.38	129	16.74	116	19.02	112	21.34	106	23.88	104	24.98	102	26.14	101	29.26	107
Clark Canyon Reservoir																								
Monthly Average Precip	2.16		2.59		2.53		2.43		2.09		2.59		2.97		3.41		3.04		1.54		1.46		1.67	
Monthly Precip and % of Average	2.74	127	2.24	87	1.51	60	1.86	76	4.59	220	1.41	55	2.87	97	2.59	76	2.74	90	1.37	89	0.83	57	2.73	163
Year-to-Date Precip and % of Average	2.74	127	4.99	105	6.50	89	8.36	86	12.94	110	14.36	100	17.23	99	19.81	95	22.56	95	23.93	94	24.76	92	27.49	97
Jefferson Drainage																								
Monthly Average Precip	2.11		2.61		2.61		2.53		2.15		2.60		2.97		3.38		3.01		1.58		1.54		1.72	
Monthly Precip and % of Average	2.71	129	2.52	96	1.77	68	1.96	78	4.25	198	1.41	54	3.19	108	2.79	82	2.65	88	1.47	93	1.26	82	2.54	148
Year-to-Date Precip and % of Average	2.71	129	5.23	111	7.00	95	8.96	91	13.21	110	14.63	100	17.82	101	20.61	98	23.26	97	24.73	97	25.99	96	28.53	99
Madison Drainage																								
Monthly Average Precip	2.81		3.80		4.15		3.98		3.34		3.71		3.78		4.05		3.25		1.83		1.65		1.89	
Monthly Precip and % of Average	2.73	97	3.63	95	2.24	54	3.53	89	9.14	274	1.74	47	5.16	137	3.48	86	3.55	109	1.25	68	1.08	65	3.24	172
Year-to-Date Precip and % of Average	2.73	97	6.35	96	8.59	80	12.11	82	21.25	118	22.99	106	28.15	110	31.63	107	35.18	107	36.43	105	37.50	103	40.74	107
Gallatin Drainage																								
Monthly Average Precip	3.03		3.37		3.43		3.30		3.00		3.90		4.47		5.00		4.17		2.23		1.93		2.27	
Monthly Precip and % of Average	3.60	119	4.87	145	2.43	71	3.60	109	5.37	179	1.53	39	6.13	137	3.10	62	4.47	107	2.57	115	1.27	66	4.07	179
Year-to-Date Precip and % of Average	3.60	119	8.47	132	10.90	111	14.50	110	19.87	123	21.40	107	27.53	112	30.63	104	35.10	104	37.67	105	38.93	103	43.00	107
Canyon Ferry Reservoir																								
Monthly Average Precip	2.36		3.01		3.13		3.03		2.57		3.00		3.29		3.68		3.17		1.66		1.57		1.79	
Monthly Precip and % of Average	2.81	119	3.04	101	1.97	63	2.57	85	5.80	226	1.53	51	3.97	121	3.00	82	3.01	95	1.60	96	1.28	81	3.00	167
Year-to-Date Precip and % of Average	2.81	119	5.86	109	7.82	92	10.39	90	16.19	115	17.72	104	21.69	106	24.70	103	27.70	102	29.30	101	30.58	100	33.58	104
Gibson Reservoir																								
Monthly Average Precip	2.14		2.64		2.58		2.31		2.15		2.33		2.47		3.41		3.58		1.72		1.99		2.08	
Monthly Precip and % of Average	2.97	139	1.52	58	1.88	73	2.05	89	2.34	109	1.08	46	3.36	136	7.30	214	2.05	57	1.90	111	1.33	67	4.39	211
Year-to-Date Precip and % of Average	2.97	139	4.49	94	6.37	87	8.42	87	10.77	91	11.85	84	15.21	92	22.50	112	24.55	104	26.45	104	27.79	102	32.18	109
Lake Elwell Reservoir																								
Monthly Average Precip	3.00		4.20		4.16		3.96		3.46		3.58		3.40		4.12		4.12		1.86		2.14		2.60	
Monthly Precip and % of Average	3.52	117	2.38	57	3.40	82	3.32	84	3.58	103	1.14	32	4.68	138	6.90	167	2.72	66	1.92	103	1.34	63	5.70	219
Year-to-Date Precip and % of Average	3.52	117	5.90	82	9.30	82	12.62	82	16.20	86	17.34	78	22.02	85	28.92	97	31.64	93	33.56	94	34.90	92	40.60	100
Sherburne Reservoir																								
Monthly Average Precip	4.55		7.60		6.90		7.35		5.35		5.15		4.60		4.60		5.25		2.45		2.00		3.30	
Monthly Precip and % of Average	5.70	125	4.55	60	5.95	86	5.15	70	5.20	97	1.45	28	6.30	137	3.25	71	4.45	85	2.30	94	1.95	98	4.60	139
Year-to-Date Precip and % of Average	5.70	125	10.25	84	16.20	85	21.35	81	26.55	84	28.00	76	34.30	83	37.55	81	42.00	82	44.30	82	46.25	83	50.85	86
Bighorn Lake																								
Monthly Average Precip	2.36		2.32		2.19		2.12		1.88		2.58		3.06		3.66		2.84		1.84		1.34		2.20	
Monthly Precip and % of Average	2.06	88	2.87	124	1.50	68	1.61	76	2.38	127	1.41	54	3.11	102	6.68	183	3.25	114	1.51	82	1.09	81	3.87	176
Year-to-Date Precip and % of Average	2.06	88	4.93	105	6.43	94	8.04	89	10.42	96	11.82	88	14.93	90	21.62	107	24.87	108	26.37	106	27.46	105	31.33	110

The following Natural Resources Conservation Service SNOTEL site data was used to compute Table MTT1B:

Lima Reservoir.....Crab Creek, Divide, Island Park, Lakeview Ridge and Tepee Creek
Clark Canyon Reservoir....Beagle Springs, Bloody Dick, Darkhorse Lake, Divide, Lakeview Ridge, Lemhi Ridge and Tepee Creek
Jefferson Drainage.....Beagle Springs, Bloody Dick, Calvert Creek, Clover Meadow, Darkhorse Lake, Divide, Frohner Meadow, Lakeview Ridge, Lemhi Ridge, Lower Twin, Moose Creek, Mule Creek, Rocker Peak, Saddle Mtn, Short Creek and Tepee Creek
Madison Drainage.....Beaver Creek, Black Bear, Carrot Basin, Clover Meadow, Lower Twin, Madison Plateau, Tepee Creek and Whiskey Creek
Gallatin Drainage.....Carrot Basin, Lick Creek and Shower Falls
Canyon Ferry Reservoir.....Beagle Springs, Beaver Creek, Black Bear, Bloody Dick, Calvert Creek, Carrot Basin, Clover Meadow, Darkhorse Lake, Divide, Frohner Meadow, Lakeview Ridge, Lemhi Ridge, Lick Creek, Lower Twin, Madison Plateau, Moose Creek, Mule Creek, Rocker Peak Saddle Mtn, Short Creek, Shower Falls, Tepee Creek and Whiskey Creek
Gibson Reservoir.....Dupuyer Creek, Mount Lockhart, Waldron and Wood Creek
Lake Elwell Reservoir.....Badger Pass, Dupuyer Creek, Mount Lockhart, Pike Creek and Waldron
Sherburne Reservoir.....Flattop Mountain and Many Glacier
Bighorn Lake.....Bald Mountain, Bear Trap Meadow, Blackwater, Bone Springs Div, Burgess Junction, Dome Lake, Evening Star, Hansen Sawmill, Kirwin, Middle Powder, Owl Creek, Powder River Pass, Shell Creek, Sucker Creek, Sylvan Lake, Sylvan Road, Timber Creek and Younts Peak

Table MTT 2: Precipitation in inches and percent of average 2019 mountain precipitation.

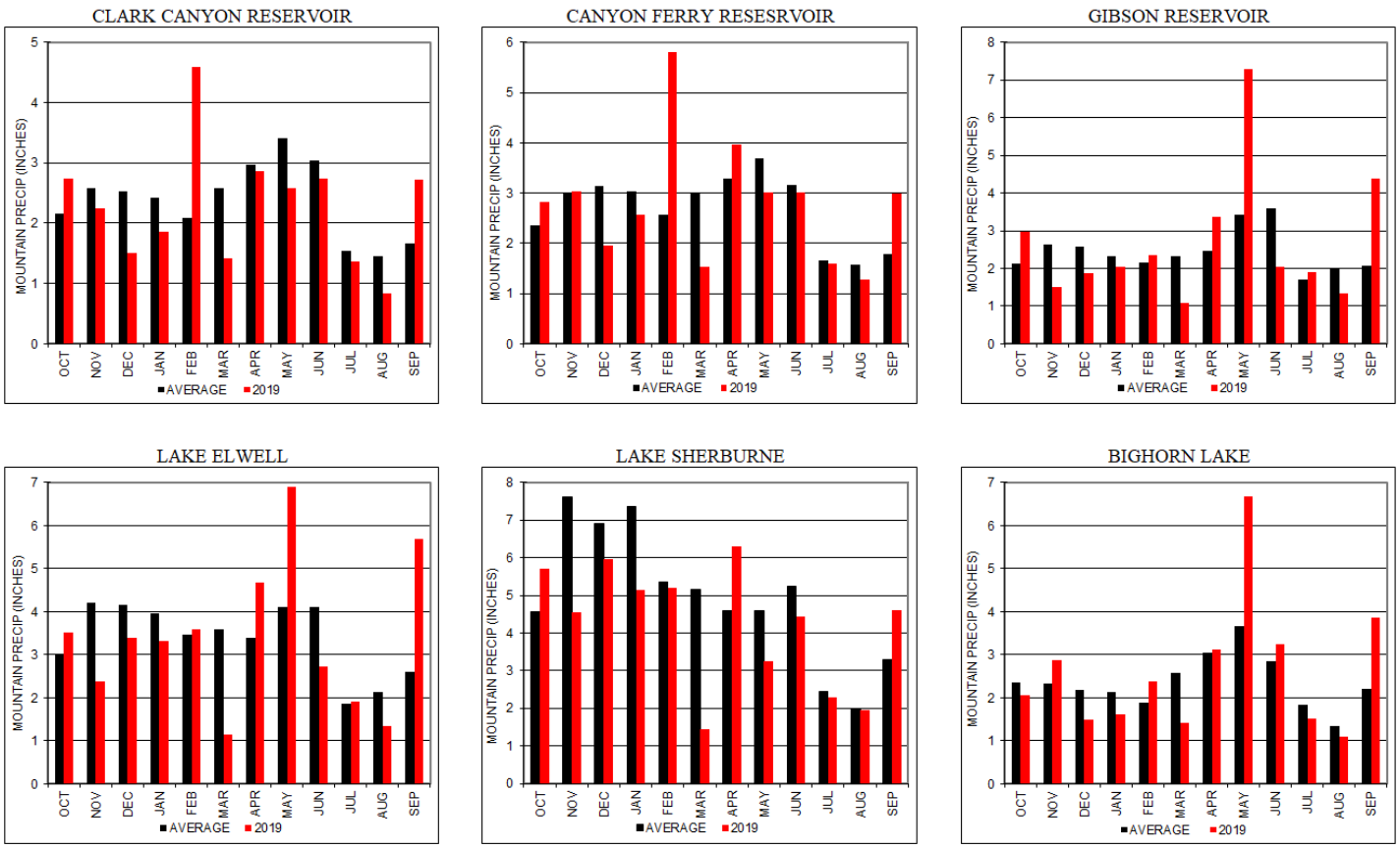


Figure 10: Precipitation in inches and percent of average 2019 mountain precipitation.

January through March

On January 1 the Natural Resources Conservation Service (NRCS) begins compiling reports on mountain snowpack or snow water equivalents throughout Montana and parts of Wyoming. For January 1, the NRCS mountain snow water content ranged from 76 percent of normal in the Madison Basin to 108 percent of normal in the Gallatin Basin, Figure 11. A tabular report of the snow water content is also shown on Table MTT3. On January 1 Reclamation began forecasting the April through July spring runoff volumes for Reclamation reservoirs east of the Continental Divide. The water supply forecasts prepared on January 1 indicated April through July runoff volumes varied from 66 percent of average at Yellowtail Dam to 98 percent of average at Canyon Ferry Dam, Table MTT4.

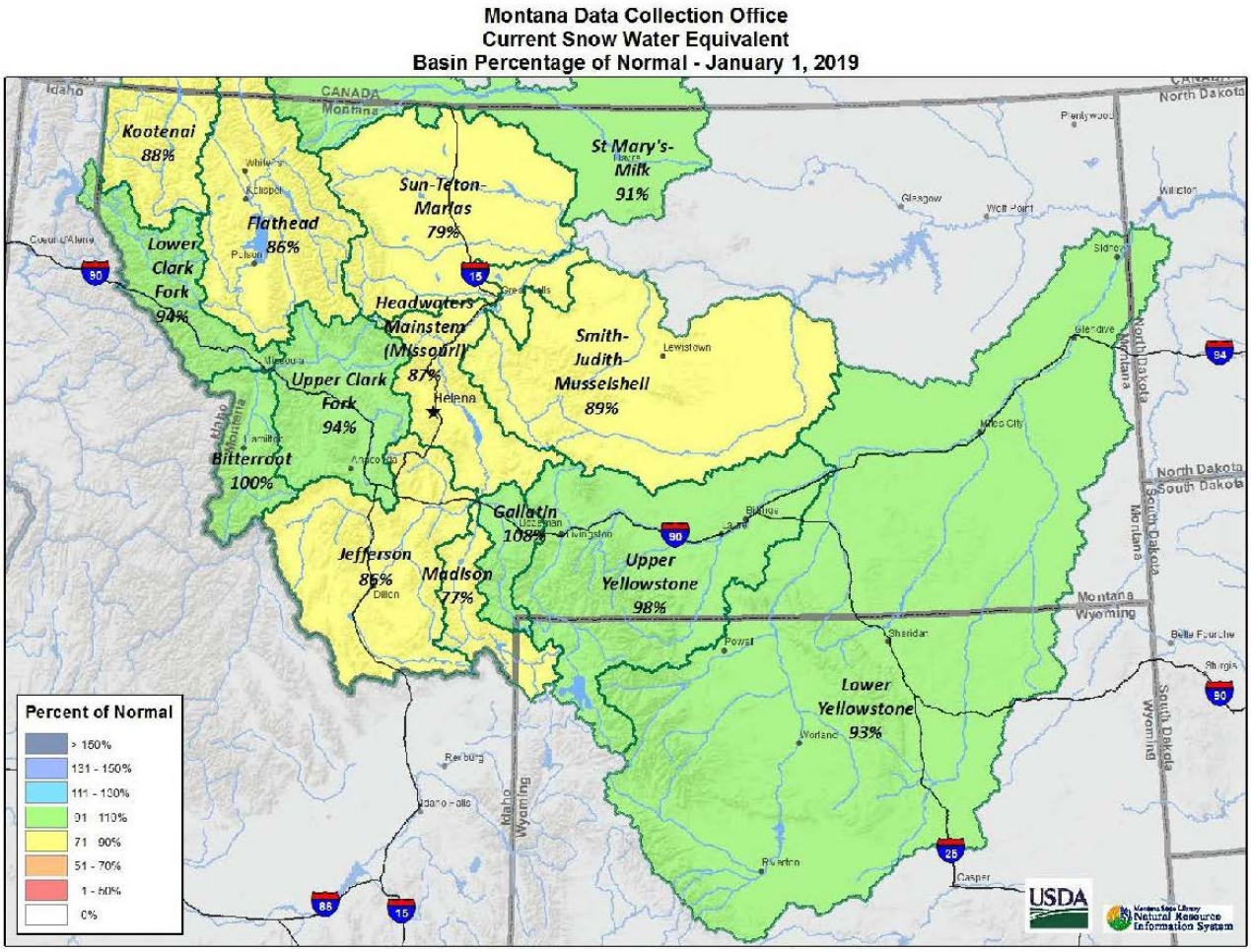


Figure 11: January 1, 2019 Snow Water Equivalent, percent of normal (NRCS)

Statewide composite for Montana temperatures continued to be mixed for January. Temperature averages were 8°F above normal in the eastern half to near normal for the western half. Precipitation was heaviest along the northwestern border and Glacier Park region of Montana while the driest areas were in the southwest. A cold front brought areas of freezing rain to western Montana on the 9 and 10, while a milder period lasted from the 11 through the 16, then another winter storm brought snow to the state later in the month.

Drainage Basin	Jan 1	Feb 1	Mar 1	Apr 1	May 1
Jefferson	85	91	115	105	102
Madison	77	85	130	114	115
Gallatin	108	106	123	107	115
Missouri Headwaters Mainstem	87	111	126	117	118
Sun-Teton-Marias	79	82	91	81	103
St. Mary - Milk River	91	86	97	86	90
Lower Yellowstone (Bighorn Basin)	93	93	102	92	90

Table MTT 3: 2019 mountain snow water content as a percent of normal

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 FORECAST 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	69	89	61.6	79	93.7	120	86.2	111	55	89	27.9	64	75.1	96	87
Canyon Ferry	1,745.50	98	1,793.4	101	2,322.20	130	1,972.30	116	1,615.0	116	1,092.00	129	2,114.90	118	107
Gibson	354.4	89	335.3	80	340.1	81	300	73	298	82	174	80	348.8	82	116
Tiber	299	78	295	76	303	79	234	61	240	73	125	64	459.8	119	196
Sherburne	92	93	90	90	87	87	82	82	77	86	45	77	87.8	88	107
Fresno	72.5	90	69.6	86	71.4	88	53.5	85	40.5	75	30.7	84	29.9	42	42
Yellowtail	810	66	884	72	1,176.00	96	1,025.00	84	852	81	988	132	1,678.20	137	164

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

Table MTT 4: 2019 Water Supply Forecasts

Temperatures through the end of January were generally near to below normal. There were a couple of bigger storms late in the month. Some areas had one to two feet of snow during this time. Individually, the first storm brought 8-12 inches to southeast Montana and 6-9 inches to north-central portions. The second storm had heavier amounts, with 10-17 inches reported in portions of central and eastern Montana.

After a couple of warm days at the start of February, a cold front moved through the state causing rapid temperature drops. In 10 minutes, the temperature dropped 31°F at Loma, from 57°F to 26°F. The cold front also brought heavy snow across central and southwest Montana, totaling 4-5 inches. By February 4, high temperatures were around -10°F across much of central Montana with heavy snow falling over northeast Montana. Ending on the February 5, Glasgow had a record 3-day snowfall of 13.5 inches. The cold air caused temperatures to plunge to -46°F north of Havre on the 7, and to -51°F at Scobey on February 8. Many record lows were set on these dates over northern Montana. As cold air continued to push into western Montana, blizzard conditions occurred in the northwest.

The cold air pushed into southwest Montana and northern Wyoming. Dillon had a record cold maximum temperature on February 9, reaching only -3°F. Strong east winds continued over portions of western Montana, producing wind chills to -45°F. On the 10, Cut Bank reached only -12°F, setting a record. On February 12 and 13, heavy snow fell over northwest Montana. As the snow continued to pile up with the continued cold temperatures, Great Falls measured 14 inches of snow on the 16.

After a brief warm up, temperatures again bottomed out at -37°F at Shelby on February 19. Temperatures rose above 20°F over portions of the plains on February 20, which was the first since the cold air hit. A cold front brought blizzard conditions to central Montana on February 23. For the rest of the month, there were periods of snow, sometimes heavy, with persistent cold conditions. Cold air hit the valleys in the southwest late in the month, causing rapid temperature changes. At one spot near Cameron, the temperature rose from -1°F to 30°F in 30 minutes, and then fell back to -1°F in 15 minutes.

Ice jams began to form on many of the rivers during February because of extreme and extended cold conditions across the state. Many records for intensity and longevity of cold temperatures were

set during this period as well as new records for monthly precipitation totals. See Figures 12 through 15 for February temperature and precipitation departures from normal in Montana and Wyoming. In February, the mountain precipitation resulted in a low of 97 percent of average at Sherburne Reservoir and a high of 319 percent of average above Lima Reservoir in the Red Rock Basin. The valley precipitation also resulted in high monthly values with a low of 114 percent of average at Sherburne Reservoir and a high of 448 percent of average in the Sun-Teton Basin.

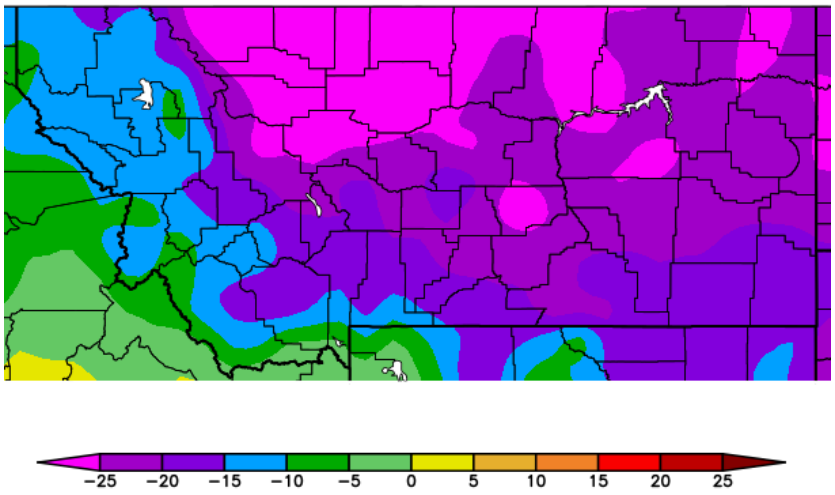


Figure 12: Montana February 2019 temperature departures from normal (°F) (NOAA Regional Climate Center).

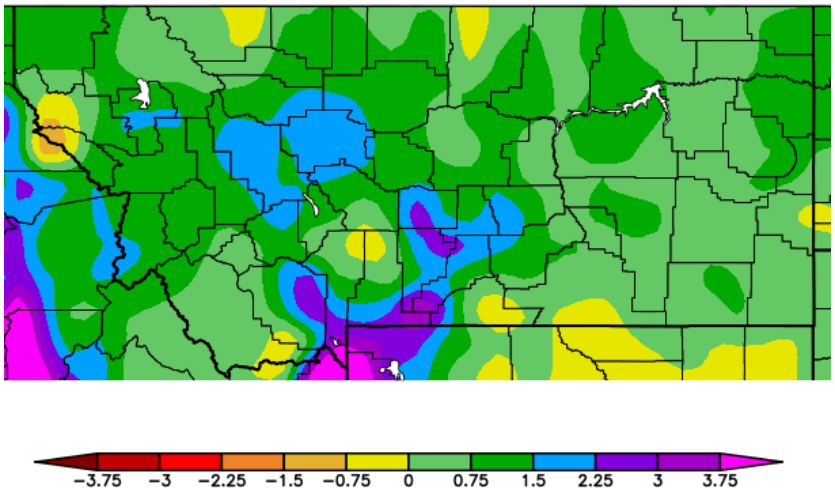


Figure 13: Montana February 2019 precipitation departures from normal (in) (NOAA Regional Climate Center).

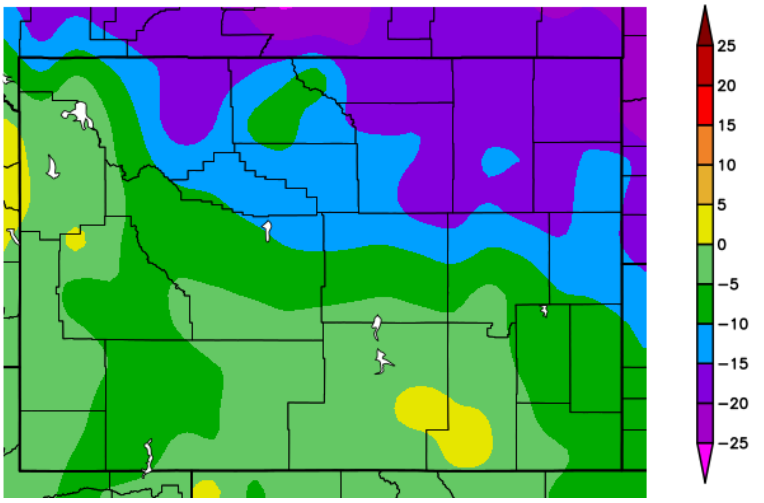


Figure 14: Wyoming February 2019 temperature departures from normal (°F) (NOAA Regional Climate Center).

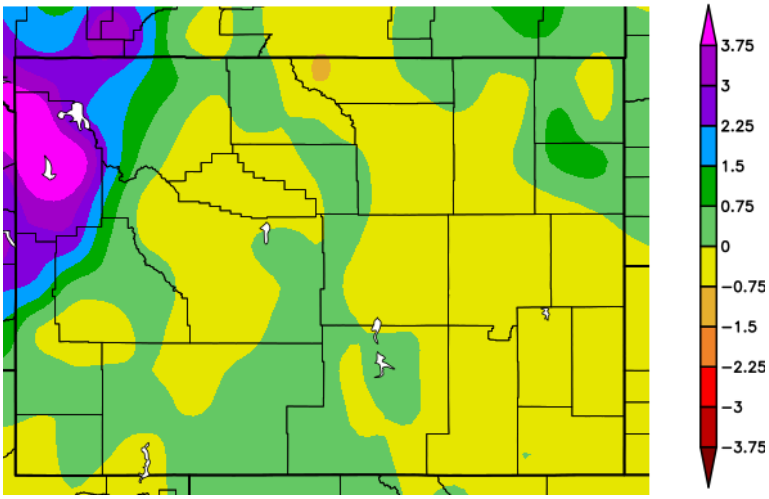


Figure 15: Wyoming February 2019 precipitation departures from normal (in) (NOAA Regional Climate Center).

Due to the precipitation in February, all the April through July water supply forecasts either increased or remained the same for the March 1 forecast. Forecasts ranged from 87 (Sherburne Reservoir) to 130 (Canyon Ferry Reservoir) percent of average. See Figure 16 for the March 1 percent of normal SWE.

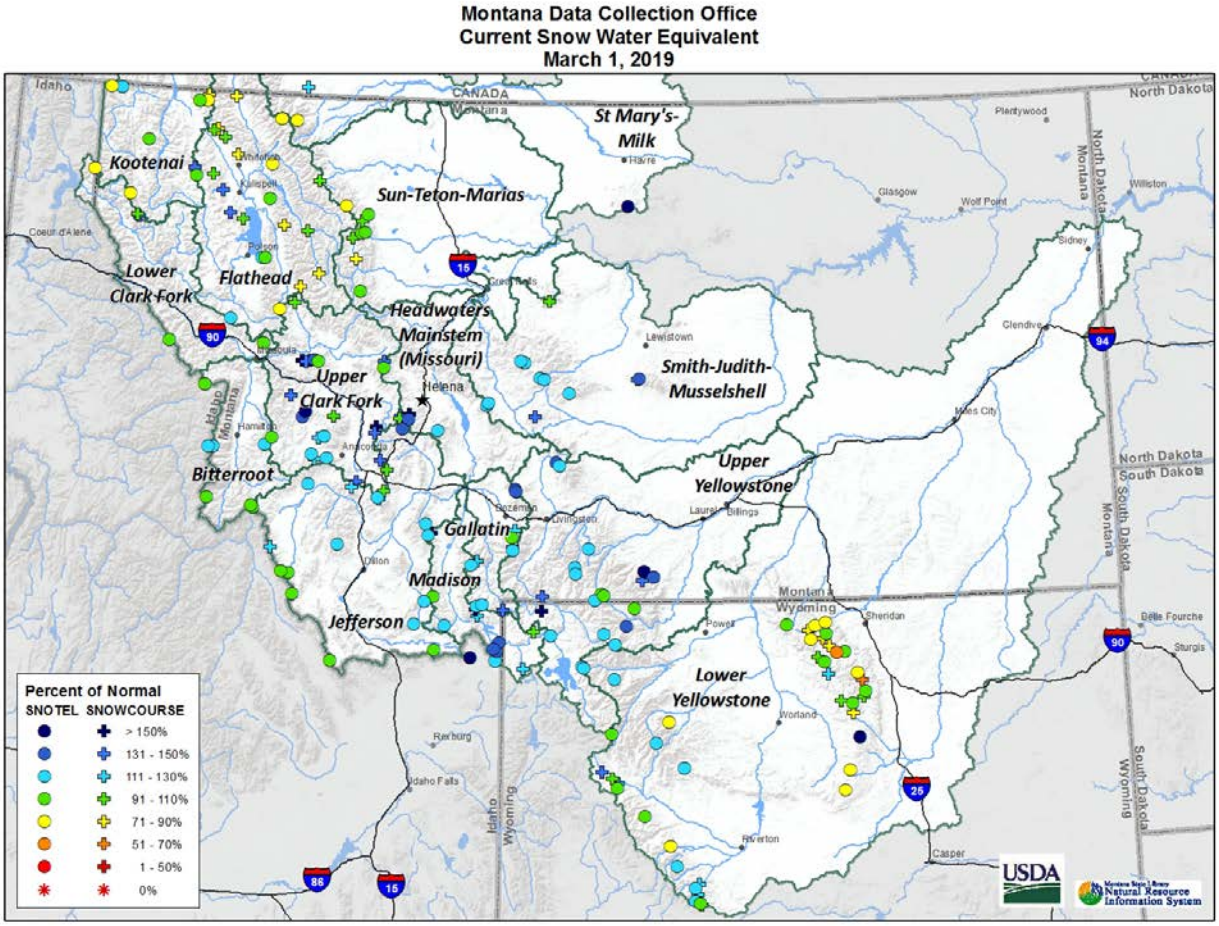


Figure 16: March 1, 2019 Snow water equivalent per site, percent of normal (NRCS).

The cold and snowy pattern from February persisted into early March. Blizzard conditions prevailed over north central Montana. Many locations in central and southwest Montana reported their coldest March temperature on record during this period. The temperature finally went above freezing at Great Falls on March 7. This 32 day period broke the previous long period of 31 days ending February 14, 1929. Since records began at Great Falls (1891), there have been only 8 winters during which the temperature failed to reach freezing for more than 20 consecutive days.

The cold and snowy conditions prevailed for the first 10 days of March. Heavy snow fell over the southeast on March 9. Ice jam flooding started in southwest Montana on March 9. Windy and warmer conditions pushed into portions of eastern Montana on March 11. Blizzard conditions caused roads to be closed along the Rocky Mountain Front. Wind gusts reached 68 miles per hour (mph) at Two Medicine and 74 mph near Choteau. Heavy snow fell over northwest Montana.

From March 16 through the rest of the month, warmer weather brought melting snow and flooding. Many rivers and streams were flooding, with ice jams producing very high water. An ice jam on the Missouri River at the Fred Robinson bridge produced one of the highest stages since the 1950s. Great Falls also had 13 days with a foot or more snow on the ground. This was the second longest

stretch of time, with the longest being a 15-day period in 1936. Helena had a 20 day stretch with a foot or more on the ground, a new record. The old record was 19 days, ending February 8, 1962.

April through June

The April 1 SWE was below normal except for the Upper Missouri River Basin. The resulting April through July forecasted runoff volumes declined from the March 1 forecasts. The April 1 forecasts ranged from 61 percent of average for Tiber Dam to 116 percent of average for Canyon Ferry Dam. All of Reclamation's reservoirs reached their peak snowpack for the year by April 18, Figure 21.

April's temperatures averaged near normal with above normal precipitation. A storm system moved into western Montana on April 9, producing up to two inches of precipitation. This system continued eastward and produced rain and snow across much of the rest of the state. Over three inches of SWE was reported in areas along the Rocky Mountain Front with Badger Pass reporting 23 inches of snow. Temperatures dropped into the teens at many locations on the morning of April 13. The weather warmed mid-month, but eventually cold air returned, and widespread precipitation fell at the end of the month. Amounts from one to two inches of rain fell over a wide area of central Montana. A station near Livingston measured 2.16 inches. The coldest air of the month moved in on April 28 with blizzard conditions occurring across north central Montana. Record lows were set in north central Montana on April 29 and 30. Lewistown reached 10°F on April 29 and Great Falls dropped to 15°F on April 30.

May's average temperatures were below normal over eastern Montana, with slightly above normal values in the west. May temperature anomalies ranged from 6.1°F below normal at Baker to 2.1°F above normal at Mullan Pass. Figure 17 shows the variation, with the warmest average temperatures in western Montana. Precipitation was above normal over much of central and southeast portions, with below normal elsewhere, Figure 18.

The first two weeks of May were very dry across all the western half of the state, with mountain and valley locations recording minimal precipitation. The weather patterns changed mid-month with low-pressure systems dominating the weather pattern across the western and central United States. This typical spring weather pattern favors some locations in the state over others. The east facing basins along the plains tend to receive the most precipitation from the counterclockwise rotation of low-pressure systems and resulting upslope flow.

Heavy rain fell over the Memorial Day weekend along the Rocky Mountain Front. The highest amount of precipitation, 11.43 inches, fell southwest of Augusta. This caused roads to be washed-out and isolated several communities due to flooding along Elk Creek and the Sun River. Precipitation totals during the last 14 days of May along the Rocky Mountain Front ranged from 4.3 to 9.0 inches, causing quick and significant increases in river volumes with widespread flooding in many other areas. See the individual summary reports for Gibson and Tiber Reservoir for rain totals and impact on reservoir operations.

The Bighorn Basin continued to accumulated snowpack in the mountains during the first two weeks of May, before warmer weather began the melt at most elevations. Then a slow-moving low-pressure system delivered incredible amounts of mountain snow and valley precipitation for late May. In general, SNOTEL sites in the Wind River Range and the Absaroka Range received 2.3 inches to 8.7 inches of SWE during this storm cycle and up to 27 inches of snow. Further east in the Bighorn Range, the storm fell as a mix of rain in the valleys and at low elevations in the

mountains, and snowfall at mid and high elevation sites. Up to 4.7 inches of SWE was added to the snowpack at high elevations and up to 7.1 inches of precipitation fell elsewhere in the Bighorn Basin valleys. Monthly precipitation for May ranged from 142 percent to 375 percent of average. See Figure 19 and 20 for monthly average temperature and precipitation departures for May in the Bighorn Basin. See the individual summary report for Bighorn Lake and Reservoir for rain totals and the effects these storms had on reservoir operations.

By the end of May, the year-to-date mountain precipitation varied from a low of 81 percent of average above Sherburne Reservoir to 112 percent of average above Gibson Reservoir. The year-to-date valley precipitation varied from a low of 96 percent of average in the Red Rocks Basin above Lima Reservoir to near 150 percent of average in the Sun and Bighorn River Basins.

Also, during May, major flooding was occurring on the main stem Missouri River system below Fort Peck Reservoir. Therefore, the USACE issued flood control orders in late May to decrease releases from our reservoirs to minimize flooding on the Missouri River and the Missouri River mainstem reservoir system. The USACE and Reclamation coordinated to allow a portion of Canyon Ferry, Bighorn, and Tiber Reservoirs to enter the flood control pool space. Reclamation continued the coordination of release schedules and reservoir storage levels with the USACE throughout June and July. See the individual reservoir summaries for more information on flood control operations.

The month of June yielded below normal precipitation, 57-71 percent throughout Montana, except for above average amounts within the Milk River basin (145 percent). The below normal conditions allowed the reservoirs to fill slowly with steady river releases while continuing to coordinate flood operations with the USACE. Temperatures remained near normal during June. The inflows into Reclamation facilities for the month of June ranged from 59 percent of average at Fresno Reservoir to a high of 217 percent of average at Bighorn Lake.

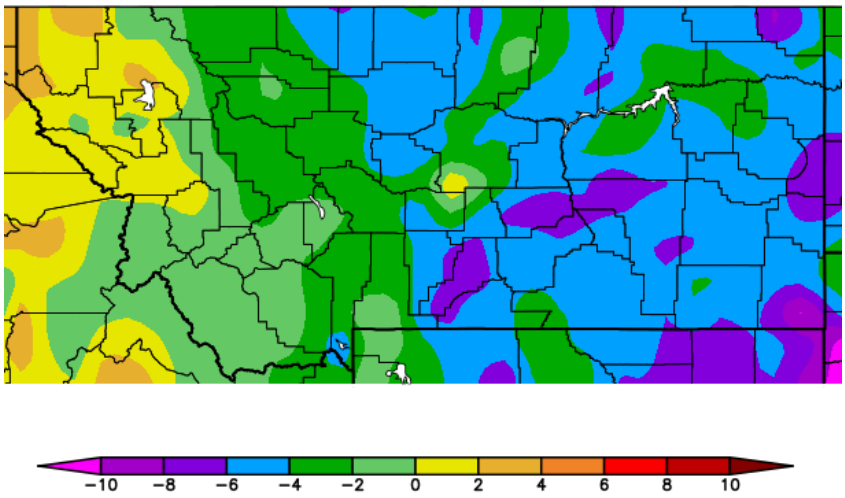


Figure 17: Montana May 2019 temperature departures from normal (°F) (NOAA Regional Climate Center).

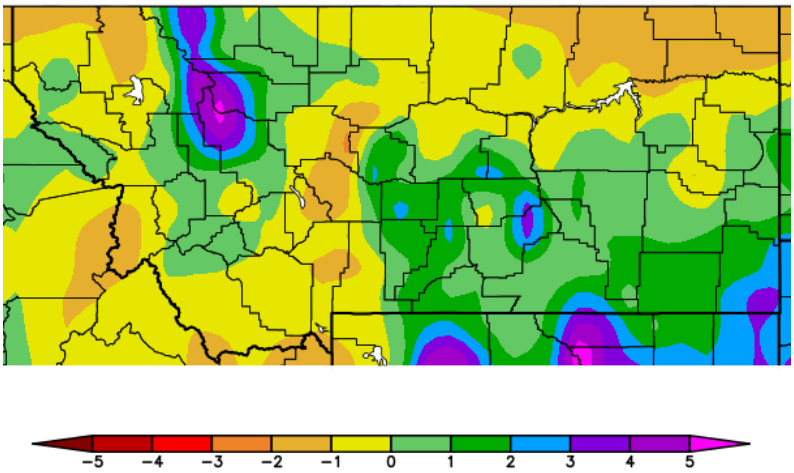


Figure 18: Montana May 2019 precipitation departures from normal (in) (NOAA Regional Climate Center).

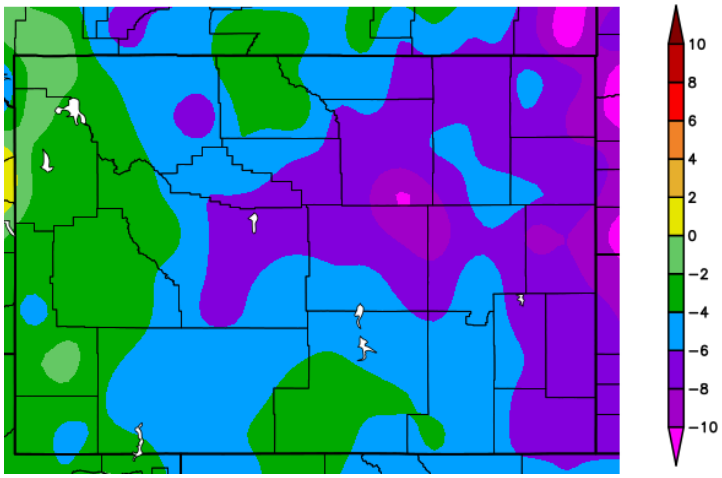


Figure 19: Wyoming May 2019 temperature departures from normal (°F) (NOAA Regional Climate Center).

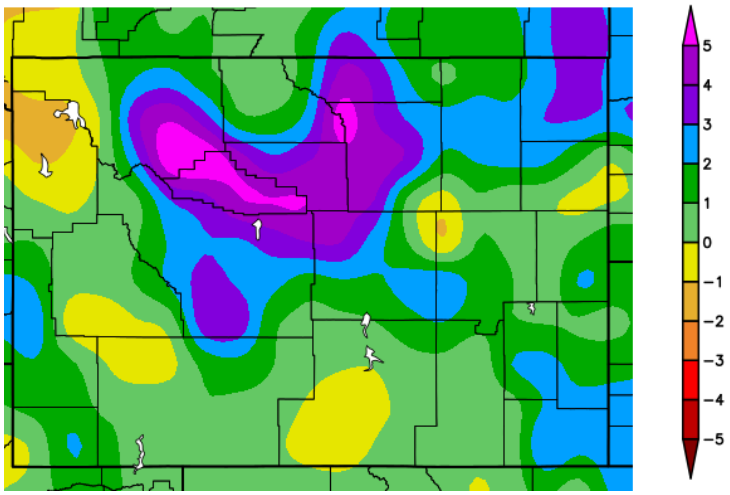


Figure 20: Wyoming May 2019 precipitation departures from normal (in) (NOAA Regional Climate Center).

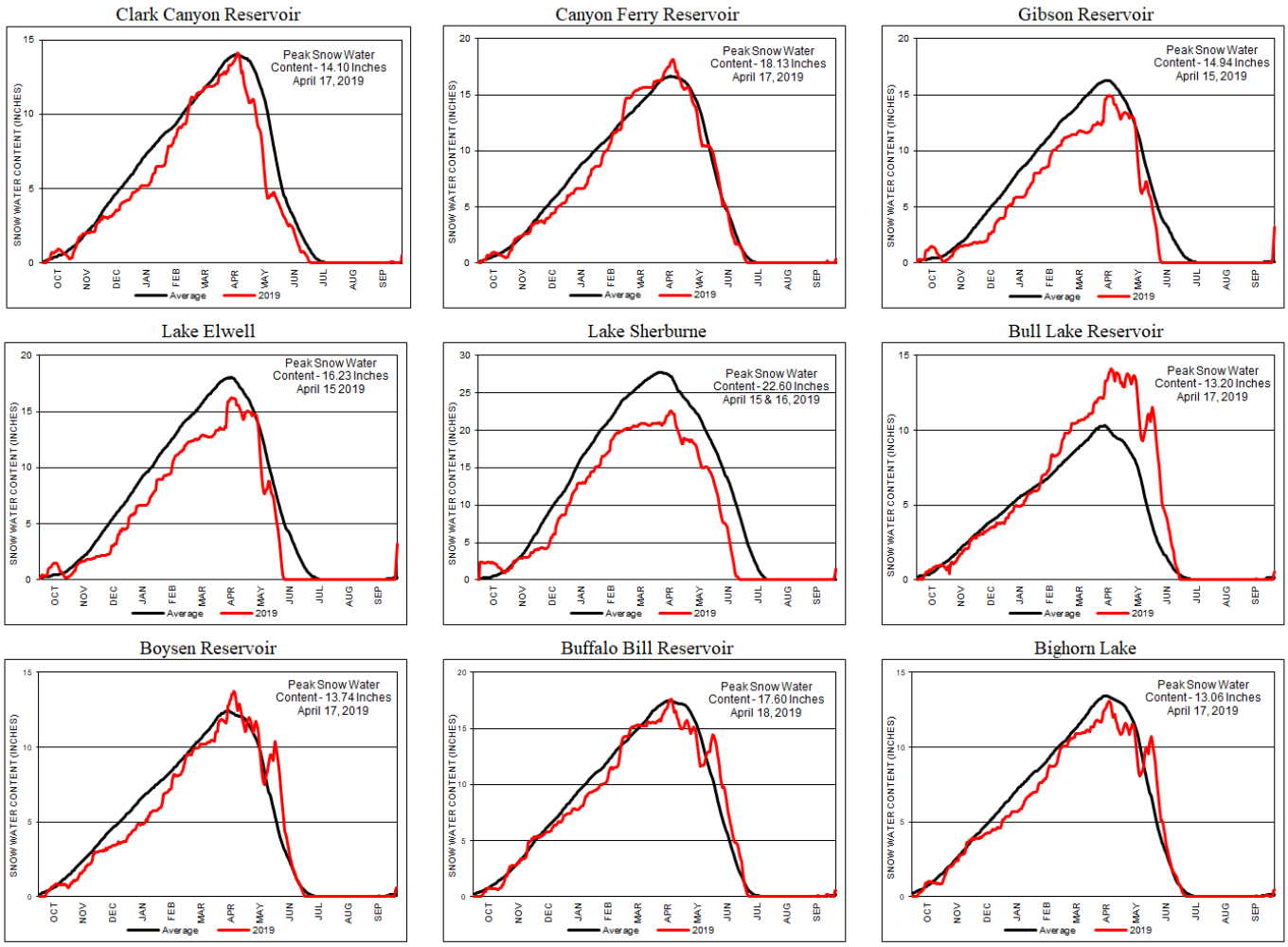


Figure 21: Water year 2019 Snow Water Content

July through September

July brought cooler temperatures and mixed precipitation to Montana, Figure 22 and 23. Irrigation demand continued to rely on reservoir storage. By the end of July, the actual April through July runoff volumes for water year 2019 ranged from 82 percent of average into Gibson Dam to 137 percent of average into Yellowtail Dam, Table MTT4.

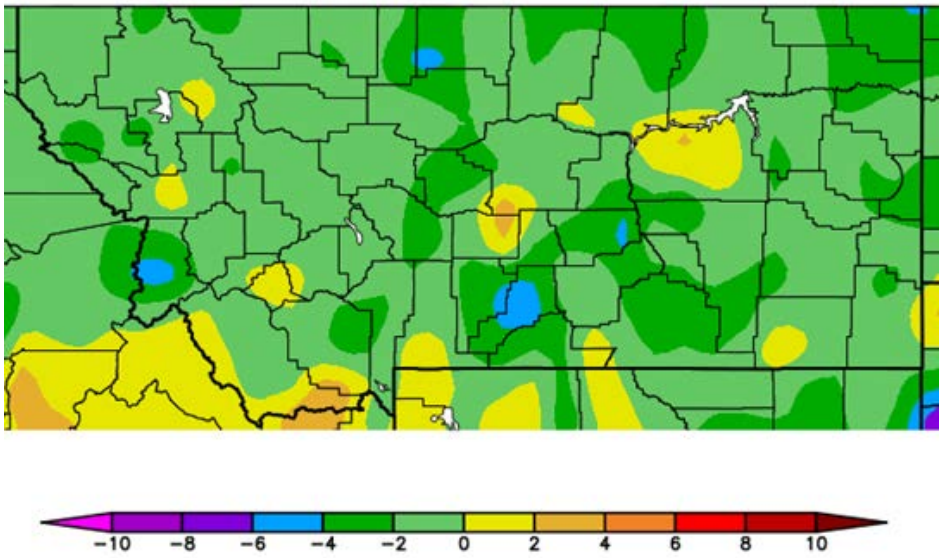


Figure 22: July 2019 temperature departures from normal (°F) (NOAA Regional Climate Center).

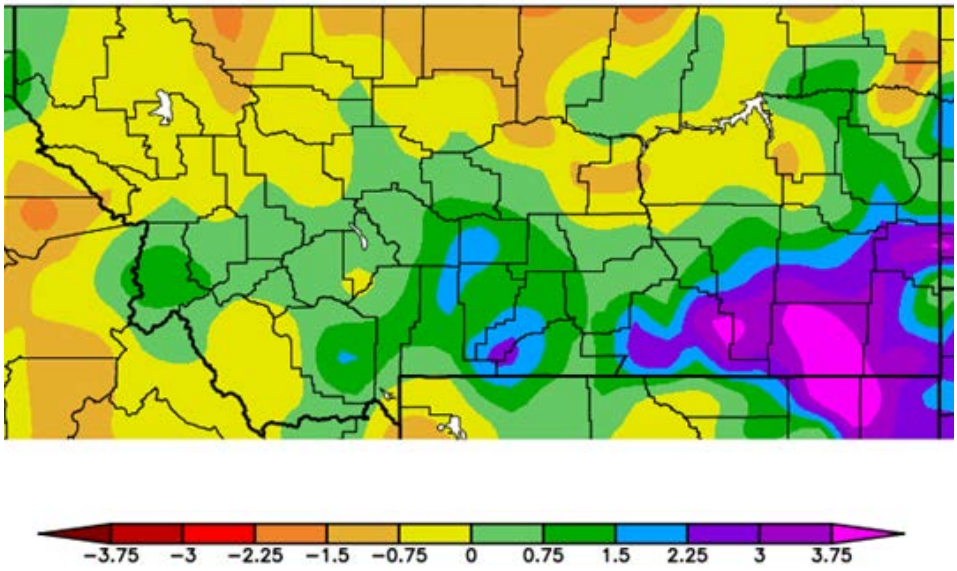


Figure 23: July 2019 precipitation departures from normal (in) (NOAA Regional Climate Center).

August continued to deliver near average temperatures and average to above average precipitation throughout the eastern half of Montana. Due to wet conditions during July and August, the September 12 Montana drought status was updated to near average to slightly moist for most of the state, see Figure 24.

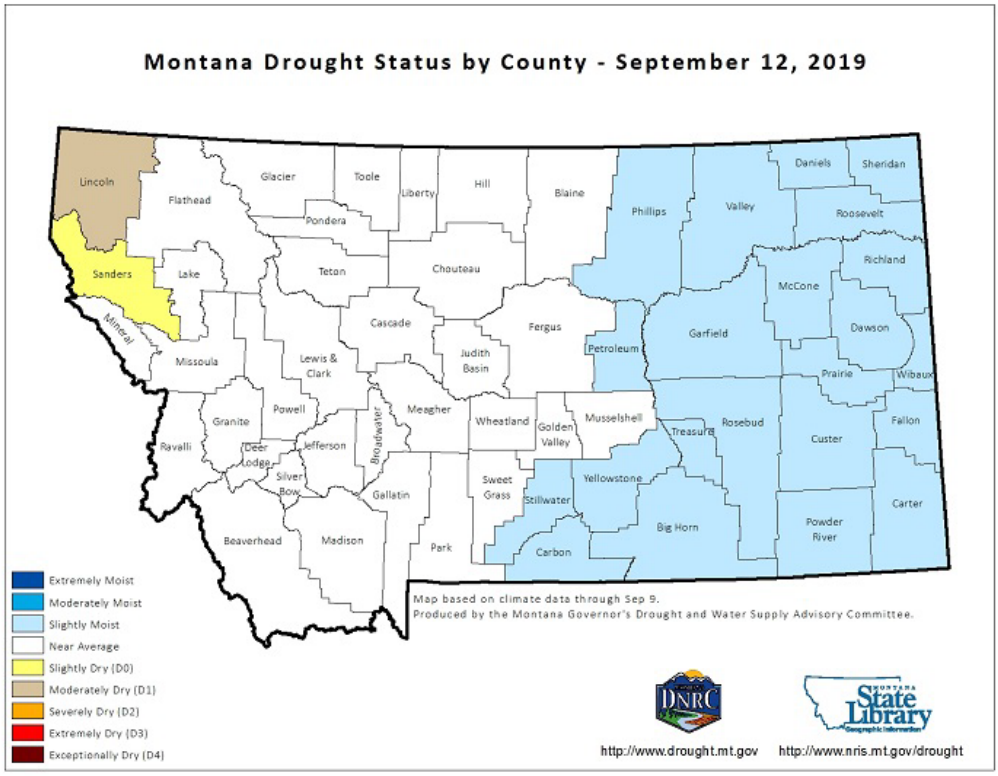


Figure 24: Montana Drought Status Map, September 12, 2019, produced by the Montana Governor's Drought and Water Supply Advisory Committee.

September ended with a historic winter storm that impacted much of Montana from September 28 through September 30. Many areas broke September snowfall and low temperature records. Multiple feet of snow fell along the Rocky Mountain Front and adjacent high plains, with a foot or more in some areas across northern and central Montana. The highest amounts reported were 52 inches in Babb, 48 inches in Browning and 46 inches at the Badger Pass SNOTEL site. Great Falls set a one day 24-hr record, 17.7 inches of snowfall. Low temperatures were in the single digits or teens across most impacted areas.

Water year 2019 ended with varying storage levels. Willow Creek Reservoir was empty at 0 percent of average while Fresno and Nelson Reservoirs were 138 percent of average. The Reclamation reservoirs that ended the year fullest were Nelson Reservoir and Bighorn Lake at 98 percent of normal full capacity. Total inflows into Reclamation facilities in Montana east of the Continental Divide ranged from 82 percent of average at Fresno Dam to 130 percent of average at Bighorn Lake.

The USACE reported the operations of Reclamation projects under the jurisdiction of the Montana Area Office (MTAO) east of the Continental Divide prevented approximately $5.1 million in total flood damages during water year 2019. The damages prevented were credited to the operations of Clark Canyon, Canyon Ferry, Tiber, Fresno, Gibson and Yellowtail. The total flood damages prevented by MTAO's facilities since 1950 is approximately $618.9 million.

Flood Benefits

The USACE evaluated reservoir regulation data pertaining to Reclamation reservoirs within the jurisdiction of the MTAO and indicated that six reservoirs provided flood relief during water year 2019. They were Clark Canyon Reservoir, Canyon Ferry Lake, Lake Elwell, Fresno Reservoir, Gibson Reservoir and Bighorn Lake. The most notable examples of peak flows regulated by Reclamation reservoirs during spring runoff are listed in the following table.

Reservoir	Peak Inflow (cfs)	River Discharge (cfs)	Date
Clark Canyon Reservoir	615	176	04/22/19
Canyon Ferry Lake	16,257	7,000	05/18/19
Lake Elwell	14,294	1,537	05/28/19
Fresno Reservoir	2,219	44	03/26/19
Gibson Reservoir	5,304	3,894	05/27/19
Bighorn Lake	16,007	4,789	05/29/19

Table MTT 5: Notable peak flows regulated by Reclamation facilities.

The USACE estimated the operations of Reclamation reservoirs in Montana during water year 2019 reduced flood damages by $5,064,000. 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 are listed in Table MTT6. For additional information on the operations of the reservoirs within the jurisdiction of the MTAO, refer to the individual "Unit Operational Summaries for Water Year 2019" in this report. Figure 25 shows the annual flood damages prevented by MTAO reservoirs since 1950.

Reservoir	Local	Mainstem	2019 Total	Prev. Accum.	Total Accum.
Clark Canyon Reservoir	0	364	364	18,860	19,224
Canyon Ferry Lake	921	667	1,588	265,161	266,749
Lake Elwell	70	1,341	1,411	99,008	100,419
Fresno Reservoir	365	0	365	19,548	19,913
Gibson Reservoir[1]	1	0	1	3,102	3,103
Bighorn Lake	382	953	1,335	197,709	199,044
Lake Sherburne[2]	0	0	0	10,412	10,412
Total	1,739	3,325	5,064	613,800	618,864

1-No space allocated to flood control, but some flood protection provided through other purposes.
2-Includes USACE of Engineers estimated flood damages.

Table MTT 6: Flood damages prevented by Reclamation facilities, in thousands of dollars

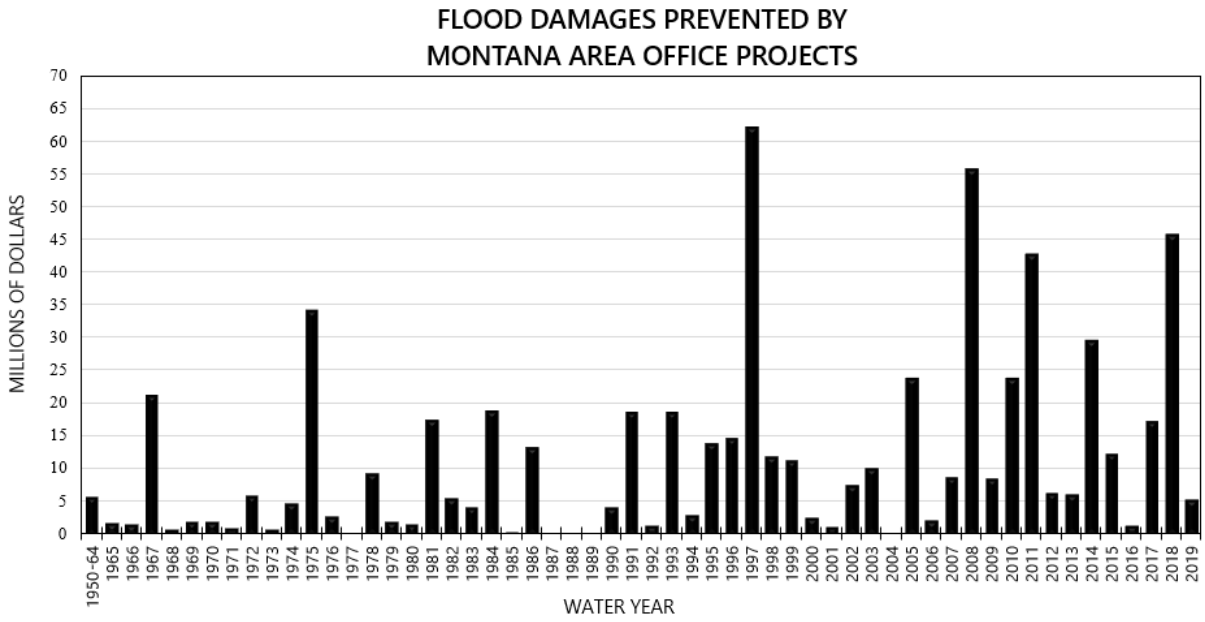


Figure 25: Plot of flood damages prevented by Montana Area Office facilities between 1950 and 2019.

Unit Operational Summaries for Water Year 2019

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 AF (255,643 AF 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 other authorized purposes of the reservoir.

Figure 26: Aerial view of Clark Canyon 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 the reservoir has a storage capacity of 174,367 AF and a surface area of 5,151 acres at a reservoir elevation of 5,46.10 feet. Since closure in 1964, the reservoir has accumulated a sediment volume of 4,106 AF below elevation 5546.10 feet. This volume represents a 2.3 percent loss in capacity and an average annual loss of 114.7 AF. The revised area-capacity table was put into effect on October 1, 2001.

Water year 2019 started with a storage content of 132,839 AF at elevation 5,537.63 feet and a river release near 190 cfs. The climatic conditions began with below average temperatures, two to four degrees below normal, with above average precipitation in the Red Rocks Basin and below normal in the Beaverhead Basin during the month of October. Soil moisture conditions remained above normal and inflows into Clark Canyon were near 350 cfs. Very dry conditions, 50 percent of average, occurred in November with normal temperatures. Inflows into Clark Canyon declined slightly to a 300 cfs average. December improved slightly with near normal precipitation falling in the basins and two to four degrees cooler than normal temperatures. By the end of December, the year-to-date mountain and valley precipitation was 86 and 87 percent of average, respectively. Inflows decreased to 250 cfs with a storage content of 151,932 AF at elevation 5,541.64 feet.

On January 1, the snowpack above Clark Canyon was off to a slow start, as it was near 78 percent of average. The average temperature anomalies during January ranged from two to six degrees above normal in the Beaverhead and Red Rock basins. By mid-month the SWE declined to near 70 percent of average. Due to the declining snowpack and warm temperatures, on January 18, the USACE issued an order to allow Clark Canyon to fill to elevation 5,544.1 feet while maintaining a river release of 200 cfs. By the end of January some precipitation fell, bringing the SWE back up to near 78 percent of average.

February brought bitter cold temperatures and above normal precipitation to the Red Rocks and Beaverhead Basins. Temperatures ranged from 5 to 15 degrees below normal while 100 to 400 percent of normal precipitation fell during the month. Due to the cold temperatures, ice formed on the Beavered River and caused local irrigation ditches and fields to flood. Therefore, on February 11 the USACE issued flood control regulation order 19-02 to reduce releases from Clark Canyon from 200 cfs to 175 cfs. By the end of February, the year-to-date mountain and valley precipitation was 110 and 105 percent of average, respectively.

The March 1 measured snowpack remained steady at near average conditions. Based on snowpack and basin conditions, the March 1 runoff projection for the April through July period was 93,700 AF, or 120 percent of the 30-year average. The East Bench Unit Joint Board (Joint Board), consisting of three representatives from each water user entity, met on March 5 to discuss the water supply outlook for the 2019 irrigation season. The forecast projected above average storage levels, therefore the Joint Board tentatively set full allotments with the Clark Canyon Water Supply Company (CCWSC) at 4.0 AF/acre and the East Bench Irrigation District (EBID) at 3.1 AF/acre.

The bitter cold continued into the month of March. Temperature anomalies ranged from 4 to 15 degrees below normal with new record lows experienced in Dillon. Ice jams were still present however no other low land flooding was noted. Releases from Clark Canyon Dam remained at 175 cfs while inflows reduced to 200 cfs by mid-month. A pocket of precipitation fell in the Red Rocks and Beaverhead Basin where the SWE increased to average. By the months end, temperatures rose, allowing the low elevation snow to begin melting. Streams were still ice covered therefore some additional low land flooding was occurring throughout the basins.

On April 1, the NRCS measured the mountain snowpack in the Beaverhead Basin at 106 percent of median. The water supply forecast prepared on April 1 predicted the April through July runoff into Clark Canyon Reservoir would be 111 percent of average, totaling approximately 86,200 AF. Even though the forecasts decreased from the March projections, the forecast still projected a full water supply. Therefore, the Joint Board confirmed full allotments for the 2019 irrigation season by letter to Reclamation on April 15, 2019 (CCWSC 4.0 AF/acre, EBID 3.1 AF/acre).

The month of April brought 25-70 percent of normal precipitation (1.5 inches below normal) to the basin with very warm temperatures occurring in the Red Rocks Basin (4 to 8 degrees above normal) while the Beaverhead Basin temperatures were near normal. Inflows into Clark Canyon increased to near 500 cfs by April 10 while the snow-pack above Clark Canyon peaked on April 17. Due to the warm temperatures, the high elevation snow started to melt and by April 22 and inflows increased to a peak of 615 cfs. The snowpack quickly decreased from 100 percent of normal on April 18 to 80 percent of normal by April 28. The reservoir steadily increased and reached full pool on April 26 while releases were increased to 240 cfs. Inflows started to decline, but reservoir storage continued to encroach into the flood control pool. Therefore, on May 2 the USACE issued flood regulation

order 19-03 to increase releases to 600 cfs to evacuate the water within the flood control pool. Clark Canyon Reservoir reached peak storage content of 176,536 AF at elevation 5,546.52 feet. On May 6 the USACE issued flood control order 19-04 to reduced releases to 445 cfs as the flood control pool was evacuated. Releases for the remainder of the month were based upon meeting irrigation demands.

The water supply forecast prepared on May 1 predicted a May through July runoff into Clark Canyon Reservoir of 55,000 AF, or 89 percent of average. May was dry with average temperatures. The snowpack above Clark Canyon Dam declined from 11 inches of SWE on May 1 down to 3.7 inches of SWE by May 31.

The water supply forecast prepared on June 1 predicted a June through July runoff into Clark Canyon Reservoir of 27,900 AF, or 64 percent of average. Very dry conditions prevailed through June with 1.5 inches less than normal precipitation received in the basins above Clark Canyon Dam. Again, very warm conditions persisted in the Red Rocks Basin while near normal temperatures occurred in the Beaverhead Basin.

A slight shift in weather during July occurred with cooler temperatures and near normal precipitation in Beaverhead Basin and up to 200 percent of normal precipitation in the Red Rocks Basin. As a result, total inflow during July was 20,600 AF. Releases changes from Clark Canyon Dam were based upon irrigation demands.

Snowmelt runoff during April through July was average, at 96 percent, totaling 75,100 AF. Daily inflows into Clark Canyon Reservoir averaged 424 cfs during April, 230 cfs during May, 253 cfs during June and 335 cfs during July. Releases during the April through July time period averaged 186 cfs in April, 431 cfs in May, 608 cfs in June, and 597 cfs in July. Storage reached the peak for the year of 176,536 AF at elevation 5,546.52 feet on May 2.

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 filled to the top of the conservation pool. The reservoir peaked at 72,984 AF, elevation of 6,580.90 feet, on May 23. Lima Reservoir ended the water year with a storage content of 34,092 AF, elevation 6,571.64 feet, and a release near 70 cfs. The drainage area above Lima Reservoir accounts for about 25 percent of the total drainage area above Clark Canyon Reservoir.

August temperatures and precipitation were near average. On August 10 - 11 severe thunderstorms storms passed through southwest Montana. Golf-ball size hail fell in the Dillon and Sheridan areas and a microburst was reported in the Tobacco Root mountain range which caused 200 to 250 acres of trees to be blown down. Clark Canyon Reservoir drafted to 5,531.76 feet by August 31 as irrigation demands continued. September brought much needed precipitation, up to 163 percent of normal precipitation in the mountains and up to 132 percent of normal in the Beaverhead Basin valley.

On September 10, the Joint Board held a meeting to discuss winter releases as per Contract 069D670009 and Contract 069D670010. Reclamation provided a most probable reservoir operation plans with winter releases ranging from 85 cfs to 140 cfs. The Joint Board discussed the need to fill to full pool and the 85 cfs winter releases rate would accomplish this goal. However, Reclamation wrote in a letter dated October 9, 2019 to the Joint Board setting the winter release rate at 100 cfs as

per the intent of the Environmental Assessment guidelines. Reclamation, the Joint Board and MT FWP further coordinated and agreed to a 90 cfs winter release rate while storing 10 cfs for spring pulses. The winter release from Clark Canyon Reservoir was set at 90 cfs on October 16.

Most of the storage water released from Clark Canyon Reservoir during water year 2019 was released from April 25 through September 30 for flood control purposes and meeting downstream irrigation demands. The EBID water users received approximately 68,091 AF at the point of diversion, leaving 2,245 AF of their allotment in the reservoir. The CCWSC received supplemental water along with their water rights of 94,215 AF, leaving 9,465 AF of their supplemental water in the reservoir. The total May 15 through September 29 irrigation deliveries recorded by the river commissioner for the "non-signer" users on the Beaverhead River was 36,258 AF on approximately 4,840 acres.

The total inflow to Clark Canyon Reservoir during water year 2019 was 104 percent of the 30-year average, totaling approximately 205,300 AF. The total annual release to the Beaverhead River from Clark Canyon Reservoir was 236,000 AF. By the end of September, the total cumulative valley precipitation for the water year was 91 percent of average, while the total cumulative mountain precipitation was 97 percent of average.

The USACE determined that during water year 2019, Clark Canyon Reservoir prevented $0 in local flood damages and $364,000 in main stem flood damages.

Important Events in Water Year 2019

January 18, 2019: USACE Flood Control Regulation Order No. 19-01 was issued. Current release near 200 cfs was to be maintained until the reservoir reaches elevation 5,544.1 feet.

February 11, 2019: Flood Control Regulation Order No. 19-02 was issued by USACE. An ice jam formed on the Beaverhead River causing flows to unexpectedly pass through irrigation ditches and across fields. Release were reduced to near 175 cfs.

May 2, 2019: Flood Control Regulation Order No. 19-03 was issued by USACE. Releases were increased to 600 cfs to evacuate water within the flood control pool. Clark Canyon Reservoir reached peak storage content of 176,536 AF at elevation 5,546.52 feet.

May 6, 2019: Flood Control Regulation Order No. 19-04 was issued by USACE. Releases were reduced to 445 cfs as the flood control pool was evacuated.

Additional hydrologic and statistical information pertaining to the operation of Clark Canyon Reservoir during water year 2019 can be found in Table MTT7 and Figure 27.

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	5537.63	132,839	OCT 01, 2018
END OF YEAR	5531.78	107,593	SEP 30, 2019
ANNUAL LOW	5531.24	105,424	SEP 10, 2019
ANNUAL HIGH	5546.52	176,536	MAY 02, 2019
HISTORIC HIGH	5564.70	283,073	JUN 25, 1984

INFLOW-OUTFLOW DATA	INFLOW	DATE	OUTFLOW	DATE
ANNUAL TOTAL (AF)	269,619	OCT 18-SEP 19	230,579	OCT 18-SEP 19
DAILY PEAK (CFS)	615	APR 22, 2019	704	JUL 27, 2019
DAILY MINIMUM (CFS)	117	JUN 07, 2019	171	SEP 30, 2019
PEAK SPILL (CFS)			0	N/A
TOTAL SPILL (AF)			0	N/A

	INFLOW*		OUTFLOW*		CONTENT*	
MONTH	KAF	% OF AVG	KAF	% OF AVG	KAF	% OF AVG
OCTOBER	21.8	130	13.8	170	140.8	159
NOVEMBER	18.0	104	11.6	156	147.3	150
DECEMBER	16.7	113	12.0	165	151.9	144
JANUARY	15.3	118	12.1	192	155.2	138
FEBRUARY	13.0	110	10.1	180	158.0	133
MARCH	14.5	97	10.7	165	161.8	128
APRIL	25.2	172	11.1	139	176.0	132
MAY	14.1	88	26.5	120	163.6	128
JUNE	15.1	57	36.1	111	142.5	118
JULY	20.6	78	36.7	85	126.4	127
AUGUST	14.0	93	32.9	105	107.5	129
SEPTEMBER	16.8	114	16.7	104	107.6	132
ANNUAL	205.3	105	230.6	119		
APRIL-JULY	75.0	96				

* Based on previous 30 years

Table MTT 7: Hydrologic data for 2019: Clark Canyon – East Bench Unit. New sediment survey data effective October 1st, 2001.

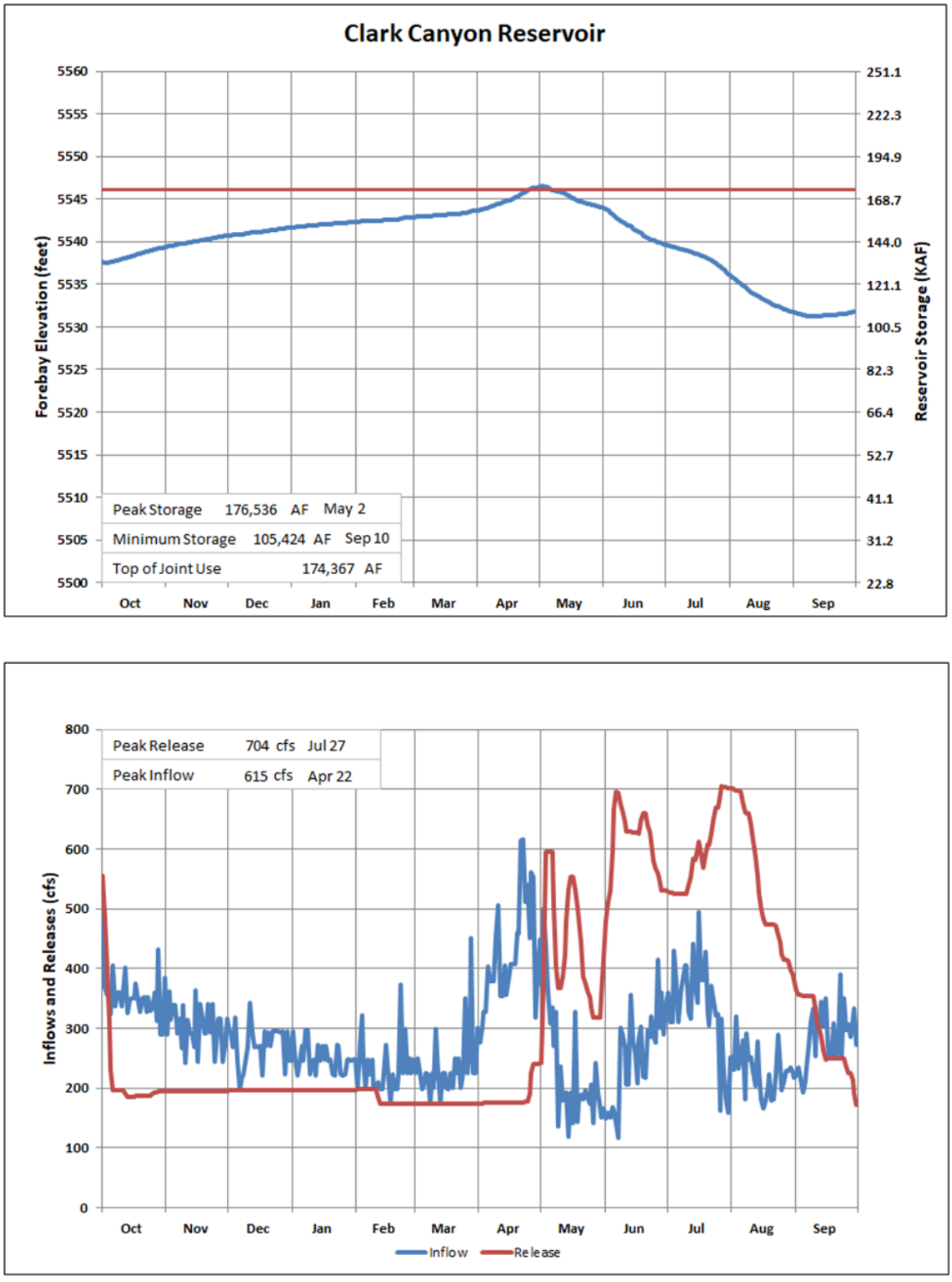


Figure 27: Plot of WY2019 hydrologic data for Clark Canyon Reservoir.

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 AF. The top three 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 is evacuated for flood control purposes, only to the extent that refill during the spring runoff is reasonably assured. The conservation storage is operated 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 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 receive 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.

Figure 28: Canyon Ferry Dam spillway and outlet works

In 1997, a hydrographic and a topographic survey were conducted resulting in a new elevation-area capacity table and curve. The survey determined that Canyon Ferry Lake had a storage capacity of 1,992,977 AF and a surface area of 34,048 acres at reservoir elevation 3,800.00 feet. Since closure in 1953, the reservoir has accumulated a sediment volume of 59,746 AF below reservoir elevation 3,800.00 feet. This volume represents a 2.91 percent loss in capacity and an average annual loss of 1,345.6 AF. The revised area-capacity table was put into effect on October 1, 1998, reflecting the new storage levels.

Water year 2019 started with a storage content of 1,633,041 AF at an elevation of 3,789.04 feet (104 percent of average), and releases to the Missouri River near 4,100 cfs.

October prevailed with two to four degrees below normal temperatures with mixed precipitation patterns. Below normal conditions prevailed in the Jefferson Basin, while above normal precipitation prevailed in the Madison and Gallatin Basins. Inflows averaged 4,250 cfs while releases remained near 4,100 cfs below Holter Dam. November temperatures returned to normal while the

same precipitation trends continued in the respective basins. Due to near normal climate patterns, inflows into Canyon Ferry slightly increased to an average of 4,460 cfs. The SWE by November 30 was 88 percent of average.

Normal temperature trends continued with below normal precipitation falling during December in the Upper Missouri Basin. Northwestern Energy requested additional flow for the month of December, therefore releases from Canyon Ferry were increased to 4,700 cfs. By the end of December, the valley precipitation had a year-to-date percent of average of 113 in the Jefferson, 136 in the Madison, and 139 in the Gallatin. On December 31, the storage content of Canyon Ferry Reservoir was at 1,607,686 AF or elevation 3,788.24 feet with inflows near 3,100 cfs.

On January 1 the SWE of the mountain snowpack above Canyon Ferry Reservoir was 81 percent of average. Temperature during January continued to be near normal throughout the Upper Missouri Basin while precipitation continued to decline. Precipitation departures ranged from a low of 25 percent in the Beaverhead Basin up to 110 percent of normal in the Madison and Gallatin Basin. Snow accumulation was slowly building due to the drier precipitation patterns, which resulted in below normal averages. On January 31, the storage content of Canyon Ferry Reservoir was at 1,548,425 AF or elevation 3,786.35 feet with inflows near 3,700 cfs while releases remained at 4,700 cfs.

On February 1 the mountain snowpack measured 83 percent of average. February brought bitter cold temperatures starting on February 3 and lasting through March 6. Maximum temperatures did not rise above 32 degrees for the entire 32 day stretch. In addition, 30 out of 32 days' temperatures were below 0 degrees and 20 out 32 days the low temperatures were below -10 degrees as recorded at Great Falls. These extreme and extended cold temperatures caused ice jams along the Missouri River. One property located along the bank of the Missouri had water backed-up and frozen to the roofline of an 8-foot-tall boat house. In addition, some roads along the Missouri River in Great Falls were flooding and had to be closed to traffic. Other low-lying structures along the Missouri were also seeing impacts. February also brought above average low and high elevation snow resulting in an end of month SWE of 112 percent of average.

After March 6, temperatures slowly rebounded to highs in the 40's which allowed for a slow melt to the massive amounts of ice in the river system. No other flooding impacts were noted. Inflows into Canyon Ferry Dam began to rise by the end of March as the ice thawed in the basins above, while the ice below remained. The high inflows caused the reservoir elevation to increase as releases changes downstream were steady due to river icing near Great Falls. See Figure 29 depicting the severity of ice buildup, over 11 feet high, on a section along the Missouri River.

Figure 29: Northwestern Energy employee measures ice on the Missouri River in March 2019.

On April 1 the mountain snowpack declined to 101 percent of average. Reclamation's April through July forecasted inflow volume was 116 percent of average (1,972.3 thousand-acre feet (KAF)). Temperatures began to rise, melting the basins low elevation snowpack and causing inflows to rise to 10,300 cfs by April 10. Diversions for the Helena Valley Irrigation District to the Helena Valley Reservoir also began on April 10. Snow continued to accumulate at above average rates in the Gallatin and Madison mountain ranges resulting in a peak SWE of 18.1 inches on April 17. As the Missouri River was free of ice, releases from Canyon Ferry Dam steadily increased throughout the month from 5,400 cfs to a peak release of 11,000 cfs by April 24 and inflows increased to 13,000 cfs by April 23. The reservoir elevation by the end of April was 3,784.47 feet.

On May 1, Reclamation's May through July forecasted inflow volume remained near 116 percent of average (1,615.0 KAF). Inflows slowly declined to near 8,000 cfs by May 13 from the melt in late April. Releases were also decreased to near 6,800 cfs to begin filling the reservoir. Rising temperatures in the basin began to melt the mid to high elevation snow and inflows rose to 16,200 cfs by May 18. Releases were maintained near 7,000 cfs as 11.8 feet remained to fill to the top of the joint use pool. Overall, the month of May had below normal temperatures with continual dry conditions in the Jefferson and part of the Madison Basins. Above normal precipitation fell in the Gallatin Basin.

Unlike the conditions in parts of the Upper Missouri, major flooding was occurring on the main stem Missouri River system below Fort Peck Reservoir. Therefore, on May 30 the USACE issued a

flood control order to decrease releases to near 6,210 cfs to minimize flooding on the Missouri River and the Missouri River mainstem reservoir system. The USACE and Reclamation coordinated on the use of a portion of the Canyon Ferry flood control pool space. Coordination with the USACE continued throughout June and July.

On June 1 Canyon Ferry Reservoir was at elevation 3,788.88 feet with inflows near 11,300 cfs. The updated June through July runoff forecast was 1,092.0 KAF, or 129 percent of average. The runoff in June was slow and steady, reaching near 16,000 cfs by June 8. Inflows started to slowly decline allowing releases to be decreased to near 5,600 cfs to the river by mid-month with the plan still to utilize some flood control space. On June 24 Canyon Ferry Reservoir entered the flood control pool and by the months end inflows were near 6,000 cfs, releases near 4,300 cfs, and the reservoir was at elevation 3,797.56 feet.

Cool and wet conditions occurred during the first two weeks of July which kept inflows into Canyon Ferry above 5,000 cfs. The reservoir filled to the peak elevation of 3,798.16 feet by July 9. In coordination with the USACE, releases were gradually increased to 6,000 cfs to begin evacuating the flood control pool. The flood control pool was evacuated on July 25. Inflows by the months end were near 2,400 cfs, while releases to the Missouri River were reduced to near 4,900 cfs.

The April through July runoff into Canyon Ferry during water year 2019 was 120 percent of average, totaling approximately 2,115,000 AF.

August generated normal temperatures with below normal precipitation in all three of the upstream basins, the Jefferson, Madison, and Gallatin. Canyon Ferry Reservoir continued to slowly draft as inflows averaged 2,375 cfs while releases to the Missouri River averaged near 4,400 cfs. September took a turn and produced much above average precipitation in all three of the basins. The valley recorded approximately 155 percent of average in the Jefferson, 204 percent in the Madison, and 265 percent in the Gallatin Basin during September. Temperatures however were near normal for the month.

By the end of the water year, Canyon Ferry Lake had a storage content of 1,624,470 AF at elevation of 3,788.77 feet (103 percent of average), with inflows near 4,300 cfs and releases near 4,300 cfs. The annual inflow to Canyon Ferry Lake was 113 percent of average, totaling 3,892,422 AF.

During water year 2019, Canyon Ferry powerplant generated 372,444,000 kilowatt-hours, 99 percent of the long-term average dating back to 1967. The powerplant used 3,029,437 AF, or 78 percent of the total water released from the dam. The other 22 percent was a combination of releases to meet irrigation needs for Helena Valley Irrigation District (177,633 AF), 317,176 AF was released through the river outlet gates, and 376,746 AF spilled through the spillway gates.

The USACE estimated that during water year 2019, Canyon Ferry Dam prevented $921,000 in local flood damages and prevented $667,000 in flood damages downstream on the Missouri River main stem.

Important Events in Water Year 2019

December 2018 and January 2019: In coordination with Northwestern Energy, releases were increased to 4,700 cfs to the river. The extra volume delivered was in accordance with the operation agreement.

April 10, 2019: Helena Valley Irrigation District started pumping water to the Helena Valley Reservoir. Diversions from Canyon Ferry Reservoir were adjusted throughout the season to meet irrigation demands from the Helena Valley Reservoir.

April 2019: Canyon Ferry releases were increased throughout the month to a peak release of 11,000 cfs to control reservoir storage.

May 30, 2019: USACE issued flood control order no. CAFE 19-1 to decrease releases to near 6,210 cfs minimize flooding on the Missouri River and the Missouri River mainstem reservoir system.

June 13, 2019: USACE issued flood control order no. CAFE 19-2 to decrease releases to near 5,980 cfs minimize flooding on the Missouri River and the Missouri River mainstem reservoir system.

June 24, 2019: USACE issued flood control order no. CAFE 19-3 to decrease releases to near 5,250 cfs minimize flooding on the Missouri River and the Missouri River mainstem reservoir system. Decreases of approximately 250 cfs each day will be made between June 24-26.

June 28, 2019: USACE issued flood control order no. CAFE 19-4 to decrease releases to near 4,745 cfs minimize flooding on the Missouri River and the Missouri River mainstem reservoir system. Decreases of approximately 250 cfs each day will be made between June 27-28.

July 6-9, 2019: USACE issued flood control order no. CAFE 19-5 and CAFE 19-6 to increase releases to 5,600 cfs to control the rate of fill and begin storage evacuation following efforts to minimize flooding on the Missouri River and Missouri River mainstem reservoir river system. 250 cfs increases will be applied.

July 16, 2019: USACE issued flood control order no. CAFE 19-7 to increase releases to 6,250 cfs to evacuate storage following efforts to minimize flooding on the Missouri River and Missouri River mainstem reservoir river system.

July 24-25, 2019: USACE issued flood control order no. CAFE 19-8 to decrease releases to 5,750 cfs as evacuation of storage was nearly done following efforts to minimize flooding on the Missouri River and Missouri River mainstem reservoir river system is nearing completion.

October 1, 2019: HVID discontinued all diversions to Helena Valley Reservoir.

Additional statistical information of Canyon Ferry Reservoir and its operations during water year 2019 can be found on Table MTT8 and Figure 30.

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

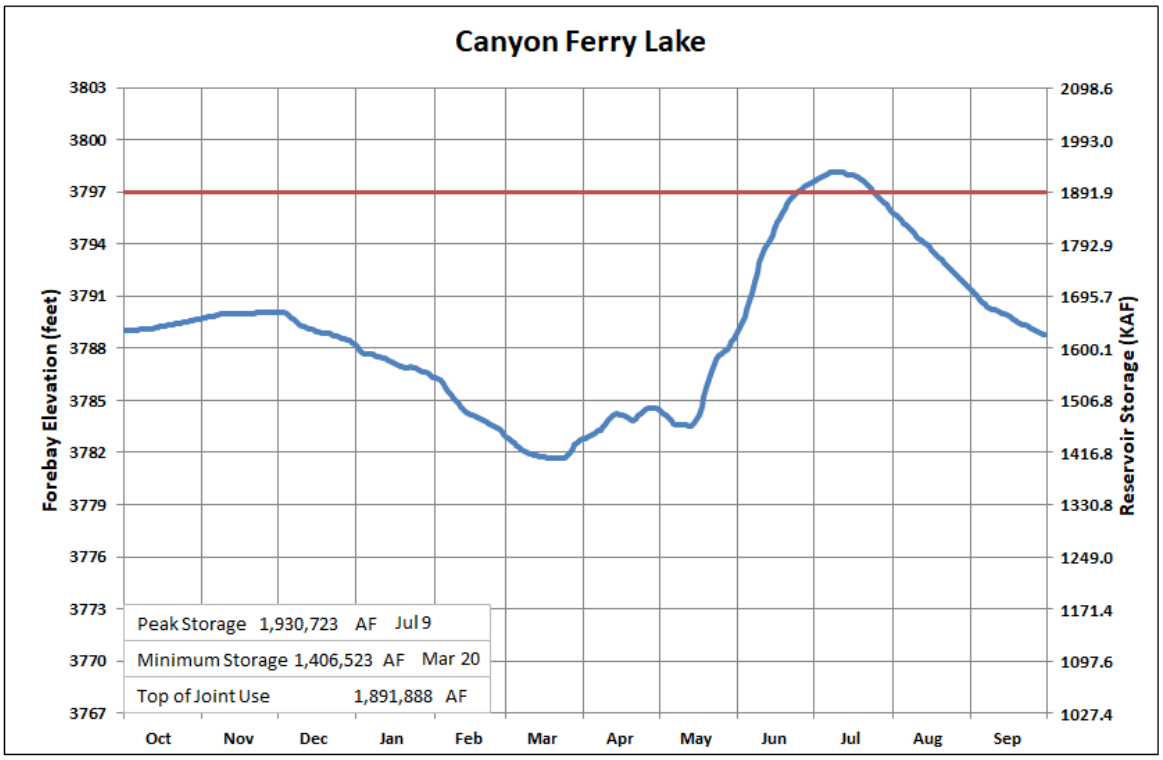
STORAGE-ELEVATION DATA	ELEVATION (FT)	STORAGE (AF)	DATE
BEGINNING OF YEAR	3789.04	1,633,041	OCT 01, 2018
END OF YEAR	3788.77	1,624,470	SEP 30, 2018
ANNUAL LOW	3781.65	1,406,523	MAR 20, 2019
ANNUAL HIGH	3798.16	1,930,723	JUL 10, 2019
HISTORIC HIGH	3800.00	2,050,900	JUN 23, 1964

INFLOW-OUTFLOW DATA	INFLOW	DATE	OUTFLOW	DATE
ANNUAL TOTAL (AF)	3,982,422	OCT 17-SEP 18	3,900,993	OCT 18-SEP 19
DAILY PEAK (CFS)	16,257	MAY 18, 2019	11,131	APR 24, 2019
DAILY MINIMUM (CFS)	1,943	AUG 9, 2019	3,878	OCT 6, 2018
PEAK SPILL (CFS)			5,638	APR 29, 2019
TOTAL SPILL (AF)			693,922	OCT 18-SEP 19

	INFLOW*		OUTFLOW*				CONTENT*	
MONTH	KAF	% OF AVG	TO HELENA VALLEY (KAF)	% OF AVG	RIVER KAF	% OF AVG	KAF	% OF AVG
OCTOBER	261.9	116	0.0	---	240.8	107	1,654.0	104
NOVEMBER	265.5	109	0.0	---	254.3	114	1,665.2	103
DECEMBER	230.1	111	0.0	---	287.6	114	1,607.7	102
JANUARY	230.1	110	0.0	---	289.4	110	1,548.4	102
FEBRUARY	270.5	135	0.0	---	271.7	111	1,448.2	99
MARCH	285.6	113	0.0	---	293.6	107	1,439.2	99
APRIL	559.0	182	4.2	55	503.3	180	1,490.6	101
MAY	632.7	122	11.2	69	484.2	140	1,627.9	100
JUNE	633.7	94	22.4	122	328.7	77	1,910.6	103
JULY	289.5	107	17.8	88	325.9	101	1,856.3	104
AUGUST	146.1	108	21.1	107	271.1	117	1,710.1	103
SEPTEMBER	187.6	119	11.8	108	261.5	121	1,624.5	101
ANNUAL	3,892.4	113	88.7	94	3,812.2	115		
APRIL-JULY	2,114.9	120						

* Based on previous 30 years

Table MTT 8: Hydrologic data for Canyon Ferry Reservoir, water year 2019.



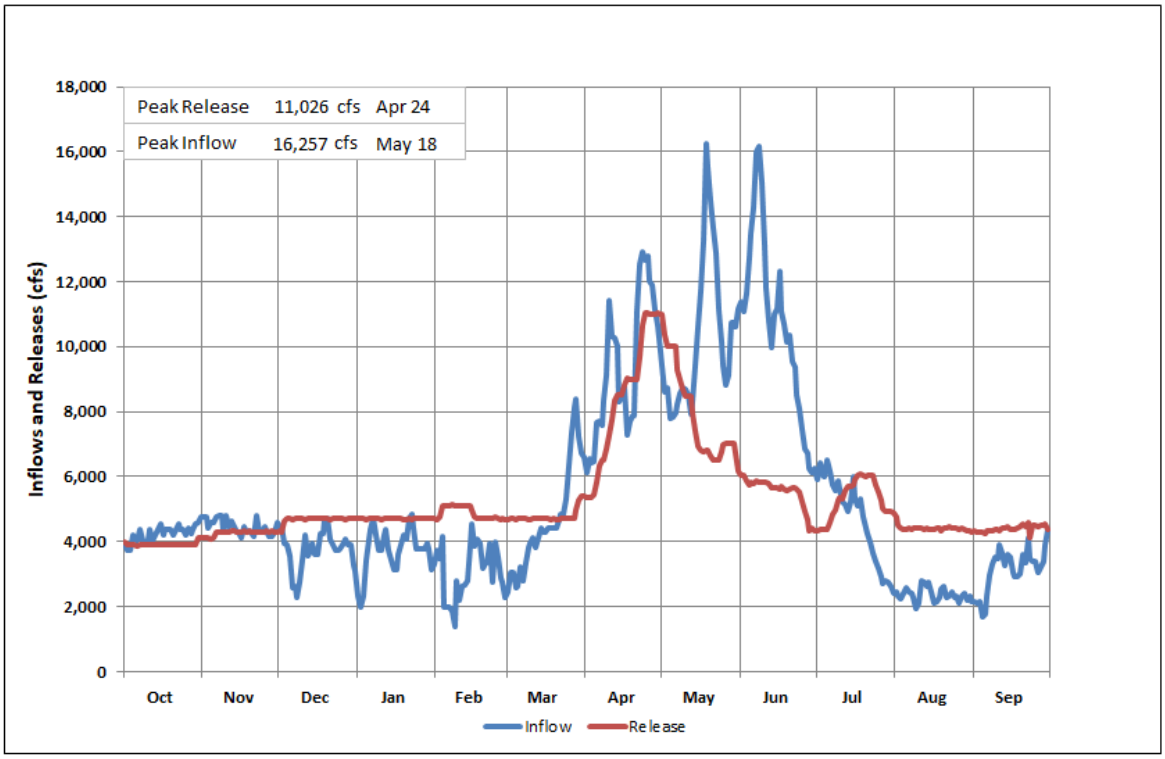


Figure 30: Plot of hydrologic data for Canyon Ferry Reservoir in water year 2019.

Helena Valley Reservoir

Helena Valley Reservoir is a regulating off-stream reservoir for Helena Valley Unit (P-S MBP), located west of Canyon Ferry Reservoir. It has a total capacity of 10,451 AF, which is used for irrigation and furnishing a supplemental municipal water 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 can irrigate about 14,100 acres of full-service land and 3,500 acres of supplemental service lands. Present development services about 13,867 full-service acres, including 5,200 acres previously irrigated by pumping from Helena Valley Reservoir or from other streams.

Figure 31: Helena Valley Reservoir and Dam

At the beginning of the water year, storage in Helena Valley Reservoir was 8,935 AF at elevation of 3,816.99 feet. Operating criteria 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 was started on April 10. Storage in Helena Valley Reservoir steadily increased with diversions from Canyon Ferry as well from local snowmelt and rain runoff. Diversions were made as normal throughout the year to meet irrigation demands. By the end of water year, Helena Valley Reservoir ended with a storage content of 8,898 AF at elevation 3,816.91 feet. During the water year, 88,650 AF of water was pumped to Helena Valley Reservoir from Canyon Ferry Reservoir. HVID released 98,795 AF for irrigation. All irrigation deliveries were discontinued for the 2019 season on October 1, 2019.

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

Statistical information pertaining to Helena Valley Reservoir is shown in Table MTT9.

RESERVOIR ALLOCATIONS	ELEVATION (FEET)	RESERVOIR STORAGE (AF)	STORAGE ALLOCATION (AF)
Top of Inactive Storage	3805	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	3816.99	8,935	10/1/2018
End of Year	3816.91	8,898	9/30/2019
Annual Low	3812.92	7,188	4/1/2019
Annual High	3819.98	8,861	7/9/2019
Historic High	3820.6	10,738	6/2/1975

INFLOW-OUTFLOW DATA	ANNUAL
Pumped from Canyon Ferry to Helena Valley Unit	88,650 AC-FT
Released from reservoir for irrigation	98,795 AC-FT
Delivered to the City of Helena for municipal use	1,112 AC-FT

MONTH	FOREBAY ELEVATION (FEET)	STORAGE CONTENT (KAF)	PUMPED TO HELENA VALLEY (KAF)
OCTOBER	3816.13	8.5	0.1
NOVEMBER	3815.37	8.2	0
DECEMBER	3814.63	7.8	0
JANUARY	3813.95	7.6	0
FEBRUARY	3813.5	7.4	0
MARCH	3812.93	7.1	0
APRIL	3818.57	9.6	4.2
MAY	3818.2	9.5	11.1
JUNE	3818.75	9.7	22.4
JULY	3818.44	9.6	17.8
AUGUST	3818.79	9.8	21.1
SEPTEMBER	3816.91	8.8	11.8
ANNUAL			88.5

Table MTT 9: Helena Valley Reservoir hydrologic data for water year 2019.

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 three miles below Gibson Reservoir to divert flows 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 Greenfields Irrigation District (GID). Releases from Willow Creek Reservoir re-enter the Sun River where they can be diverted at the Fort Shaw Diversion Dam to supply Fort Shaw Irrigation District.

Gibson Reservoir is located on the Sun River west of Augusta, Montana, and has a total capacity of 96,477 AF. In 2009, a new hydrographic and topographic survey was conducted to measure reservoir volume, resulting an updated elevation-area capacity table and curve. The previous survey, completed in 1996, measured the reservoir volume lost due to sediment accumulations after major forest fires in 1988.

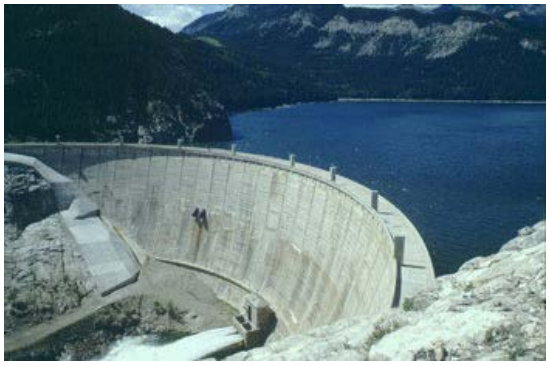


Figure 32: Gibson Reservoir and Dam

The 2009 survey data yielded a capacity increase of 2,211 AF at elevation 4,724.0 feet from the previous survey conducted in 1996. The increase was likely due to more detailed data collection and improved geographic information system capabilities since 1996. The revised area-capacity table established a storage capacity of 98,688 AF and a surface area of 1,334 acres at elevation 4,724.0 feet (top of active conservation). Since closure in 1929, the reservoir accumulated 6,172 AF of sediment below reservoir elevation 4,724.0 feet. The revised area-capacity table was placed into effect January 1, 2013.

The spillway crest is at elevation 4,712.0 feet (83,248 AF). Depending on runoff conditions and reservoir levels, spillway gates remain open during spring runoff, until inflows and remaining snowpack indicate that the runoff is receding. Once runoff has peaked, the spillway gates are progressively closed to fill the reservoir another 12 feet to the top of the conservation pool at elevation 4,724.0 feet (98,688 AF).

Gibson Reservoir began water year 2019 with a storage content of 17,146 AF and a corresponding elevation of 4,635.97 feet. At the end of the 2018 irrigation season, fall releases from Gibson Reservoir were diverted to Willow Creek Reservoir bringing the reservoir storage to desired winter carry-over levels. All diversions to Willow Creek Reservoir were discontinued on November 7,

2018. After diversions ceased, the winter releases to the Sun River were reduced and maintained near 180 cfs.

Precipitation was above average at the start of water year. The month of October yielded valley and mountain precipitation at 141 and 139 percent of average, respectively in the Sun River Basin. However, the mountain precipitation gained slowly throughout November and December. The cumulative valley precipitation for October through December was at 126 percent of average while the cumulative mountain precipitation was 87 percent of average.

Due to the below average snow fall in the Sun River Basin, on January 8, the mountain snowpack in the Sun River drainage was at 80 percent of normal, as reported by the NRCS. January temperatures were 2 to 4 degrees above normal while precipitation amounts were near average throughout the Sun River Basin. The snowpack above Gibson Reservoir continued to slowly increase, which resulted in a February 4 mountain snowpack at 83 percent of average.

February brought bitter cold temperatures starting on February 3 and lasting through the first week in March. The monthly temperature departure was 15 to 25 degrees below normal. Inflows during February averaged near 130 cfs while releases from Gibson Reservoir averaged 140 cfs. Due to the cold temperatures and reduced inflows, Gibson Reservoir drafted to 4,634.48 feet (16,342 AF) by February 28. Inflows during the first half of March remained near 115 cfs with continued below normal temperatures. A slow warm up later in the month resulted with inflows rising to near 200 cfs. Gibson reservoir ended the month at elevation of 4,635.78 feet.

The below average precipitation accumulated during March resulting in an April 1 SWE being recorded at 77 percent of average. The April spring forecast for Gibson Reservoir during water year 2019 was for below average inflows (73 percent of average) due to the below average snowpack outlook. On April 10 a storm system brought much needed precipitation and snow to the Sun River Basin, increasing the SWE to 90 percent of average. Inflows into Gibson slowly increased from a steady 200 cfs at the beginning of April to approximately 2,300 cfs by the end of the month. The average monthly inflow was near 790 cfs, or 100 percent of average.

The May 1 spring runoff volume was forecasted at 82 percent of the 30-year average or 298,000 AF. On May 1, Gibson reservoir was at elevation 4,687.04 feet (55 percent full) with inflows at 880 cfs and river releases to the Sun River near 450 cfs. Greenfield Irrigation District began refilling Pishkun Reservoir via the Pishkun Supply Canal on May 2. Gibson reservoir was slowly filling as the snowmelt runoff began. By May 16 inflows increased to near 4,250 cfs while the river release increased to 900 cfs to control the rate of fill. The reservoir filled to elevation 4,704.04 feet, or 19.8 feet from full, while the SWE declined to 66 percent of average. Inflows began to decline as temperatures were below normal while the reservoir continued to slowly fill to elevation 4,712.0 feet, the bottom of the spillway gates, by May 22. In coordination with Greenfield Irrigation District, it was determined that the spillway gates could be closed to gradually fill the remaining 12 feet of storage.

On May 24, the NWS issued a notification that heavy rainfall (1 to 2 inches) was expected along the Rocky Mountain Front late Saturday (May 25) through Sunday (May 26) that could lead to possible flooding. The notification indicated snow could fall from 7,500 feet to as low as 6,000 feet. The SWE for Gibson reservoir was 6.8 inches, therefore potential for rain on snow could contribute to

heavy runoff in the basin depending on actual temperatures. MTAO communicated this notification to GID.

The storm system moved into the area as predicted. On Sunday, May 26 the NWS estimated inflows into Gibson would reach a peak of 5,400 cfs on Tuesday, May 28. The forecast on Sunday also estimated 1 inch of rain or more was anticipated to fall in the drainage area that day. As more rain fell and inflows continued to increase, Greenfield Irrigation District in turn increased releases to the Sun River to near 4,000 cfs by 10 pm while the reservoir was near elevation 4,719.0 feet.

Inflows continued to rise, and at 1:00 pm on May 27 the reservoir elevation was at 4,720.94 feet, or 3.1 feet below the full pool elevation of 4,724.0 feet. Total releases through the spillway gates and river outlet works was near 4,200 cfs. Tributary gains below Gibson Dam result in a flow near 5,000 cfs over Sun River Diversion Dam to the Sun River. Tributary flows below Sun River Diversion Dam, estimated near 5,000 cfs or more caused projections to rise near or above 10,000 cfs at Sun River near Simms and Vaughn. As the day progressed, Greenfield Irrigation District continued to increase releases out of Gibson Dam to a maximum of 4,800 cfs. This release, minus diversions, plus tributary flows, resulted in a maximum release to the Sun River near 5,350 cfs.

The table below summarizes the May 15 through May 17 precipitation, in inches, that fell in and around the Sun River drainage.

GIBSON DAM				
	Antecedent	**3-Day Storm**		**Total**
	May 15-22	**May 25-27**		**May 15-27**
NOAA STATIONS				
CHOTEAU 8 NE	1.37	0.96		2.33
CHOTEAU	1.73	1.27		3.00
DUTTON 3.3 ENE	1.42	0.89		2.31
FAIRFIELD	0.00	0.00		0.00
GIBSON DAM	3.00	4.02		7.08
GREAT FALLS	0.91	0.72		1.63
ROGERS PASS 9 NNE	1.73	2.72		4.62
SUN RIVER 4 S	1.02	0.00		1.02
SNOTEL STATIONS				
DUPUYER CREEK	3.10	5.90		9.30
MOUNT LOCKHART	1.60	3.30		5.00
WALDRON	0.90	2.80		4.30
WOOD CREEK	2.60	3.60		6.20

Table MTT 10: Measured precipitation in inches from the May 2019 storm event.

On May 28 at 2:45 pm the reservoir elevation was at 4,721.67 feet (95,600 AF), or 2.3 feet below the full pool elevation of 4,724.0 feet (98,688 AF). Releases from Gibson Dam were reduced from a peak release of 4,800 cfs to 4,200 cfs. Diversions to Pishkun Reservoir were at 350 cfs and tributary

flows below Gibson Dam were 800 cfs. As a result, current flows over the Sun River Diversion Dam to the Sun River were reduced from 5,350 cfs to 4,600 cfs. As the day progressed and inflows receded, Greenfield Irrigation District continued to decrease releases out of Gibson Dam to 3,400 cfs. This release, minus diversions, plus tributary flows, resulted in a release to the Sun River near 3,800 cfs.

By the afternoon of May 29 flows on the Sun River declined well below 10,000 cfs. The reservoir elevation was at 4,722.37 feet (96,525 AF), or 1.63 feet below the full pool elevation of 4,724.0 feet (98,688 AF). Releases from Gibson Dam were further reduced to 3,400 cfs. Diversions to Pishkun Reservoir were 350 cfs and tributary flows below Gibson Dam were 550 cfs. As a result, flows over the Sun River Diversion Dam to the Sun River were 3,600 cfs.

Gibson Reservoir's operational releases and combined downstream tributary flow did cause some minor flooding along the Sun River. According to the USGS and the NWS, on May 27 the peak river gage at the town of Simms was 9.15 feet (11,400 cfs), while the town of Vaughn was 6.66 feet (9,820 cfs), both within minor flood stage ranges.

Releases to the Sun River continued to remain near 3,600 cfs – 3,800 cfs through June 4 as inflows fluctuated. By June 9 flows over Sun River Diversion Dam slowly declined to 1,200 cfs as inflows were also receding. This trend continued until June 20 when irrigation demands started to exceed inflows into Gibson Reservoir. Gibson Reservoir was drawn down to elevation 4,717.5 feet by the months end.

July brought cooler and near average precipitation patterns across the Sun River drainage. Despite the favorable conditions, inflows into Gibson averaged near 64 percent. The end of month storage content was 38,450 AF. The actual April through July runoff total of 358,100 AF was 83 percent of average. Inflows during April, May, June, and July were 100, 95, 75, and 64 percent of average, respectively.

Conditions during August resulted in average temperatures and precipitation patterns. The valley precipitation was 98 percent of average, while mountain precipitation was 67 percent of average. Diversions to the Pishkun Supply Canal were discontinued on August 24. From this point forward, releases from Gibson Reservoir were adjusted to meet downstream senior water rights and minimum river flows. Gibson Reservoir reached a storage content of 5,859 AF on August 31.

Temperatures during the first half of September were very warm. A cold front moved in the Sun River Basin around September 20 producing 2 to 4 feet of snow. The August through September inflow to Gibson Reservoir totaled 33,100 AF, 87 percent of average. Gibson Reservoir ended the water year with a content of 7,653 AF of storage at elevation 4,616.07 feet on September 30. Total annual inflow to Gibson Reservoir for water year 2019 was 447,100 AF, 83 percent of average.

Even though no space is allocated to flood control in Gibson Reservoir, the USACE still estimates flood damages prevented by Gibson Reservoir. The USACE determined that during water year 2019, Gibson Reservoir contributed 1,000 dollars to the local reduction of flood damages. Since 1950 Gibson Reservoir has prevented $3,103,000 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 AF at elevation 4,370.0 feet.

Figure 33: Pishkun Reservoir

In 2002, Reclamation surveyed Pishkun Reservoir to develop a bathymetric profile and compute a current storage-elevation relationship (area-capacity tables). Data was used to calculate reservoir capacity lost due to sediment accumulation since the previous survey, completed in 1940. The 2002 survey determined that Pishkun Reservoir has a storage capacity of 46,694 AF and a surface area of 1,522 acres at reservoir elevation 4,370.0 feet. Comparisons show the total reservoir capacity in 2002 was slightly greater than the original volume computed in 1940. It was the general conclusion that the difference between the surveys was due to differences in the detail of the two surveys. The revised area-capacity table was put into effect on October 1, 2005, reflecting the new storage levels.

The content in Pishkun Reservoir at the beginning of the water year 2019 was 18,927 AF at elevation 4,345.86 feet. Storage during the fall and winter was maintained near 19,000 AF as a coffer dike was constructed. The dike was removed in late April and diversions from the Sun River started refilling the reservoir on May 4. On May 12, irrigation releases from Pishkun Reservoir began and fluctuated between 450 cfs and 550 cfs throughout the remainder of the month. Storage slowly filled and reached near the top of active conservation pool at elevation 4,370.0 feet on May 26.

Pishkun releases from June through September were based on meeting irrigation demands. A maximum release of 1,702 cfs was recorded as well as the maximum inflow of 1,381 cfs. All diversions from the Sun River into Pishkun Reservoir were discontinued on September 7.

GID delivered a full allotment (2.0 AF per acre) to its water users in water year 2019. Approximately 239,800 AF of water was released from Pishkun Reservoir from May 12 through September 30 to help meet irrigation demands on the Sun River Project. By the end of the water year, the reservoir storage was 27,900 AF at elevation 4,355.77 feet, 99 percent of average and 60 percent of full capacity.

Additional hydrologic and statistical data pertaining to Pishkun Reservoir can be found in Table MTT12 and Figure 36.

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 AF at elevation 4,142.0 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.

Figure 34: Willow Creek Reservoir

In 2002, Reclamation surveyed Willow Creek Reservoir to develop a bathymetric profile map and compute a present storage-elevation relationship (area-capacity tables). Data were used to calculate reservoir capacity lost due to sediment accumulation since dam closure in 1911. The 2002 survey determined that Willow Creek Reservoir has a storage capacity of 34,819 AF and a surface area of 1,509 acres at a reservoir elevation of 4,144.00 feet. Since closure in 1911, the reservoir had an estimated volume change of 431 AF below reservoir elevation 4,144.00 feet. This volume represents a 1.2 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.

Willow Creek Reservoir content at the beginning of water year 2019 was 20,749 AF at elevation 4,133.89 feet. Greenfield Irrigation District (GID) continued to divert water from the Sun River via the Willow Creek Feeder Canal from October until November 9, 2018. No releases from Willow Creek Reservoir were made throughout the fall and winter. Through diversions and natural inflows, Willow Creek Reservoir gained approximately 9,460 AF of storage or 7.0 feet by March 30.

Inflows continued to slowly fill the reservoir, therefore, to manage the storage, GID initiated releases on April 15. Releases continued throughout April and into May as inflows continued to fluctuate with the spring runoff. Towards the end of May, the NWS was predicting a high amount of precipitation in the Sun River basin over the Memorial Day weekend. MTAO and the GID were watching the storm as rain fell in the basin. Inflows on May 25 averaged 120 cfs with reservoir elevation at 4,140.74 feet. On May 26, the rain continued, therefore GID increased the releases from Willow Creek Dam from 98 cfs to 195 cfs in the morning to slow the rate of fill. It was estimated that 2 -3 inches of rain fell in the Willow Creek drainage over the previous 24 hours. The elevation on May 26 at 7:00 pm was 4,141.15 feet (30,613 AF) with an estimated inflow of 700 cfs. Full pool is at elevation 4142.0 feet (31,848 AF) with the uncontrolled spillway crest at elevation 4,144.0 feet (33,819 AF). MTAO continued to be in contact with GID to re-evaluate the extent of

the rain event and discussed maximizing the releases to 325 cfs to slow the rate of fill. At the time, field staff from GID unknowingly set the downstream flume stage approximately 1 foot below the actual gauge height reading. Therefore, during the event releases were thought to be less than actuals by as much as 100-125 cfs. All inflows and releases described here after are considered the corrected actual values. The evening of May 26, GID increased the release to near 460 cfs, which was exceeding the recommend maximum release of 350 cfs.

The morning of May 27 Willow Creek Reservoir elevation was at 4,142.3 feet, or 1.7 feet below the uncontrolled spillway elevation of 4,144.0 feet. Current inflows into the Reservoir were approximately 1,900 cfs and were fluctuating while releases remained at 460 cfs. The reservoir increased 1.09 feet in 12-hours and was anticipated to continue rising at roughly 0.09 feet per hour. At that rate the pool would reach the spillway crest early the next morning unless inflows receded. Rain was still falling at the site and forecasts were calling for additional rain throughout the rest of the day. The average inflow for May 27 was 1,717 cfs.

On May 27, GID inspected Willow Creek Dam and noticed an earth slide on the downstream face of the Willow Creek stability berm. In response, Reclamation and GID were mobilized to the Dam to monitor conditions and perform 24-hour inspections. It was determined that it was a superficial earth slide due to excess soil saturation from the heavy rainfall. Reclamation staff was on site throughout the night to monitor reservoir elevations, inflows, releases, and the superficial earth slide on the downstream face of the Willow Creek stability berm.

The morning of May 28 the reservoir elevation was at elevation 4,143.54 feet, or 0.46 feet below the uncontrolled spillway. Current inflows were above 850 cfs while releases remained at 460 cfs. At this rate the reservoir was anticipated to continue rise and reach the spillway crest mid-morning on May 29 unless inflows recede further. On the morning of May 29 inflows were still above 500 cfs with a reservoir elevation at 4143.88 feet, 0.12 feet below the uncontrolled spillway. Reclamation and GID staff continued to monitor conditions through the day including the superficial earth slide. By the morning of May 30, the current reservoir elevation was 4,143.96 feet, or 0.04 feet below the uncontrolled spillway elevation. Inflows into the reservoir declined below 500 cfs while releases were maintained at 460 cfs. At these inflows, the reservoir was anticipated to hold at its current elevation. By late afternoon on May 31, the reservoir was at elevation 4,143.93 feet, or 0.07 feet below the uncontrolled spillway. Inflows continued to decline to approximately 400 cfs and releases were maintained at 460 cfs. Willow Creek reservoir continued to slowly draft and on June 10, the water surface exited the surcharge pool. The reservoir elevation was 4,140.94 feet, or 1.06 feet below the top of normal pool elevation of 4,142.0 feet. Releases were reduced to 300 cfs on June 17 and 210 cfs on June 18.

Releases continued to meet downstream demands throughout the summer. However, through inspections of the facility, it was determined by Reclamation and GID that maintenance on the outlet works was needed as possible gate failure could occur. The maintenance required the conduit to be dry, therefore the evacuation of the entire reservoir was needed. The maintenance was planned to be completed in the fall after the irrigation season was over. GID notified the Fish, Wildlife, and Parks of the planned drawdown and held public meetings to communicate that the lake would be empty, and no fishery would remain. Communication by GID to the state and public continued throughout the summer and fall.

Releases between 200-250 cfs were made until August 25 as the storage was fully evacuated. The maintenance lasted from August 26 through October 18, 2019. During this time inflows were passed through the reservoir, which were near 20 cfs. Once the maintenance was completed, diversion from the Sun River Diversion Dam through the Willow Creek Feeder Canal were initiated and the reservoir began to refill.

Additional hydrologic and statistical data pertaining to Willow Creek Reservoir can be found in Table MTT13 and Figure 37.

Important Events in Water Year 2019

April 15, 2019: Releases out of Willow Creek Reservoir were initiated.

May 2, 2019: Diversions to the Pishkun Supply Canal were initiated.

May 25-29, 2019: A 2-3-inch rainstorm fell in the Sun River Basin causing minor flooding along the Sun River and caused Willow Creek to nearly reach the uncontrolled spillway.

August 26, 2019: Willow Creek Reservoir reached 0 AF in order to perform maintenance on the outlet works.

September 7, 2019: Releases from Pishkun Reservoir for irrigation deliveries were discontinued for the season.

September 30, 2019: Willow Creek Reservoir remained empty as maintenance continued for the river outlet works.

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	98,687	98,687

STORAGE-ELEVATION DATA	ELEVATION (FT)	STORAGE (AF)	DATE
BEGINNING OF YEAR	4634.97	17,146	OCT 01, 2018
END OF YEAR	4616.07	7,653	SEP 30, 2019
ANNUAL LOW	4610.70	5,662	SEP 06, 2019
ANNUAL HIGH	4724.13	98,860	JUN 18, 2019
HISTORIC HIGH	4732.23	116,400	JUN 08, 1964

INFLOW-OUTFLOW DATA	INFLOW	DATE	OUTFLOW	DATE
ANNUAL TOTAL (AF)	447,064	OCT 18-SEP 19	456,556	OCT 18-SEP 19
DAILY PEAK (CFS)	5,304	MAY 27, 2019	4,589	JUN 04, 2019
DAILY MINIMUM (CFS)	96	FEB 04, 2019	106	AUG 18, 2019

	INFLOW*		OUTFLOW*				CONTENT*	
MONTH	KAF	TOTAL CANAL KAF	TOTAL CANAL KAF	% OF AVG	RIVER KAF	% OF AVG	KAF	% OF AVG
OCTOBER	14.0	6.1	6.1	170	13.9	185	17.2	78
NOVEMBER	13.2	1.3	1.3	40	13.5	146	16.8	66
DECEMBER	9.7	0.0	0.0	---	9.5	93	17.0	63
JANUARY	8.8	0.0	0.0	---	8.8	99	17.0	55
FEBRUARY	7.2	0.0	0.0	---	7.9	99	16.3	48
MARCH	9.4	0.0	0.0	---	8.6	88	17.0	43
APRIL	46.9	0.0	0.0	---	9.6	44	54.3	95
MAY	149.1	42.1	42.1	91	105.5	124	97.8	110
JUNE	119.4	67.1	67.1	105	65.3	64	90.1	99
JULY	36.4	81.5	81.5	101	7.7	38	38.4	76
AUGUST	18.9	42.2	42.2	107	10.8	96	5.8	23
SEPTEMBER	14.1	0.0	0.0	0	14.4	148	7.6	40
ANNUAL	447.1	240.3	240.3	93	253.0	83		
APRIL-JULY	351.8							

* Based on past 30 years

Table MTT 11: Water year 2019 hydrologic data for Gibson Reservoir (Sun River Project). New Sediment survey data effective 10/01/2013.

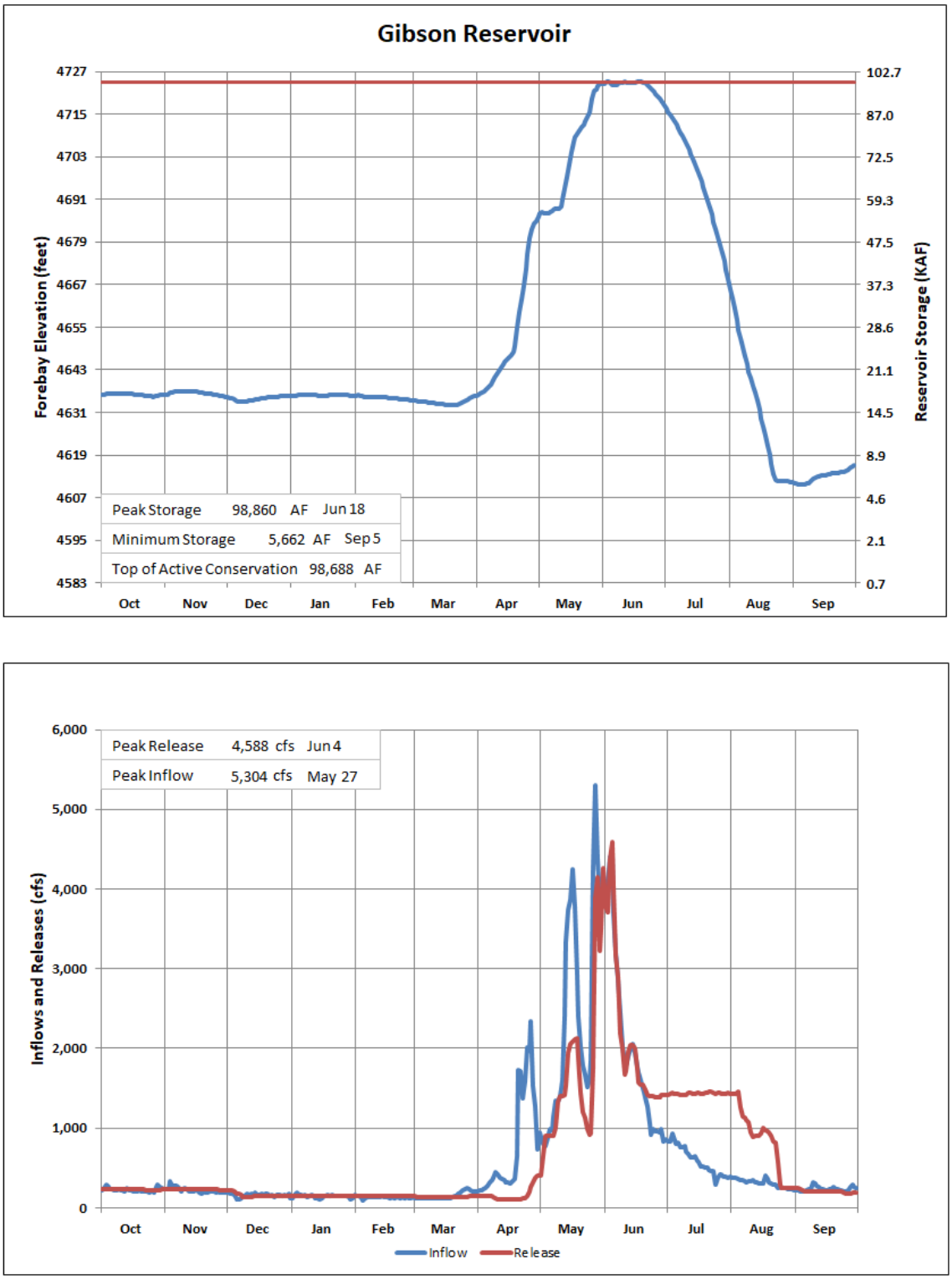


Figure 35: Plot of water year 2019 hydrologic data for Gibson Reservoir.

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	4346.28	19,262	OCT 01, 2018
END OF YEAR	4355.77	27,919	SEP 30, 2019
ANNUAL LOW	4345.80	18,879	DEC 01, 2018
ANNUAL HIGH	4370.08	46,816	JUN 08, 2019
HISTORIC HIGH	4371.40	48,950	JUL 04, 1953

INFLOW-OUTFLOW DATA	INFLOW	DATE	OUTFLOW	DATE
ANNUAL TOTAL (AF)	242,354	OCT 18-SEP 19	239,850	OCT 18-SEP 19
DAILY PEAK (CFS)	1,381	JUL 8, 2019	1,702	JUN 19, 2019
DAILY MINIMUM (CFS)	0	*	0	*

* During non-irrigation season

	INFLOW*		OUTFLOW*		CONTENT*	
MONTH	KAF	% OF AVG	KAF	% OF AVG	KAF	% OF AVG
OCTOBER	0.0	---	0.0	---	18.9	61
NOVEMBER	0.0	---	0.0	---	18.9	60
DECEMBER	0.0	---	0.0	---	18.9	60
JANUARY	0.0	---	0.0	---	18.9	60
FEBRUARY	0.0	---	0.0	---	18.9	60
MARCH	0.0	---	0.0	---	18.9	60
APRIL	0.0	---	0.0	---	21.8	57
MAY	43.2	103	21.8	63	46.0	100
JUNE	68.9	112	75.6	113	39.5	98
JULY	81.3	106	77.4	97	43.4	115
AUGUST	47.9	121	54.4	131	36.8	103
SEPTEMBER	0.8	7	10.3	58	27.9	95
ANNUAL	242.3	100	239.8	99		
APRIL-JULY	193.4	103				

* Based on past 30 years

Table MTT 12: Water year 2019 hydrologic data for Pishkun Reservoir (Sun River Project). New Sediment survey data effective October 1, 2005.

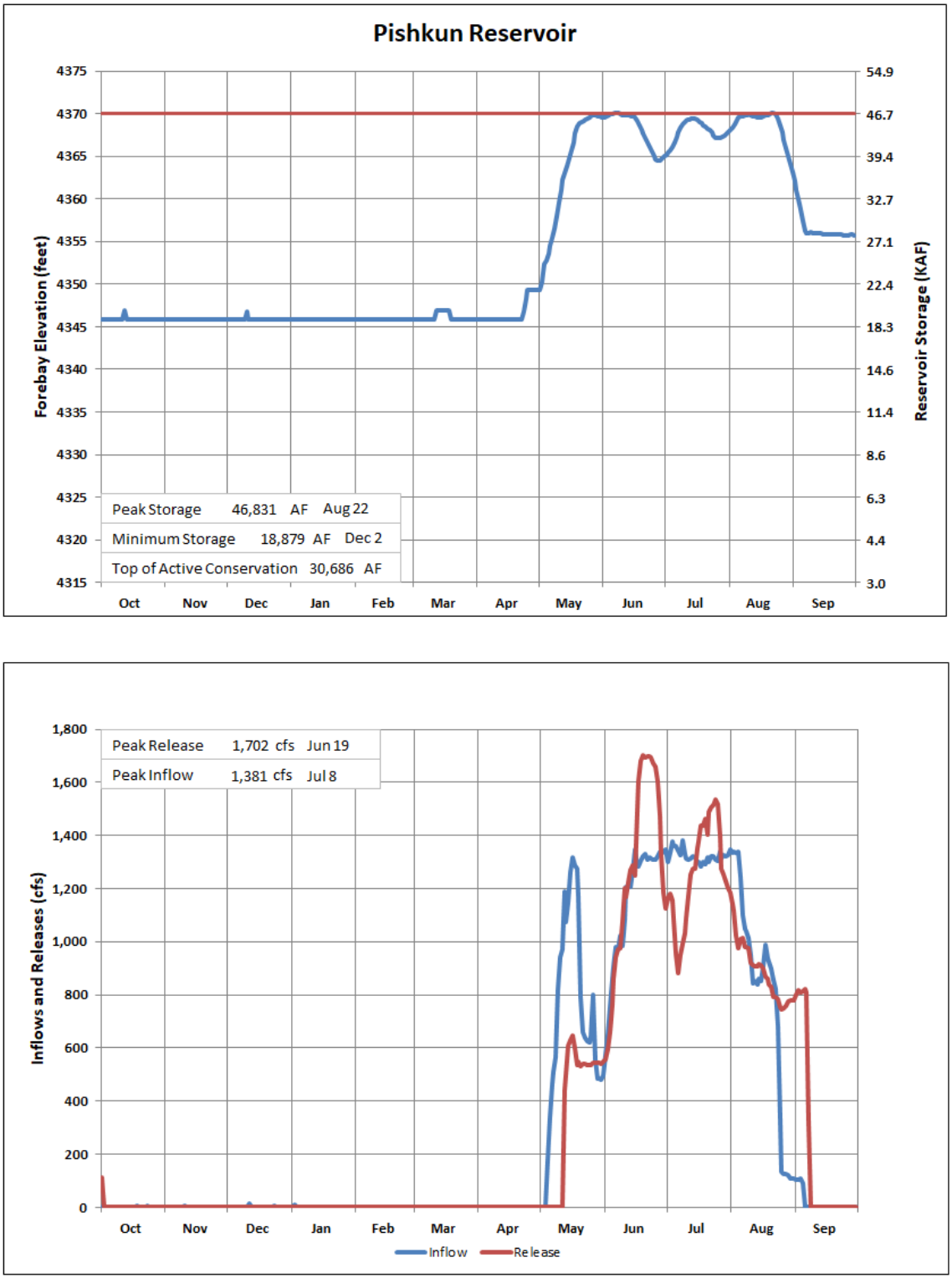


Figure 36: Plot of water year 2019 hydrologic data for Pishkun Reservoir.

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	4133.74	20,562	OCT 01, 2018
END OF YEAR	4085.00	0	SEP 30, 2019
ANNUAL LOW	4085.00	0	AUG 26, 2019
ANNUAL HIGH	4143.96	34,758	MAY 30, 2019
HISTORIC HIGH	4144.80	36,033	JUN 22, 2018

INFLOW-OUTFLOW DATA	INFLOW	DATE	OUTFLOW	DATE
ANNUAL TOTAL (AF)	30,944	OCT 18-SEP 19	51,625	OCT 18-SEP 19
DAILY PEAK (CFS)	1,560	MAY 27, 2019	306	MAY 27, 2019
DAILY MINIMUM (CFS)	0	*	0	*

* During non-irrigation season

	INFLOW*		OUTFLOW*		CONTENT*	
MONTH	KAF	% OF AVG	KAF	% OF AVG	KAF	% OF AVG
OCTOBER	5.7	356	0.0	---	26.3	119
NOVEMBER	1.7	100	0.0	---	28.0	117
DECEMBER	0.3	50	0.0	---	28.3	116
JANUARY	0.3	100	0.0	---	28.7	116
FEBRUARY	0.5	166	0.0	---	29.2	117
MARCH	1.0	200	0.0	---	30.2	119
APRIL	2.7	193	2.0	667	30.9	116
MAY	11.5	348	7.7	700	34.7	120
JUNE	2.0	68	14.9	595	21.7	73
JULY	2.8	280	12.7	205	11.8	49
AUGUST	1.1	1100	13.0	342	0	0
SEPTEMBER	1.2	200	1.2	200	0	0
ANNUAL	30.9	207	51.6	346		

* Based on past 30 years

Table MTT 13: Water year 2019 hydrologic data for Willow Creek Reservoir (Sun River Project). New Sediment survey data effective October 1, 2005.

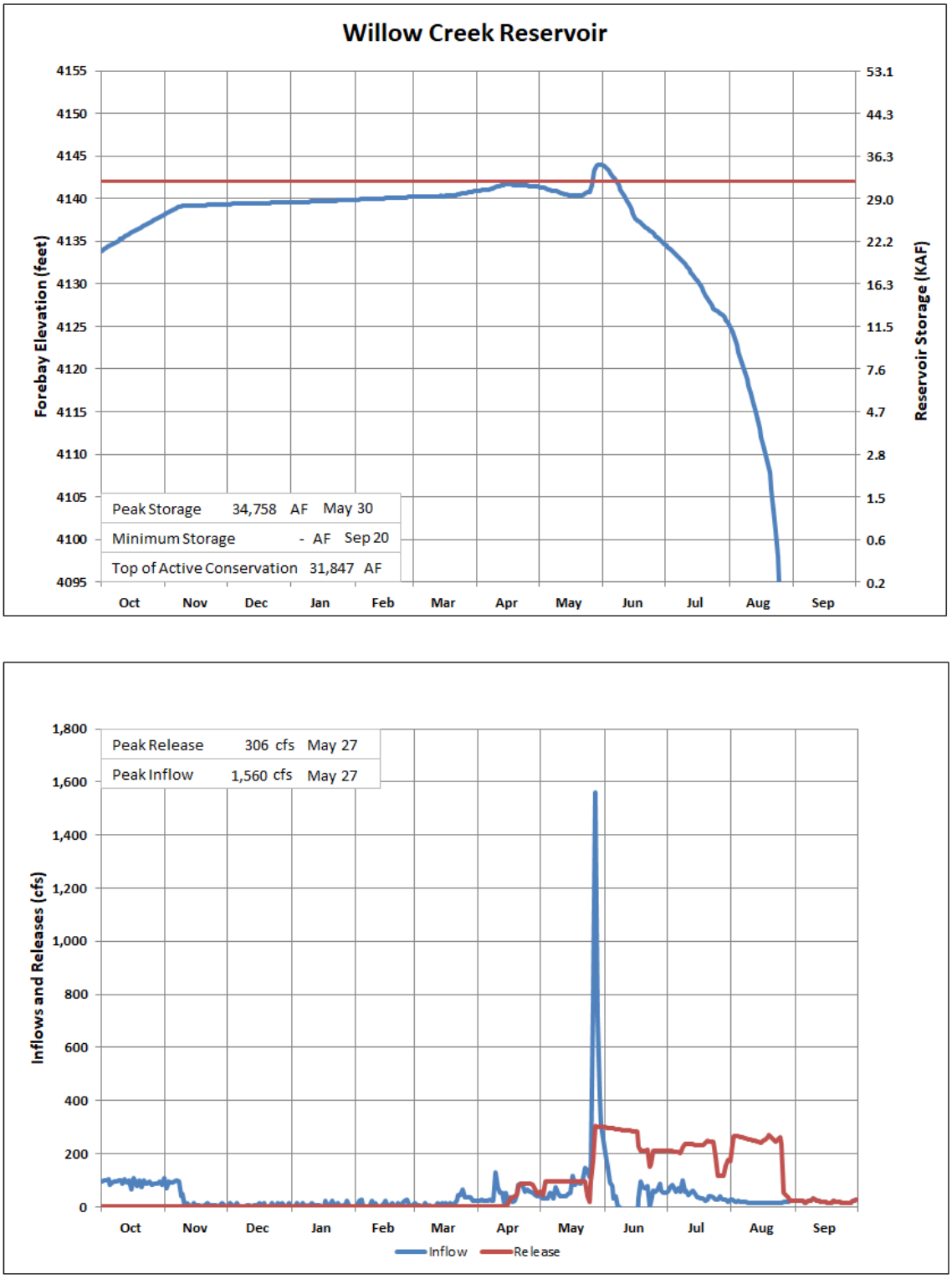


Figure 37: Plot of water year 2019 hydrologic data for Willow Creek Reservoir.

Lake Elwell (Tiber Dam)

Tiber Dam (P-S MBP) is located on the Marias River near Chester, Montana. It was built to provide 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 rate of settlement increased following the flood of 1964 and the heavy runoff of 1965. The settlement was attributed to a weakness of the underlying shale formation in which small lenses of gypsum slowly 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. The construction consisted of modifying the canal outlet works for use as an auxiliary outlet works and closing the entrance channel of the spillway with a temporary earth fill cofferdam. To accommodate these changes, the reservoir operating criteria was revised, and the active capacity was eliminated. Work on modification of the spillway to restore active conservation capacity started in 1976 and was completed in October 1981. The 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.

Figure 38: Tiber Dam and Lake Elwell.

Because the irrigation distribution works have not yet been constructed, the reservoir is operated for flood control, fishery and recreation benefits. The reservoir does provide irrigation water to several individual operators by water service contracts and provides about 1,500 AF 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 area-capacity tables. 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 AF 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 AF below an elevation of 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. The river outlet works underwent extensive modification to incorporate the addition of a 7.5 megawatt powerplant, privately owned by Tiber Montana, LLC. A bifurcation pipe was installed in the downstream end of the river outlet works tunnel 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.

Lake Elwell began water year 2019 with a storage content of 855,038 AF at an elevation of 2,988.99 feet. This was 108 percent of average. Releases were reduced to the winter release rate of 600 cfs on October 2, 2018, following an efficiency test of the powerplant turbine.

Water year 2019 started off wetter and cooler than average during October. Conditions turned drier and warmer than average during November and December. Cumulative valley precipitation through December was 99 percent of average and mountain precipitation was 82 percent of average. Inflow during this period totaled 50,861 AF, 94 percent of average. Releases were maintained at approximately 600 cfs. By the end of December, Lake Elwell storage was 796,165 AF, 107 percent of average.

On January 1 the NRCS reported snowpack in the Marias River Basin above Lake Elwell was at 74 percent of average. The January water supply forecast, based primarily on mountain snowpack, indicated the April-July runoff into Lake Elwell would be 299,000 AF, 78 percent of average. During January, valley precipitation was above average at 137 percent, but mountain precipitation was only 84 percent of average.

On February 1 the NRCS reported the mountain snowpack was 79 percent of average. The February water supply forecast indicated the April-July runoff would be about 295,000 AF, 76 percent of average. There was not much change from the previous month. Precipitation was above average in February. Temperatures rapidly dropped at the beginning of February. The average temperature for February in Marias River Basin was 20 to 25 degrees below normal.

The NRCS reported the mountain snowpack was 85 percent of average on March 1. The March water supply forecast indicated the April-July runoff would be 303,000 AF, 79 percent of average. The lowest storage content for the year occurred on March 20 at 736,595 AF, at an elevation of 2,981.20 feet. Warmer temperatures towards the end of March melted off low elevation snow and increased inflows into Lake Elwell. Inflows jumped from an approximate base flow of 200 cfs to a daily peak of 6,800 cfs on March 24. Inflows receded back to approximately 730 cfs after the low elevation snow melted out. Precipitation during March was much below average.

On April 1, the mountain snowpack was only 76 percent of average. The water supply forecast prepared in April indicated the April-July runoff would be 61 percent of average, totaling 234,000 AF. Releases were decreased to 500 cfs on April 5 due to the low water supply forecast. April precipitation was above average in the valley and below average in the mountains. April inflow was

69,700 AF, 121 percent of average. Snowpack peaked on April 15 at 90 percent of the average peak snowpack.

On May 1, the NRCS indicated the mountain snowpack increased to 94 percent of average. The May 1 water supply forecast was for a May through July runoff of 240,000 AF, 73 percent of average. Releases were decreased to 400 cfs on May 9 to accommodate an antenna installation on the Marias River by Montana Fish, Wildlife and Parks. Releases were increased to 700 cfs on May 10 based on the improved forecasted inflows. Snowmelt and rain bumped inflows to higher than average around the middle of May. Based on actual inflows, storage conditions, and forecasted inflows, releases were increased to 1,500 cfs during May 21-23.

A strong weather system moved through the area on May 25-27 producing heavy precipitation. Precipitation totals are detailed in the table below. Daily average inflows peaked at 14,300 cfs on May 28 from the heavy precipitation and snowmelt runoff. Meanwhile, due to a series of weather events dating back to March, flooding was occurring along the Missouri River below Fort Peck Dam. During the local runoff event, coordination was taking place between Reclamation and the USACE. During May 30-31, releases from Tiber Dam were reduced to powerplant capacity, 740 cfs, by USACE reservoir regulation order TIBR-19-01 to utilize replacement storage space in an effort to minimize flooding on the Missouri River mainstem and the Missouri River mainstem reservoir system. Lake Elwell filled to 2,993 feet, normal full pool, on May 28.

TIBER DAM				
	Antecedent	3-Day Storm		Total
	May 15-22	May 25-27		May 15-27
NOAA STATIONS				
CHESTER	0.41	0.24		0.65
CUT BANK AIRPORT	1.25	0.49		1.74
DUNKIRK 19 NNE	0.73	0.89		1.62
EAST GLACIER	1.64	0.00		1.64
GALATA 16 SW	1.50	0.86		2.36
SHELBY	1.20	0.80		2.00
SNOTEL STATIONS				
DUPUYER CREEK	3.10	5.90		9.30
MOUNT LOCKHART	1.60	3.30		5.00
PIKE CREEK	2.10	2.40		4.50
WALDRON	0.90	2.80		4.30

Table MTT 14: Measured precipitation in inches during the May 2019 storm event at Tiber Dam.

On June 1, the NRCS indicated the mountain snowpack was only 67 percent of average due to the heavy melting in May. Inflow continued to decrease through the month of June from a daily average of approximately 6,000 to 1,000 cfs as snowmelt tapered off. Storage continued to increase

through the month at the direction of the USACE. Monthly precipitation percentages for June were much below average at 64 and 66 percent of average for the valley and mountains, respectively.

Storage peaked on July 1 at 1,084,069 AF, at an elevation of 3,001.22 feet. This was the fourth highest storage content of record and the highest since 2011. By USACE reservoir regulation orders TIBR-19-02 and TIBR-19-03, releases from Tiber Dam were increased to 3,500 cfs during July 8-11, to start evacuating storage from the exclusive flood control pool. Powerplant bypass releases were made through the auxiliary outlet works, providing cooler water temperatures to the Marias River. Releases were decreased during July 23-25 to 2,500 cfs by USACE reservoir regulation order TIBR-19-04, decreasing the rate of evacuation of the exclusive flood control pool.

July and August inflows were much below average at 55 and 43 percent of average, respectively. Releases were reduced during August 6-9 to 1,500 cfs. All the storage in the exclusive flood control pool was evacuated by August 8. Releases were decreased again to 1,000 cfs during August 14-15 to conserve storage. On August 20, releases were reduced once more to 720 cfs, powerplant capacity, to conserve storage.

An efficiency test of the powerplant turbine was conducted on September 21 which required varied releases between 500 and 700 cfs. Precipitation in September was much above average at 214 and 219 percent of average in the valley and mountains, respectively. A wet weather system towards the end of September caused heavy rains and snow and pushed inflows to much above average. The system set many cold temperature records and snowfall records during September 29 through October 3.

Total annual valley precipitation and total annual mountain precipitation were 120 and 100 percent of average, respectively. The April-July runoff into Lake Elwell during water year 2019 was 119 percent of average, totaling 459,806 AF. This was 197,767 AF less than the April-July inflow experienced in 2018. The total annual inflow was 113 percent of average, 611,911 AF. This was 191,386 AF less than the total annual inflow experienced in water year 2018. By the end of water year 2019, Lake Elwell storage was 858,565 AF at an elevation of 2,989.20 feet. This was 108 percent of normal and 3,527 AF or 0.21 feet higher than reported on September 30, 2018.

The USACE determined that during water year WY 2019, Lake Elwell prevented $70,000 in local flood damages and prevented $1,341,000 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 $100,419,000.

Important Events in Water Year 2019

October 2, 2018: An efficiency test was conducted on the powerplant turbine. Releases were briefly decreased to 500 and 550 cfs for the test. Releases were decreased to 600 cfs as the winter release rate.

March 20, 2019: Storage was drafted to a water year low of 736,595 AF, at an elevation of 2,981.20 feet.

April 5, 2019: Releases were decreased to 500 cfs based on forecasted inflows.

May 9-10, 2019: Releases were decreased to 400 cfs based at the request of FWP to assist with antenna installation. Releases were increased to 700 cfs following the antenna installation based on forecasted inflows.

May 21-23, 2019: Releases were increased to 1,500 cfs to manage the rate of fill of Lake Elwell. Powerplant bypass was released through the spillway.

May 28, 2019: Water year 2019 inflow peaked at 14,294 cfs.

May 30-31, 2019: Releases were decreased to 720 cfs, powerplant capacity, by USACE reservoir regulation order TIBR-19-01 to utilize replacement storage space in Lake Elwell.

July 8, 2019: Releases were increased to 1,000 cfs to start evacuating storage from the exclusive flood control pool by USACE reservoir regulation order TIBR-19-02. Powerplant bypass was released through the auxiliary outlet works.

July 6, 2019: Storage peaked for water year 2019 at 1,084,069 AF, an elevation of 3,001.22 feet.

July 9-11, 2019: Releases were increased to 3,500 cfs to evacuate storage from the exclusive flood control pool by USACE reservoir regulation order TIBR-19-03. Powerplant bypass was released through the auxiliary outlet works.

July 23-25, 2019: Releases were decreased to 2,500 cfs to decrease the evacuation rate of the exclusive flood control pool by USACE reservoir regulation order TIBR-19-04. Powerplant bypass was released through the auxiliary outlet works.

August 6-9, 2019: Releases were decreased to 1,500 cfs to gradually decrease releases since nearly the storage was evacuated from the exclusive flood control pool. Powerplant bypass was released through the auxiliary outlet works.

August 14-15, 2019: Releases were decreased to 1,000 to conserve storage. Powerplant bypass was released through the auxiliary outlet works.

August 20, 2019: Releases were decreased to 720 cfs, powerplant capacity, to conserve storage.

September 21, 2019: An efficiency test was conducted on the powerplant turbine. Releases were briefly decreased to 500 and 550 cfs for the test. Releases were maintained at 690 cfs, powerplant capacity, for the winter release rate.

Additional hydrologic and statistical information pertaining to the operation of Lake Elwell during water year 2019 can be found in Table MTT16 and Figure 39.

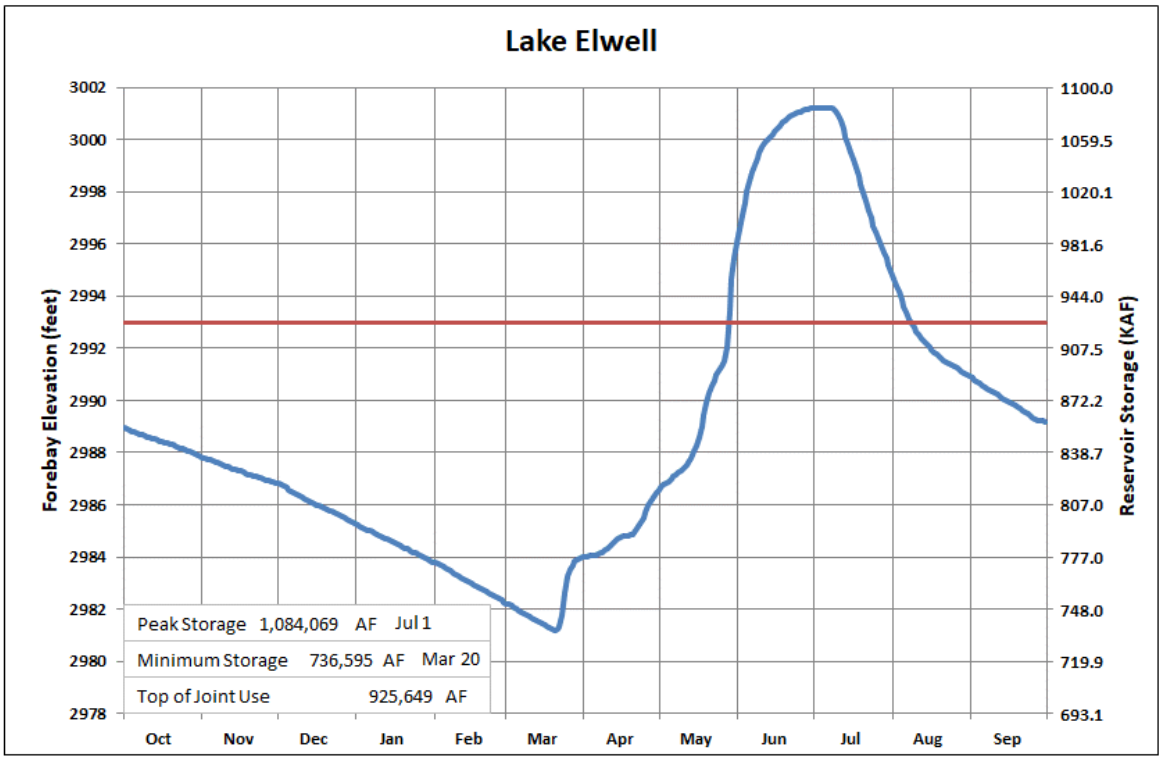
RESERVOIR ALLOCATIONS	ELEVATION (FEET)	TOTAL RESERVOIR STORAGE (AF)	STORAGE ALLOCATION (AF)
TOP OF INACTIVE AND DEAD	2966.40	554,330	554,330
TOP OF ACTIVE CONSERVATION	2976.00	667,213	112,883
TOP OF JOINT USE	2993.00	925,649	258,436
TOP OF EXCLUSIVE FLOOD CONTROL	3012.50	1,328,723	403,074

STORAGE-ELEVATION DATA	ELEVATION (FT)	STORAGE (AF)	DATE
BEGINNING OF YEAR	2988.99	855,038	OCT 01, 2018
END OF YEAR	2989.20	858,565	SEP 30, 2019
ANNUAL LOW	2981.20	736,595	MAR 20, 2019
ANNUAL HIGH	3001.22	1,084,069	JUL 1, 2019
HISTORIC HIGH	3011.42	1,303,858	JUL 19, 2011

INFLOW-OUTFLOW DATA	INFLOW	DATE	OUTFLOW	DATE
ANNUAL TOTAL (AF)	611,911	OCT'18-SEP'19	608,384	OCT'18-SEP'19
DAILY PEAK (CFS)	14,294	MAY 28, 2019	3,484	JUL 18, 2019
DAILY MINIMUM (CFS)	-121	JUL 28, 2019	430	MAY 10, 2019
PEAK SPILL (CFS)			2,764	JUL 18, 2019
TOTAL SPILL (AF)			154,473	5/21-8/20/2019

	INFLOW		OUTFLOW		CONTENT	
MONTH	KAF	% OF AVG	KAF	% OF AVG	KAF	% OF AVG
OCTOBER	18.6	122	37.5	92	836.0	109
NOVEMBER	19.5	91	35.7	110	819.9	108
DECEMBER	12.8	72	36.5	114	796.1	107
JANUARY	13.8	83	35.7	111	774.2	107
FEBRUARY	9.9	48	32.3	109	751.8	105
MARCH	60.8	140	35.7	100	776.8	107
APRIL	69.7	121	30.8	78	815.7	110
MAY	219.1	166	52.6	95	982.1	120
JUNE	146.3	97	44.5	58	1,083.9	121
JULY	24.8	55	147.3	227	961.4	111
AUGUST	5.5	43	78.7	149	888.2	107
SEPTEMBER	11.3	108	41.0	90	858.6	108
ANNUAL	611.9	113	608.4	145		
APRIL-JULY	459.6	178				

Table MTT 15: Water year 2019 hydrologic data for Lake Elwell (Tiber Dam). New sediment survey data effective October 1, 2005.



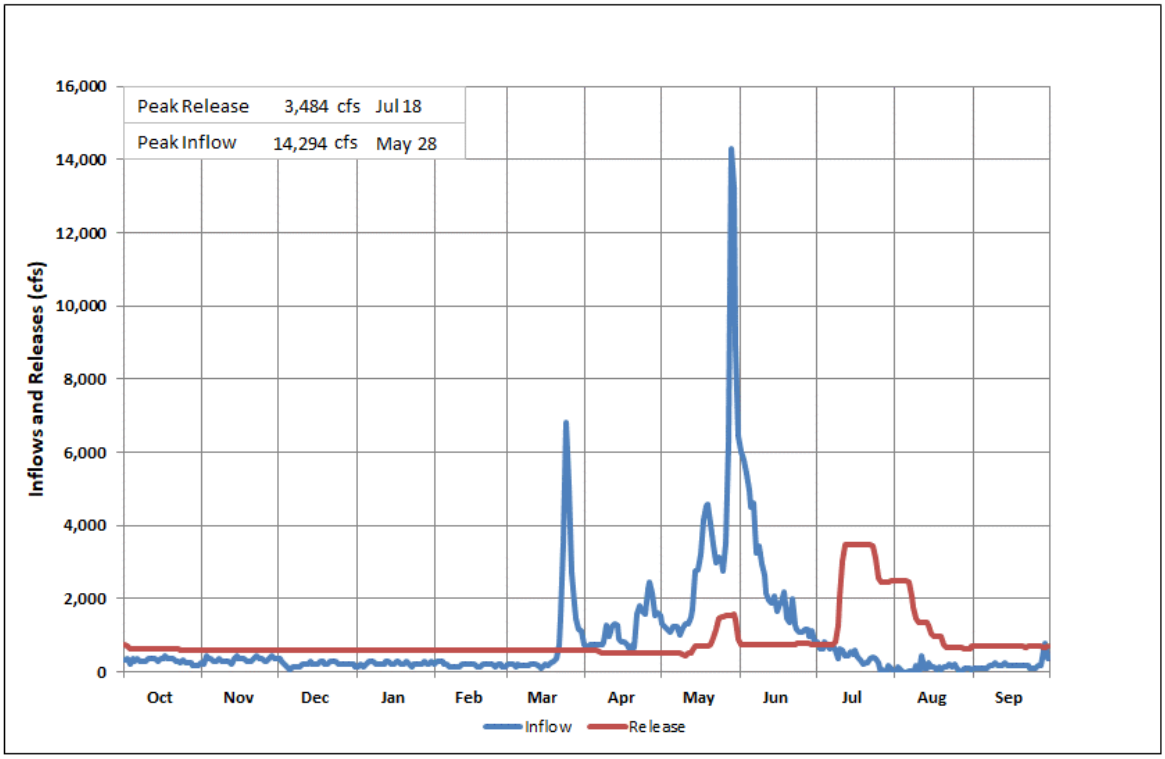


Figure 39: Plots of water year 2019 hydrologic data recorded at Lake Elwell (Tiber Dam).

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 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 AF at an elevation of 4,788.0 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 an elevation of 4,788.0 feet. The maximum combined discharge of the spillway and river outlet works is 4,000 cfs at a maximum water surface elevation of 4,810.0 feet.

Figure 40: Aerial view of Lake Sherburne

In 2002, Reclamation surveyed Lake Sherburne to develop a topographic map and compute area-capacity tables. The data was used to calculate reservoir capacity lost due to sediment accumulation since dam closure in 1919. The survey data determined a storage capacity of 66,147 AF and a surface area of 1,719 acres at a reservoir elevation of 4,788.0 feet. Since dam closure in 1919, the volume change at reservoir elevation 4,788.0 feet was estimated to be 1,707 AF between the 1983 and 2002 surveys. It is assumed the volume differences between the surveys were 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.

Lake Sherburne began water year WY 2019 with a storage content of 6,052 AF at an elevation of 4,736.56 feet, 39 percent of average. This was the lowest carryover since September 30, 1998. The low carryover was due to diverting water over to the Milk River Basin and low runoff during the

latter part of the year in the St. Mary Basin. The low reservoir levels led to the opportunity to complete some maintenance work at Lake Sherburne. Sediment and debris were cleaned out from the area around the river outlet works by heavy equipment starting around the end of September. This work continued until about mid-October. Releases were shutoff for the season from Lake Sherburne on October 17, 2018 after all the cleanout work was completed. Diversions to the St. Mary Canal were shut off for the season on September 28, 2018.

Precipitation in October 2018 was 152 and 125 percent of average in the valley and mountains, respectively and inflow was 111 percent of average. However, precipitation was below average in November and December. Cumulative mountain precipitation through the end of December was 85 percent of average. October through December inflows were 91 percent of average. Storage in Lake Sherburne by the end of December was at 15,740 AF at an elevation of 4,748.78 feet, 57 percent of average.

On January 1, the NRCS reported mountain snowpack in the St. Mary Basin was 78 percent of average. The April-July runoff forecast for January was 92,000 AF, 93 percent of average.

The February 1 mountain snowpack for the St. Mary Basin was 77 percent of average. Temperatures dropped shortly after the first of the month and were much below average during February. February precipitation was above average and the SWE increased to 83 percent of average by March 1.

The April-July runoff forecast for March was 87,000 AF, 87 percent of average. March precipitation was below average at 30 and 28 percent of average in the valley and mountains, respectively. Temperatures remained much below average during March.

Mountain snowpack was at 75 percent of average on April 1. The April, runoff forecast for April-July was 82,000 AF, 82 percent of average. Based on the April forecast, Lake Sherburne was not expected to fill to the normal full pool, elevation of 4,788.0 feet, 66,147 AF.

Diversions to the St. Mary Canal started on March 26, at an initial release of approximately 80 cfs to allow the operators to follow the water through the system to clear any snow jams and fix any other issues. Releases from Lake Sherburne were not started until April 10. The releases were started to supplement the natural runoff in the St. Mary Basin since diversions to St. Mary Canal were being increased to 200 cfs. The canal diversions were being increased to supplement the natural runoff in the Milk River Basin to fill Fresno Reservoir.

Based on storage in Lake Sherburne and runoff conditions in the St. Mary River Basin, a water delivery deficit to Canada was planned for the St. Mary River Basin. A deficit delivery is allowed under the Letter of Intent which is part of the International Joint Commission (IJC) Procedures Manual (Procedures Manual) which is used to calculate the natural flow of the St. Mary and Milk River Basins. The U.S. can create a deficit delivery to Canada during March, April, and May. The deficit would allow Reclamation to conserve storage in Lake Sherburne for later in the year. Releases from Sherburne and diversions into the St. Mary Canal were continually increased during April to move water over to Milk River Basin while creating a deficit delivery to Canada.

Inflows into Lake Sherburne started to increase during the second half of April due to above average precipitation and the start of snowmelt runoff. Storage levels were able to stay steady during April even with the increased releases due to the higher inflows.

Mountain snowpack was at 79 percent of average on May 1. The May runoff forecast for May-July was 77,000 AF, 86 percent of average. There was no drawdown on storage in Lake Sherburne since carryover storage was so low. The water supply forecast did improve by enough of an amount by May 1 that Lake Sherburne was expected to fill to full pool. Lake Sherburne releases were decreased to approximately 35 cfs during May to conserve storage. Natural runoff from snowmelt and above average precipitation during May allowed releases from Lake Sherburne to remain low without increasing the water debt to Canada. Daily average inflow into Lake Sherburne peaked for the year on May 16 at approximately 1,160 cfs.

On May 31, the total deficit delivery of St. Mary water to Canada was 1,295 AF. This water debt was carried to September 15 in accordance with the Procedures Manual.

Mountain snowpack was at 98 percent of average on June 1. The June runoff forecast for June-July was 45,000 AF, 77 percent of average. Inflows peaked again on June 3 at 1,100 cfs. Releases from Lake Sherburne in June were increased to control the rate of fill. Releases fluctuated between 300 and 600 cfs as Lake Sherburne was nearing full pool. Inflow in June was 88 percent of average at 34,400 AF as the remaining snow melted out. Precipitation in June was below average in the valley and mountains. Lake Sherburne peaked in storage on June 30 at 65,558 AF or elevation 4,787.68 feet, 0.32 feet below full pool.

Precipitation remained well below average in July and August. Inflow was also well below average in July and August at 66 percent of average. Due to the continued demand for water in the Milk River Basin and snowmelt runoff dwindling, releases from Lake Sherburne were increased in July and kept high into September. Much of the storage from Lake Sherburne was being used to keep flows above 580 cfs in the St. Mary Canal.

Releases from Lake Sherburne started decreasing on September 21 and were off on September 28. The shutdown was coordinated with the USGS to allow them to do work on the reservoir elevation sensor while the reservoir level was low. St. Mary Canal diversions were stopped on September 27. The releases from Lake Sherburne were shut off a couple days earlier than planned due to a weather system forecasted by NWS that included heavy snow. The record-breaking storm dumped over 4 feet of snow in the area. Precipitation was above average during September at 119 and 139 percent of average in valley and mountains, respectively.

The cumulative precipitation was 96 and 86 percent of average for valley and mountain areas, respectively. Lake Sherburne inflow for water year 2019 totaled 124,126 AF, 87 percent of average. This was approximately 22,461 AF less than the inflow experienced during water year 2018. The actual April-July runoff was 88 percent of average, totaling 87,813 AF. On September 30 the storage content in Lake Sherburne was 5,125 AF at an elevation of 4,735.15 feet, 33 percent of average. The low end of year storage was due to continued high demand for water in the Milk River Basin and below average runoff in the St. Mary River Basin, especially in July and August.

According to preliminary data, diversions from the St. Mary River to the Milk River totaled 169,163 AF. Canal diversions from the St. Mary River to the Milk River were discontinued on September 27.

During the 2019 irrigation season several conference calls were conducted with the IJC Field Representatives to discuss accumulated deficits by the United States and Canada on the St. Mary and Milk Rivers, respectively. More coordination than normal was needed to work out the details on how to balance water between the two nations.

Due to the dry conditions during the summer, there ended up being no natural flow in the Milk River from early July through early September. A deficit delivery of natural flow to the U.S. occurred during this time period. A deficit of 1,382 AF was created on the Milk River which was large enough to offset the deficit on the St. Mary and it was agreed by U.S. and Canada that the deficits were offsetting and no additional payback was necessary by either nation.

During water year 2019, Lake Sherburne did not contribute to the reduction of local flood damages. Since 1950 Lake Sherburne has prevented $10,412,000 in flood damages.

Additional hydrologic and statistical information pertaining to the operation of Sherburne Reservoir during water year 2019 can be found in Table MTT17 and Figure 43.

Fresno Reservoir is located above all project lands on the Milk River near Havre, Montana. A sediment survey in 2010 and finalized in 2013 determined the normal full pool capacity was 91,746 AF, a loss of 1,134 AF from the previous survey. Reclamation started using the revised elevation-area capacity tables on October 1, 2013.

Figure 41: Fresno Dam and Reservoir.

The top 33,841 AF of storage is used jointly for flood control and conservation and is not filled until the start of 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 a contract 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 also have contracts for municipal water use.

Fresno Reservoir began water year 2019 with a storage content of 40,963 AF, at an elevation of 2,561.13 feet, 99 percent of average and 45 percent of normal full capacity. Releases were reduced to 50 cfs on September 25, 2018 with water still being released for Fort Belknap Irrigation Project. Releases were reduced to the winter release rate of 42 cfs on October 3, 2018. This is the minimum amount of water that can be released from Fresno Reservoir based on the minimum gate opening for one river outlet works gate.

After the last of the St. Mary water reached Fresno Reservoir, inflows dropped to below average in October. Precipitation in the Milk River Basin from October through December 2018 was above and below average. Accumulative precipitation from October through December was 101 percent of average. Reservoir inflow was 83 percent of average from October through December. End of December storage was 42,990 AF at an elevation of 2,561.97 feet, 106 percent of average.

On January 1, the NRCS reported mountain snowpack in the Bear Paw Mountains was 162 percent of average. The NRCS reported mountain snowpack on February 1 was 147 percent of average and was 174 percent of average on March 1. Runoff is not forecasted below Fresno Dam, but the above average snowpack indicated that runoff between Fresno Dam and Dodson Diversion Dam would be above average.

Spring runoff season generally occurs during March through June. The peak snowpack and most reliable water supply runoff forecast for the Milk River Basin occurs on March 1. The March forecast for natural runoff above Fresno Reservoir for March through September was 71,400 AF, 88 percent of median. The Milk River runoff forecast is provided by Alberta Environment and Parks. Based on this forecast and expected St. Mary Canal operations, storage in Fresno Reservoir was expected to fill to the top of the conservation pool, elevation of 2,575.0 feet, by the end of May.

Temperatures were much below average during February. The NWS reported in February a 28-degree cold departure for Havre. This was the greatest cold departure from normal since January 1969.

March precipitation was below average. A warmup during the latter part of March caused heavy runoff into Fresno Reservoir from snowmelt. Inflows into Fresno Reservoir peaked at 2,219 cfs on March 26, which was the peak inflow for the year. The inflow decreased to 240 cfs by April 5. Based on the carryover storage in Nelson Reservoir and natural runoff below Fresno Dam, no water had to be transferred from Fresno Reservoir to Nelson Reservoir.

The Milk River Joint Board of Control set the irrigation allotment for the 2019 irrigation season at their April 16 board meeting based on Reclamation's presented the water supply forecast. The allotment was set at 1.8 AF/acre. Releases from Fresno Dam remained at the minimum release rate of 42 cfs until April 30. Releases were increased during April 30 through May 2 to 275 cfs to match scheduled irrigation demands.

By the end of April, water from the St. Mary River Basin through the St. Mary Canal reached Fresno Reservoir. Fresno Reservoir was at elevation 2,573.35 feet, 83,581 AF, which was 123 percent of average.

For the first half of May releases ranged between 200 and 300 cfs based on irrigation demands. Releases were increased 550 cfs during May 15-17 to control the rate fill and keep the reservoir near full pool, elevation 2,575 feet. Fresno Reservoir storage peaked at 2,575.06 feet, 92,055 AF, on May 14. Releases were later reduced to 475 cfs based on declining inflows and the desire to keep Fresno Reservoir near full. On May 25, releases were increased to 550 cfs based again on irrigation demands.

Precipitation was below average during the April and May and above average in June. Fresno inflow for April through June was only 73 percent of average. However, Fresno was still near full in early July at 2,574.86 feet, 91,076 AF, or 130 percent of average. Irrigation demands were below average during June due to the slightly wetter and cooler conditions in June.

Conditions were generally dry during July. Inflows into Fresno Reservoir remained below average as natural runoff above Fresno Reservoir went to zero cfs in July and remained there until September. Nearly all of the inflow during July came from diversions through the St. Mary Canal. Fresno Reservoir inflow during July was 82 percent of average. The Milk River Joint Board of Control did not officially raise the allotment at the July 16 meeting but based on the storage conditions on July 16 and forecasted inflows, a full water supply was expected for the remaining part of the irrigation season and the Board set middle of September as the end of the irrigation season.

Due to wetter conditions below Fresno Dam during August, irrigation demands were beginning to decrease. However, inflows into Fresno Dam remained below average. By the end of August storage in Fresno Reservoir was at 48,528 AF at elevation 2,564.07 feet, 120 percent of average.

Starting in early September, releases were ramped down even more as irrigation demand started to drop off. Precipitation during September was much above average at 269 percent. Releases were reduced on September 23 to 50 cfs for Fort Belknap Indian Irrigation Project through the end of September. Releases remained at 50 cfs during October as inflows were higher than expected into October due to the above average precipitation.

The March through September inflow for Fresno Reservoir, excluding St. Mary Canal water was approximately 29,915 AF, 42 percent of median, based on the Procedures Manual computation of natural flow at the Milk River at Eastern Crossing gaging station. A majority of the flow occurred during March, April and May.

The cumulative valley precipitation through the end of September was 127 percent of average. Total inflow into Fresno Reservoir for water year 2019 was 211,269 AF, 82 percent of average. Diversions from the St. Mary River Basin to the Milk River Basin accounted for about 72 percent of the inflow to Fresno Reservoir. Storage in Fresno Reservoir at the end of the water year 2019 was 59,103 AF, at an elevation of 2,567.34 feet, 138 percent of average and 64 percent of normal full capacity.

The USACE determined that during water year 2019, Fresno Reservoir prevent $365,000 in local flood damage and no main stem flood damages on the Missouri River below Fort Peck Reservoir. Since 1950 Fresno Dam and Reservoir has reduced flood damages by a total of $19,913,000.

Additional hydrologic and statistical information pertaining to the operation of Fresno Reservoir during 2019 can be found in Table MTT18 and Figure 44.

Nelson Reservoir located near Malta, Montana, is an off-stream reservoir, receiving 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 also serves the Glasgow Irrigation District when water is not available from Fresno Reservoir. In 1999 a sediment survey was performed and finalized in 2001. Since Nelson Reservoir operation began in 1916, the measured total volume loss due to sedimentation was 446 AF. The new revised elevation-area capacity data was implemented on October 1, 2001. Nelson Reservoir has a revised total capacity of 78,950 AF and an active capacity of 60,810 AF.

Figure 42: Nelson Reservoir.

Nelson Reservoir began water year 2019 with a storage content of 76,297 AF which was an elevation of 2,220.98 feet, 141 percent of average and 97 percent of normal full capacity. Nelson Reservoir was essentially full to begin the water year. Storage slowly decreased due to seepage through March 18, when diversions through the Dodson South reach Nelson Reservoir reached Nelson Reservoir. Storage in Nelson Reservoir on March 18 was 63,637 AF.

Releases for irrigation demands started on May 12. Releases through Nelson North Canal for Glasgow Irrigation District were not required during 2019 due to the above average precipitation in the lower part of the Milk River Basin. Storage in Nelson Reservoir was highest on July 12 at 78,518 AF, at an elevation of 2,221.50 feet. However, Nelson Reservoir was at full pool for nearly the full season except for June due to high carryover and low irrigation demand due to a wet year in the lower part of the Milk River Basin.

All releases were stopped on June 23 when the first irrigation was completed and to de-moss the Nelson South Canal. Releases through the Nelson North Canal were initiated on July 3 to control storage levels in Nelson Reservoir.

The low storage content for the 2019 irrigation season was 66,702 AF at an elevation of 2,218.62 feet on June 20.

Diversions to Dodson South Canal were stopped in early September due to near full storage conditions in Nelson Reservoir. Inflows into Nelson Reservoir stopped about September 19 and releases were also stopped on September 19. Total net inflow to Nelson Reservoir during water year

2019 was 64,701 AF. Storage on September 30, 2019 was 77,103 AF at an elevation of 2,221.17 feet, 138 percent of average and 98 percent of normal full capacity.

Additional hydrologic and statistical information pertaining to the operation of Nelson Reservoir during 2019 can be found in Table MTT19 and Figure 45.

Important Events in Water Year 2019

March 18, 2019: Diversions to Dodson South Canal reach Nelson Reservoir.

March 26, 2019: Inflow to Fresno Reservoir peaked at 2,219 cfs.

March 26, 2019: Diversion to St. Mary Canal were started to move water to the Milk River Basin.

April 10, 2019: Releases begin from Lake Sherburne as diversions to the St. Mary Canal were being increased.

April 16, 2019: MRJBC set the irrigation allotment at 1.8 AF/acre. This approximately 0.5 AF/acre lower than a full water supply.

April 17, 2019: A conference call was held with the IJC Field Representatives to discuss St. Mary and Milk River apportionments.

April 30, 2019: Fresno Reservoir releases were increased for the first time for the year to meet irrigation demand.

May 14, 2019: Storage in Fresno Reservoir reached a peak content for the year of 92,055 AF, at an elevation of 2,575.06 feet, 0.06 feet above normal full pool.

May 12, 2019: Releases were initiated from Nelson Reservoir for irrigation demands.

May 16, 2019: Inflow to Lake Sherburne peaked at 1,160 cfs.

June 12, 2019: A conference call was held with the IJC Field Representatives to discuss St. Mary and Milk River apportionments.

June 30, 2019: Storage in Lake Sherburne reached a peak content for the year, 65,558 AF, at an elevation of 4,787.68 feet, 0.32 feet below normal full pool.

July 10, 2019: A conference call was held with the IJC Field Representatives to discuss St. Mary and Milk River apportionments.

July 12, 2019: Storage in Nelson Reservoir reached a peak content for the year of 78,518 AF, at an elevation of 2,221.50 feet.

July 16, 2019: MRJBC did not revise the irrigation allotment but it was generally understood a full water supply was available if needed. The MRJBC set the end of the irrigation season as September 15.

September 11, 2019: A conference call was held with the IJC Field Representatives to discuss St. Mary and Milk River apportionments.

September 19, 2019: Inflows and releases from Nelson Reservoir were discontinued.

September 23, 2019: Releases from Fresno Reservoir are set at approximately 50 cfs.

September 27, 2019: St. Mary Canal diversions were discontinued.

September 28, 2019: Lake Sherburne releases were discontinued.

November 13, 2019: A conference call was held with the IJC Field Representatives to discuss St. Mary and Milk River apportionments.

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	4736.56	6,052	OCT 1, 2018
END OF YEAR	4735.15	5,125	SEP 30, 2019
ANNUAL LOW	4729.96	2,203	OCT 17, 2018
ANNUAL HIGH	4787.68	65,958	JUN 29, 2019
HISTORIC HIGH	4788.30	68,371	JUN 30, 1986

INFLOW-OUTFLOW DATA	INFLOW	DATE	OUTFLOW	DATE
ANNUAL TOTAL (AF)	124,126	OCT'18-SEP'19	125,053	OCT'18-SEP'19
DAILY PEAK (CFS)	1,158	MAY 16, 2019	682	JUL 31, 2019
DAILY MINIMUM (CFS)	5	JAN 28, 2019	0	*

* During non-irrigation season

	INFLOW		OUTFLOW		CONTENT	
MONTH	KAF	% OF AVG	KAF	% OF AVG	KAF	% OF AVG
OCTOBER	7.5	110	7.0	240	6.6	34
NOVEMBER	7.0	88	0.0	0	13.5	54
DECEMBER	2.2	59	0.0	0	15.7	57
JANUARY	1.8	65	0.0	0	17.6	57
FEBRUARY	1.6	62	0.0	0	19.1	58
MARCH	1.6	41	0.0	0	20.7	66
APRIL	11.7	110	12.5	68	19.9	86
MAY	29.9	95	3.4	18	46.5	128
JUNE	34.4	88	15.2	81	65.6	114
JULY	11.9	62	25.9	103	51.6	101
AUGUST	6.9	76	37.2	117	21.3	76
SEPTEMBER	7.7	138	23.9	126	5.1	33
ANNUAL	124.1	87	125.1	88		
APRIL-JULY	87.8	87.6				

Table MTT 16: Water Year 2019 hydrologic data for Sherburne Reservoir (Milk River Project). New sediment survey data effective 10/01/2005.

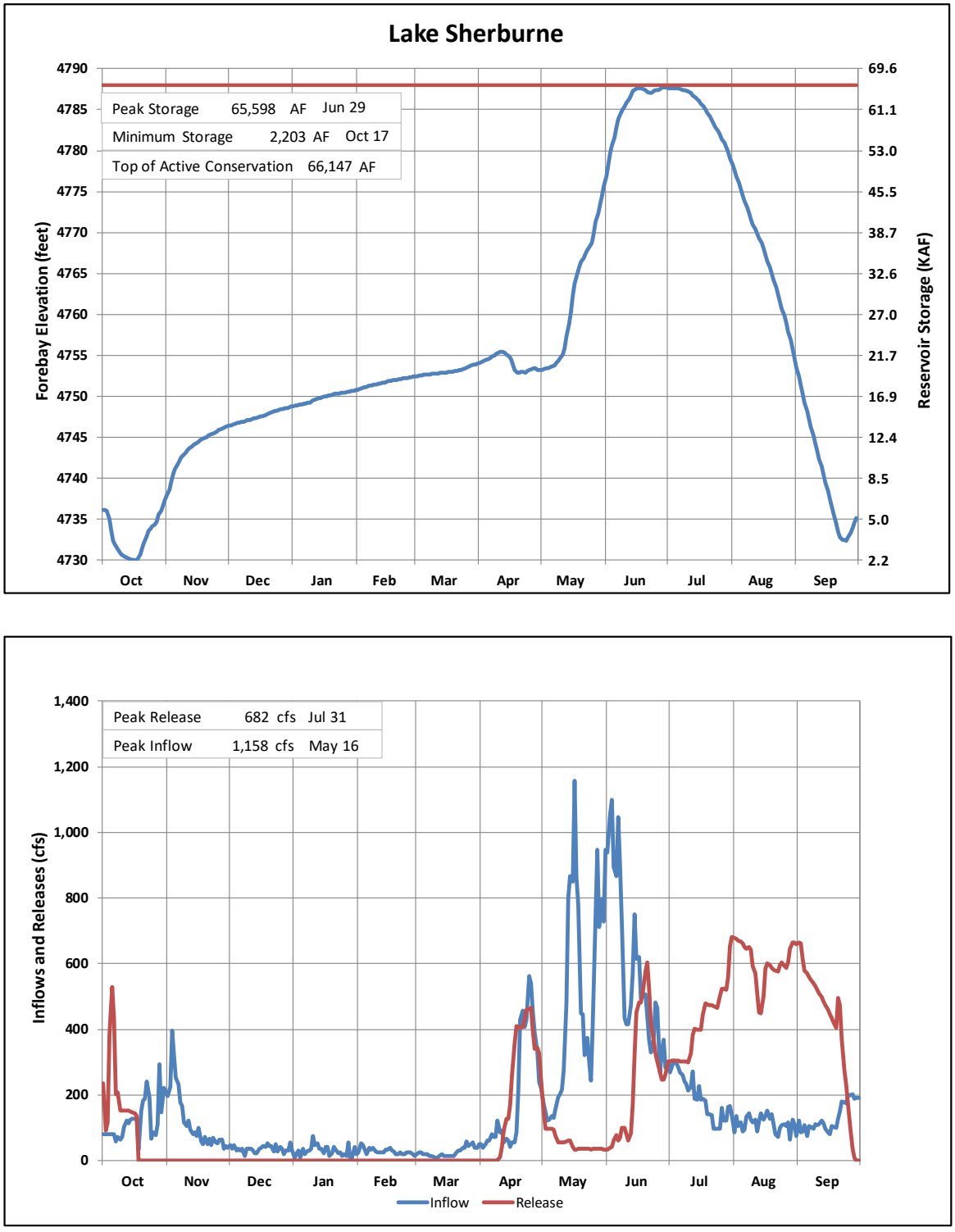


Figure 43: Plots of water year 2019 hydrologic data for Lake Sherburne Dam and Reservoir.

RESERVOIR ALLOCATIONS	ELEVATION (FEET)	TOTAL RESERVOIR STORAGE (AF)	STORAGE ALLOCATION (AF)
TOP OF INACTIVE AND DEAD	2530.00	158	158
TOP OF ACTIVE CONSERVATION	2567.00	57,905	57,747
TOP OF JOINT USE	2575.00	91,746	33,841

STORAGE-ELEVATION DATA	ELEVATION (FT)	STORAGE (AF)	DATE
BEGINNING OF YEAR	2561.13	40,963	OCT 01, 2018
END OF YEAR	2567.34	59,103	SEP 30, 2019
ANNUAL LOW	2559.45	37,087	MAR 20, 2019
ANNUAL HIGH	2575.06	92,055	MAY 14, 2019
HISTORIC HIGH	2579.35	154,023	APR 03, 1952

INFLOW-OUTFLOW DATA	INFLOW	DATE	OUTFLOW	DATE
ANNUAL TOTAL (AF)	211,269	OCT'18-SEP'19	193,657	OCT'18-SEP'19
DAILY PEAK (CFS)	2,220	MAR 26, 2019	1,187	AUG 03, 2019
DAILY MINIMUM (CFS)	0	*	42	OCT 04, 2018

* During non-irrigation season

	INFLOW		OUTFLOW*		CONTENT	
MONTH	KAF	% OF AVG	KAF	% OF AVG	KAF	% OF AVG
OCTOBER	6.6	85	2.6	43	44.9	105
NOVEMBER	2.0	75	2.6	88	44.3	105
DECEMBER	1.3	85	2.6	91	43.0	106
JANUARY	0.5	38	2.6	90	40.9	105
FEBRUARY	0.4	9	2.4	81	38.9	99
MARCH	25.1	101	2.6	25	61.4	118
APRIL	24.6	76	2.8	16	83.6	123
MAY	32.4	74	25.9	58	90.2	135
JUNE	36.5	70	38.2	79	88.5	123
JULY	26.2	82	42.6	83	72.1	136
AUGUST	26.2	85	49.8	111	48.5	120
SEPTEMBER	29.5	131	19.0	90	59.1	138
ANNUAL	211.3	82	193.7	76		

Table MTT 17: Water year 2019 hydrologic data for Fresno Reservoir (Milk River Project). New sediment survey data effective October 1, 2013.

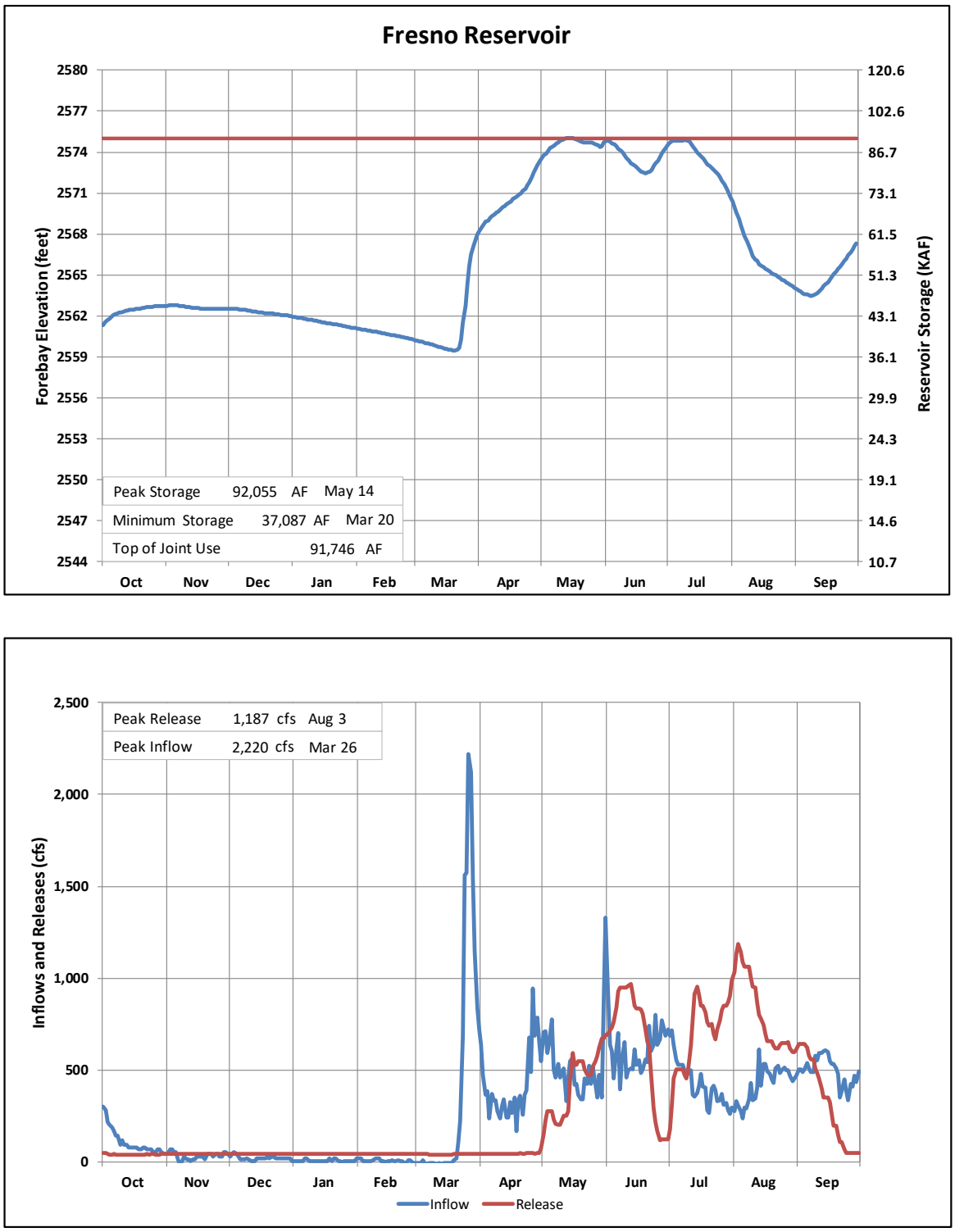


Figure 44: Plots of water year 2019 hydrologic data for Fresno Reservoir.

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	2220.98	76,297	OCT 01, 2018
END OF YEAR	2221.14	77,103	SEP 30, 2019
ANNUAL LOW	2217.83	63,637	MAR 18, 2019
ANNUAL HIGH	2221.50	78,518	JUL 12, 2019
HISTORIC HIGH	2221.68	79,297	JUN 01, 2007

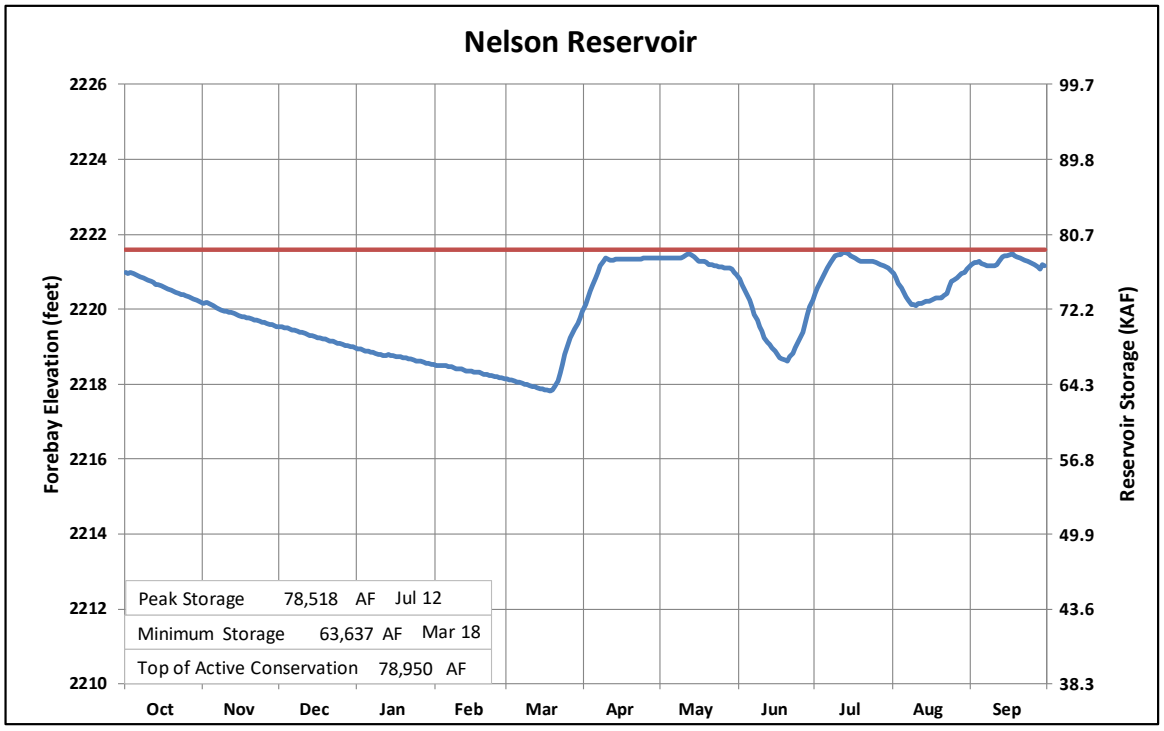
INFLOW-OUTFLOW DATA	INFLOW	DATE	OUTFLOW	DATE
ANNUAL TOTAL (AF)	64,701	OCT'18-SEP'19	63,930	OCT'18-SEP'19
DAILY PEAK (CFS)	555	MAR 24, 2019	412	JUN 1, 2019
DAILY MINIMUM (CFS)	0	*	0	*

* During non-irrigation season

	INFLOW		OUTFLOW		CONTENT	
MONTH	KAF	% OF AVG	KAF	% OF AVG	KAF	% OF AVG
OCTOBER	-3.3	---	0.0	0	73.0	133
NOVEMBER	-2.6	---	0.0	0	70.4	132
DECEMBER	-2.3	---	0.0	0	68.1	132
JANUARY	-1.8	---	0.0	0	66.3	132
FEBRUARY	-1.5	---	0.0	0	64.8	132
MARCH	7.2	202	0.0	0	72.0	136
APRIL	12.9	121	6.7	715	78.0	124
MAY	10.9	119	12.9	136	76.0	123
JUNE	8.5	86	11.6	119	73.2	117
JULY	17.5	283	14.1	94	76.6	140
AUGUST	10.3	104	9.9	87	77.0	145
SEPTEMBER	8.9	115	8.7	198	77.1	138
ANNUAL	64.7	116	63.9	117		

*Average based on 1995 to 2018

Table MTT 18: Water year 2019 hydrologic data for Nelson Reservoir (Milk River Project). New sediment survey data effective October 1, 2001.



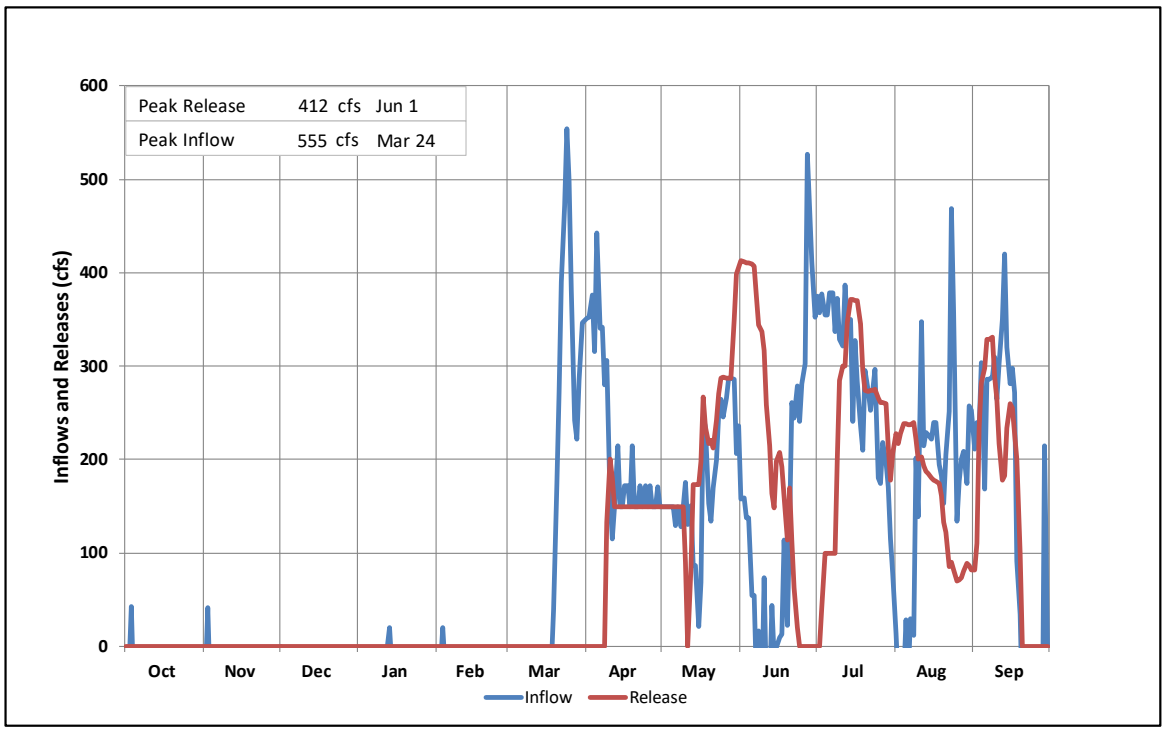


Figure 45: Plots of water year 2019 hydrologic data for Nelson Reservoir.

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 1,331,725 AF. The dam and reservoir were built for power generation, irrigation, flood control, fish and wildlife and recreation. The nameplate capacity of Yellowtail Powerplant is 250,000 kilowatts. The water is managed to support multiple beneficial uses. Reclamation has a storage allocation agreement with the Northern Cheyenne Tribe for 30,000 AF and the Crow Tribe for up to 300,000 AF of water. Reclamation has an industrial water service contract with Talen Energy for 6,000 AF. No additional water can be contracted out of Yellowtail Dam after the passage of the Crow Tribe Water Rights Settlement Act of 2010. Bull Lake, Boysen, and Buffalo Bill Reservoirs are three major tributary reservoirs located in Wyoming upstream of Bighorn Lake. These reservoirs are operated and managed by the Wyoming Area Office (WYAO) and all reservoir and river operations in the Bighorn River Basin are closely coordinated between the MTAO and WYAO.

Figure 46: Yellowtail Dam and Powerplant

In July 2007, a hydrographic and a topographic survey was conducted, and a new elevation-area capacity table and curve was developed. The 2007 survey determined Bighorn Lake has a storage capacity of 1,278,896 AF and a surface area of 17,279 acres at an elevation of 3,657.0 feet (the top of the spillway gates). Since closure of the dam in November 1965, Bighorn Reservoir accumulated a sediment volume of 103,415 AF below an elevation of 3,657.0 feet. The volume represents a 7.5 percent loss in capacity and an average annual loss of 2,480 AF from November 1965 through July 2007. The revised area-capacity table was put into effect on January 1, 2011, reflecting the new storage levels.

Bighorn Lake began water year 2019 with a storage content of 952,099 AF at an elevation of 3,634.12 feet. Precipitation was below average in October, but inflows were above average due to above average releases from Boysen and Buffalo Bill Reservoirs. Releases were decreased during October to 2,925 cfs due based on the expected winter release. Storage fluctuated in Bighorn Lake during October and ended the month at 950,290 AF or elevation 3,633.95 feet. Snowpack started accumulating in October with a midmonth snowstorm that pushed through the Bighorn River Basin.

The winter release was initially set at 2,970 cfs to the Bighorn River on November 6. This was based on planned winter releases from Boysen and Buffalo Bill Dams, forecasted winter tributary gains below Boysen and Buffalo Bill Dam, and a March 31, 2019 elevation target of 3,617 feet.

Valley and mountain precipitation were above average in November with snowpack being 101 percent of average by the end of November. Temperatures were below average during November. Inflows into Bighorn Lake during November were 126 percent of average. Releases were increased to 3,025 cfs on December 11 based on November inflows being higher than forecasted.

Precipitation and temperatures were below average during December. Cumulative precipitation through the end of December was 95 and 94 percent of average in the valley and mountains, respectively. Inflow into Bighorn Lake stayed well above average. The October through December inflow was 119 percent of average. Gains over the three-month period were 100 percent of average. Releases over the same three-month period were 119 percent of average.

Snow accumulated at a below average rate during December and on January 1, the NRCS reported mountain snowpack for the Bighorn Basin at 84 percent of average. Releases to the Bighorn River were decreased to 2,900 cfs on January 10 based on a decrease in forecasted releases from Buffalo Bill for March. The March 31 elevation target remained at 3,617 feet. During January snow fell in the mountains at an average rate. Temperatures were below average in southern half of the Bighorn River Basin and above average in the northern half of the Basin.

On February 1, the NRCS reported mountain snowpack was 84 percent of average. Releases to the Bighorn River remained a constant 2,900 cfs during February. The snowpack in February accumulated at an above average rate. Temperatures were below average during February.

On March 1, the NRCS reported mountain snowpack was 97 percent of average. The March forecasted April through July runoff was 1,176,000 AF, 96 percent of average. Under the operating criteria, on March 1, the Bighorn Lake storage target changes from March 31 to April 30. The end of April target is based on the April-July runoff forecast and the associated operating rule curve. Based on the inflow forecast, the end of April target was 3,613.5 feet. However, releases did not have to increase until March 28. Releases were increased to 3,250 cfs based on forecasted inflows. Storage at the end of March in Bighorn Lake was 794,937 AF, at an elevation of 3,615.05 feet, 104 percent of average. Temperatures in the Basin were below average during March. Precipitation in the Basin was also below average. Mountain and valley precipitation at 95 and 54 percent of average respectively.

The mountain snowpack above Bighorn Lake was 88 percent of average on April 1. The April forecast for April-July runoff was 1,025,300 AF, 84 percent of average. Based on the forecast, the end of April elevation target was raised to 3,615.1 feet. This was essentially the same elevation the reservoir was already at on March 31. River releases were increased to 3,500 cfs on April 24 based on an increase in forecasted daily inflows. Canal diversions for the year also started on April 24. Throughout the remainder of the year, diversion to the Bighorn Canal was adjusted as needed to meet irrigation demands. Precipitation was slightly above average during April at 112 percent of average in the valley and 102 percent of average in the mountains. Temperatures in April were also above average. SWE above Yellowtail Dam peaked on April 17 at 13.1 inches, 98 percent of the average.

By May 1, storage in Bighorn Lake decreased to 784,369 AF, an elevation of 3,613.39 feet. Mountain snowpack on May 1 was 89 percent of average and the May through July runoff was forecasted to be 851,600 AF or 81 percent of average. Based on the forecast, the annual minimum elevation target was 3,615.6 feet with a target date of May 1. Releases to the Bighorn River were kept at 3,500 cfs. The minimum elevation for the year was 3,612.75 feet, 780,398 AF, occurred on May 7. The elevation stayed below the minimum elevation target of 3,615.6 feet until May 20.

Temperatures were cooler than average during May. Precipitation was well above average during May at 263 and 183 percent of average in the valley and mountains respectively. Inflows into Bighorn Lake started to increase on approximately May 16 due to snowmelt runoff and wet conditions and a gradual increase in releases from Boysen Dam. Releases were increased to 4,500 cfs during May 23-26 to control the rate of fill and increasing daily runoff forecasts. Canal diversions remained at only 50 cfs due to the wet conditions.

During the second half of May snowpack was accumulating in the mountains when snowpack is normally melting out. A very heavy precipitation event occurred during May 27 through May 29 over most of the Bighorn Basin which increased runoff above maximum probable runoff conditions. Storm totals in some areas were in excess of three inches while monthly totals were greater than five inches at several locations. Precipitation totals at some sites are detailed in the table below. Daily average inflows into Bighorn Lake peaked on May 29 at 16,007 cfs. On May 29 and 30, river releases were increased to 6,500 cfs. Releases were maintained at 6,500 cfs by USACE reservoir regulation order to minimize flooding on the Missouri River and assist the Missouri River mainstem reservoir system. This same heavy rain caused forecasted flows on the Yellowstone River at Miles City to be at flood stage, but actual flows ended up being just below flood stage. Serious and devastative flooding was occurring on the Missouri River mainstem when the USACE provided the regulation order. By the end of May, storage was at 903,363 AF, elevation 3,629.15 feet. Total May inflow was 50,000 AF higher than median probable forecast.

YELLOWTAIL DAM				
	Antecedent	3-Day Storm		Total
	May 17-24	May 27-29		May 17-29
NOAA STATIONS				
BLACK MOUNTAIN	2.92	2.38		5.31
BOYSEN DAM	2.45	2.32		4.77
CODY 12 SE	1.91	3.02		5.02
THERMOPOLIS 9 NE	2.36	2.80		5.16
WORLAND 14.4 SW	2.26	2.09		4.35
SNOTEL STATIONS				
BALD MTN.	2.90	1.50		4.60
BEAR TRAP MEADOW	1.40	1.90		3.50
BLACKWATER	2.00	1.80		4.00
BURGESS JUNCTION	2.10	2.10		4.20
DOME LAKE	3.70	2.20		6.10
HANSEN SAWMILL	3.10	3.30		6.40
KIRWIN	1.70	3.50		5.20
OWL CREEK	2.10	3.20		5.40
SUCKER CREEK	3.30	2.60		6.00
TIMBER CREEK	3.40	5.10		8.70

Table MTT 19: Measured precipitation in inches during the May 2019 storm event at Yellowtail Dam.

On June 1, snowpack was 176 percent of average. This was not the peak for the year, but it was the highest percent of average for the year due to the late accumulation of snowpack during May. The June forecast for June through July runoff was 987,900 AF, 132 percent of average which was 442,000 AF higher than what was forecasted on May 1. By USACE reservoir regulation order YETL-19-03, releases were decreased to 5,500 cfs on June 3 and 4 to minimize releases for continued flood control support along the Missouri River mainstem. Inflows remained much above average and above forecasted amounts, due to continued runoff from the end of May storm and an increased rate of snowmelt runoff. Releases throughout the month of June were being coordinated with the USACE as inflow forecasts were continually revised upward. River releases peaked at 11,000 cfs on June 21 and remained at that level until June 24.

Once inflows started to recede towards the end of June and snowpack was essentially melted out, the USACE allowed releases to be decreased to 8,500 cfs, by the end of the month. Precipitation and temperatures were below average during June. Storage ended the month at elevation 3,645.9 feet, 1,101,406 AF, 5.9 feet into the exclusive flood control pool.

Through coordination with the USACE, releases to the river were increased to 9,500 cfs on July 8 and 9 due to sustained high inflows from increased releases from Buffalo Bill Dam with a storage target of approximately 40 percent of the flood control pool. Storage peaked in Bighorn Lake on July 10 at 1,133,350 AF, at an elevation of 3,648.0 feet or 8.0 feet into the exclusive flood control pool. Starting on July 17, releases were gradually decreased for the remainder of the month. Releases were kept above inflows to continue to evacuate storage from the exclusive flood control pool. Due to conditions on the Missouri River mainstem, the USACE allowed slow evacuation of the flood control pool. During July, precipitation was 112 percent in the valley and 82 percent in the mountains and temperatures in the Basin were above average. Releases to the river by the end of July were 5,500 cfs.

Operations through snowmelt runoff were closely coordinated between the MTAO, WYAO, USACE, National Park Service, and Montana Fish, Wildlife and Parks into early August. On August 1, 2019 storage in Bighorn Lake was 1,028,196 AF at an elevation of 3,640.6 feet, 112 percent of average. Within the first few days of August, releases to the Bighorn River were decreased to 3,650 cfs as the remaining storage in the exclusive flood control pool was evacuated. River releases were reduced a couple more times during August to 3,250 cfs. Inflows into Bighorn Lake during August were 206,900 AF, 135 percent of average.

Inflows remained above average during September. River releases were maintained at 3,250 cfs throughout the month of September. Several shift changes to the river gage were required to keep up with the algae growth. Valley and mountain precipitation in September were well above average at 241 and 176 percent of average, respectively.

Storage in Bighorn Lake ended water year 2019 with a content of 999,265 AF at an elevation of 3,638.27 feet. This was 112 percent of average and 47,166 AF or 4.2 feet higher than at the end of water year 2018.

Inflows into Bighorn Lake during April-July were 137 percent of average, totaling 1,221,190 AF. This was the 12th highest April-July inflow. April to July inflow in 2019 was 639,700 AF lower than the April to July inflow that occurred in 2018. The annual runoff into Bighorn Lake during water year 2019 totaled 2,973,900 AF, or 130 percent of average.

The total amount of water released to the Bighorn River during water year 2019 was 2,903,000 AF or 128 percent of average. This was 1,118,000 AF lower than what was released to the Bighorn River in water year 2018.

The water levels of Bighorn Lake during water year 2019 allowed for full-service recreation at all marinas for most of the recreation season, from Memorial Day through Labor Day. The exception to this is Black Canyon Campground had to be closed for part of June and July due to the water level in Bighorn Lake being above elevation 3,642 feet which is the elevation in which the campground starts to become inundated.

Total generation produced at Yellowtail Powerplant during water year 2019 was 896,500 megawatt-hours, 114 percent of average. This was 270,600 megawatt-hours less than what was generated in water year 2018. Approximately 84 percent of all water released from Yellowtail Dam during water year 2019 was released through the powerplant, 2,448,700 AF. The remaining 477,900 AF was released either through the river outlet gates or the spillway gates.

The USACE estimated that during water year 2019, Bighorn Lake prevented $381,800 in local flood damages and $953,300 in flood damages downstream on the Missouri River below Fort Peck Reservoir. Since construction of Yellowtail Dam in 1965, Bighorn Lake has reduced flood damages by a total of $180,534,200.

Important Events in Water Year 2019

October 1, 2018 through September 30, 2019: Yellowtail Powerplant was limited to three units for most of the year due to a major rewind project with Unit 4 currently the unit that was unavailable.

October 4, 2018: Bighorn Canal Diversions were shutoff for the irrigation season. (3,000 cfs to the Bighorn River and 0 cfs to the Bighorn Canal)

October 11, 2018: Releases to the Bighorn River were decreased to 2,925 cfs. (2,925 cfs to the Bighorn River and 0 cfs to the Bighorn Canal)

October 15-16, 2018: Inspection of the Yellowtail Afterbay Dam radial gates required the Yellowtail Afterbay Reservoir be maintained between elevations 3,174.0 and 3,178.5 feet.

October 30, 2018: Maintenance of the Yellowtail Afterbay Dam sluicegates required the Yellowtail Afterbay Reservoir be maintained between elevations 3,185.0 and 3,192.0 feet to maintain river flows through the radial gates.

November 5-16, 2018: Maintenance of the Yellowtail Dam river outlet works required the Yellowtail Afterbay Reservoir be maintained below elevation 3,190.0 feet.

November 6, 2018: Releases to the Bighorn River were increased to 2,970 cfs based on winter release operating criteria. (2,970 cfs to the Bighorn River and 0 cfs to the Bighorn Canal)

December 11, 2018: Releases to the Bighorn River were increased to 3,025 cfs based on actual November inflows being greater than forecasted November inflows. (3,025 cfs to the Bighorn River and 0 cfs to the Bighorn Canal)

January 10, 2019: Releases to the Bighorn River were decreased to 2,900 cfs based on snowpack and forecasted inflows. (2,900 cfs to the Bighorn River and 0 cfs to the Bighorn Canal)

March 20, 2019: Inspection of the Yellowtail Dam spillway required the Yellowtail Afterbay Reservoir be maintained below elevation 3,183.0 feet.

March 28, 2019: Releases to the Bighorn River were increased to 3,250 cfs based on hydrologic conditions and forecasted inflows (3,250 cfs to the Bighorn River and 0 cfs to the Bighorn Canal)

April 23, 2019: A black start test of the Yellowtail Powerplant was conducted. All four units of the Yellowtail Powerplant were offline for approximately 3 hours. The Yellowtail Powerplant is restarted in black start using the standby generator.

April 24, 2019: Diversions to the Bighorn Canal were started on April 24. (3,500 cfs to the Bighorn River and 100 cfs to the Bighorn Canal) Throughout the remainder of the irrigation season, diversion to the Bighorn Canal was adjusted as needed to meet the irrigation demands.

May 23-26, 2019: Releases to the Bighorn River were increased to 4,500 cfs to control the rate of fill of Bighorn Lake based on current and forecasted inflows due to heavy rains upstream of Yellowtail Dam. (4,500 cfs to the Bighorn River and 50 cfs to the Bighorn Canal)

May 29-30, 2019: Releases to the Bighorn River were increased to 6,500 cfs to control the rate of fill of Bighorn Lake based on current and forecasted inflows due to heavy rains upstream of Yellowtail Dam. Releases were being coordinated with the USACE (USACE Order YETL-19-01). (6,500 cfs to the Bighorn River and 50 cfs to the Bighorn Canal)

June 3-4, 2019: Releases to the Bighorn River were decreased to 5,500 cfs over a two-day period at the directions of the USACE to assist with flood control along the Missouri River mainstem (USACE Order YETL-19-02). (5,500 cfs to the Bighorn River and 150 cfs to the Bighorn Canal)

June 10, 2019: Releases to the Bighorn River were increased to 6,000 cfs at the directions of the USACE based on maximum storage projections while trying to minimize releases to mitigate flooding on the Missouri River mainstem (USACE Order YELT-19-03). (6,000 cfs to the Bighorn River and 150 cfs to the Bighorn Canal)

June 13-15, 2019: Releases to the Bighorn River were increased to 8,250 cfs at the directions of the USACE based on maximum storage projections while trying to minimize releases to mitigate flooding on the Missouri River mainstem (USACE Orders YETL-19-04,05,06). (8,250 cfs to the Bighorn River and 250 cfs to the Bighorn Canal)

June 17-27, 2019: Annual electrical and mechanical maintenance and warranty inspection of Unit 1 of the Yellowtail Powerplant was conducted. Yellowtail Powerplant was limited to two units during this timeframe.

June 17-18, 2019: Releases to the Bighorn River were increased to 10,000 cfs at the directions of the USACE based on storage projections while trying to minimize releases to mitigate flooding on the Missouri River mainstem (USACE Orders YETL-19-07,08). (10,000 cfs to the Bighorn River and 350 cfs to the Bighorn Canal)

June 20-21, 2019: Releases to the Bighorn River were increased to 11,000 cfs at the directions of the USACE based on storage projections while trying to minimize releases to mitigate flooding on the Missouri River mainstem (USACE Order YETL-19-09). (11,000 cfs to the Bighorn River and 375 cfs to the Bighorn Canal)

June 24-28, 2019: Releases to the Bighorn River were decreased to 8,500 cfs at the directions of the USACE based on storage projections while trying to minimize releases to mitigate flooding on the Missouri River mainstem (USACE Orders YETL-19-10,11). (8,500 cfs to the Bighorn River and 250 cfs to the Bighorn Canal)

July 8-9, 2019: Releases to the Bighorn River were increased to 9,500 cfs at the directions of the USACE based on storage projections while trying to minimize releases to mitigate flooding on the Missouri River mainstem (USACE Order YETL-19-12). (9,500 cfs to the Bighorn River and 150 cfs to the Bighorn Canal)

July 18, 2019: Releases to the Bighorn River were decreased to 9,000 cfs at the directions of the USACE based on storage projections while trying to minimize releases to mitigate flooding on the Missouri River mainstem (USACE Order YETL-19-13). (9,000 cfs to the Bighorn River and 250 cfs to the Bighorn Canal)

July 22-25, 2019: Releases to the Bighorn River were decreased to 7,000 cfs at the directions of the USACE based on storage projections while trying to minimize releases to mitigate flooding on the Missouri River mainstem (USACE Order YETL-19-14). (7,000 cfs to the Bighorn River and 450 cfs to the Bighorn Canal)

July 29-August 4, 2019: Releases to the Bighorn River were decreased to 4,000 cfs at the directions of the USACE based on storage projections while trying to minimize releases to mitigate flooding on the Missouri River mainstem. (5,500 cfs to the Bighorn River and 450 cfs to the Bighorn Canal)

August 3, 2019: Exclusive flood control pool of Bighorn Lake is completed evacuated after storing a maximum of 112,777 AF of water at the direction of the USACE in the exclusive flood control pool.

August 5, 2019: Releases to the Bighorn River were decreased to 3,650 cfs to conserve storage. (3,650 cfs to the Bighorn River and 450 cfs to the Bighorn Canal)

August 15, 2019: Releases to the Bighorn River were decreased to 3,500 cfs based on the forecasted water supply. (3,500 cfs to the Bighorn River and 370 cfs to the Bighorn Canal)

August 20, 2019: Releases to the Bighorn Canal were decreased to 300 cfs to accommodate chemical treatment of the algae in the canal.

August 22, 2019: Releases to the Bighorn River were decreased to 3,250 cfs based on the forecasted water supply. (3,500 cfs to the Bighorn River and 370 cfs to the Bighorn Canal)

September 4, 2019: Unit 1 and 2 of the Yellowtail Powerplant was unavailable due to transformer maintenance and testing while Unit 4 was out of service to the unit rewind. Yellowtail Powerplant was limited to one unit during 0800 to 1200 hour.

September 9-13, 2019: Unit 3 and 4 of the Yellowtail Powerplant was unavailable due to transformer maintenance and testing. Yellowtail Powerplant was limited to two units during this timeframe.

September 16-October 4, 2019: Semi-annual maintenance of the Yellowtail Afterbay Dam sluicegates required the Yellowtail Afterbay Reservoir be maintained between elevations 3,186.0 and 3,190.0 feet to maintain river flows through the radial gates.

September 25, 2019: The Bighorn Canal was shut down for the irrigation season.

Additional hydrologic and statistical information pertaining to the operations of Bighorn Lake during water year 2019 can be found on Table MTT21 and Figure 47.

For more detailed information on the operations of Boysen and Buffalo Bill Reservoirs during water year 2019, refer to the narratives for Boysen Reservoir and Powerplant and Shoshone Project under the responsibility of the WYAO.

RESERVOIR ALLOCATIONS	ELEVATION (FEET)	TOTAL RESERVOIR STORAGE (AF)	STORAGE ALLOCATION (AF)
TOP OF INACTIVE AND DEAD	3547.00	469,910	469,910
TOP OF ACTIVE CONSERVATION	3614.00	788,208	318,298
TOP OF JOINT USE	3640.00	1,020,573	232,365
TOP OF EXCLUSIVE FLOOD CONTROL	3657.00	1,278,896	258,323

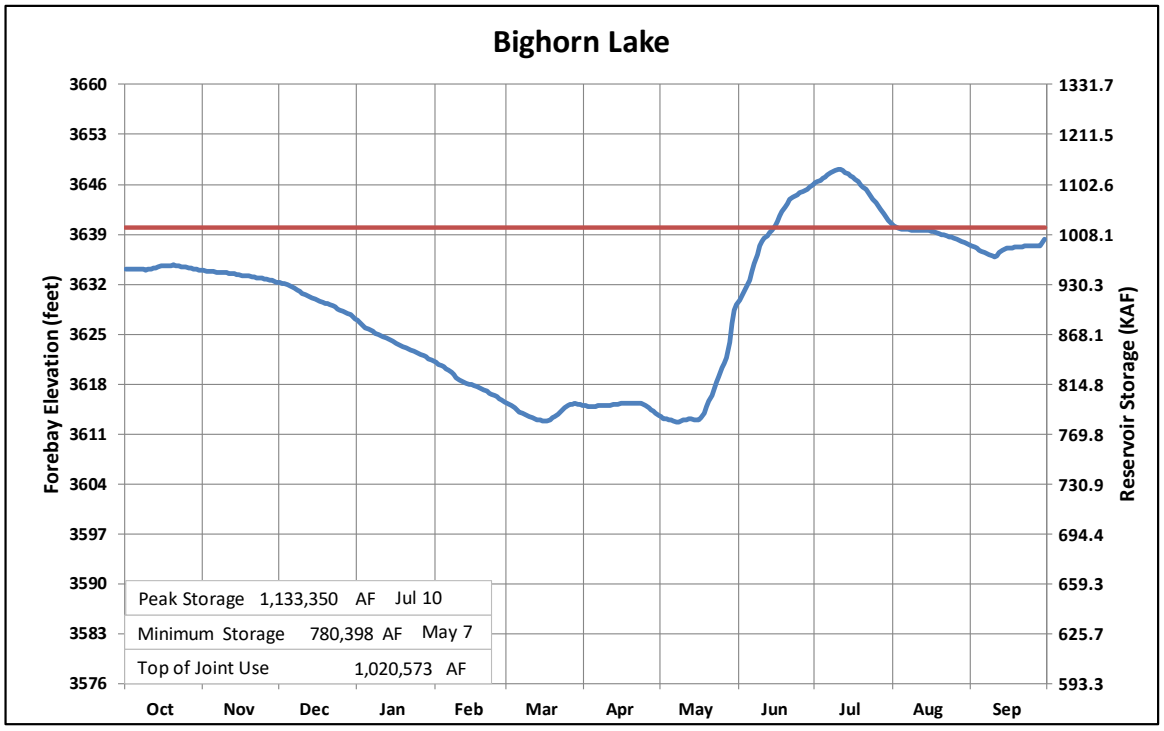
STORAGE-ELEVATION DATA	ELEVATION (FT)	STORAGE (AF)	DATE
BEGINNING OF YEAR	3634.12	952,099	OCT 01, 2018
END OF YEAR	3638.27	999,265	SEP 30, 2019
ANNUAL LOW	3612.75	780,398	MAY 07, 2019
ANNUAL HIGH	3648.06	1,133,350	JUL 10, 2019
HISTORIC HIGH	3656.43	1,365,198	JUL 06, 1967

INFLOW-OUTFLOW DATA	INFLOW	DATE	OUTFLOW*	DATE
ANNUAL TOTAL (AF)			2,902,974	OCT'18-SEP'19
DAILY PEAK (CFS)			11,000	JUN 22, 2019
DAILY MINIMUM (CFS)	2,973,904	OCT'18-SEP'19	2,900	JAN 11, 2019
PEAK SPILL (CFS)	16,007	MAY 29, 2019	7,070	JUN 22, 2019
TOTAL SPILL (KAF)	1,424	JAN 3, 2019	478,871	MAY 29, 2019-AUG 3, 2019

*Discharge to the Bighorn River

	INFLOW		OUTFLOW*				CONTENT	
MONTH	KAF	% OF AVG	CANAL KAF	% OF AVG	RIVER KAF	% OF AVG	KAF	% OF AVG
OCTOBER	175.4	107	0.7	24	181.1	112	950.3	106
NOVEMBER	154.4	126	0.0	---	175.4	120	933.6	106
DECEMBER	132.9	129	0.0	---	185.2	125	885.6	105
JANUARY	128.3	123	0.0	---	180.8	120	838.2	104
FEBRUARY	116.1	106	0.0	---	160.6	115	797.5	102
MARCH	173.0	114	0.0	---	180.2	102	794.9	104
APRIL	185.5	109	1.3	106	197.4	100	785.6	105
MAY	354.6	116	3.9	36	237.0	102	903.6	111
JUNE	676.9	143	14.2	65	469.0	144	1,101.4	118
JULY	461.2	169	18.8	68	519.8	193	1,028.2	112
AUGUST	206.9	135	25.5	96	223.8	128	990.3	112
SEPTEMBER	208.6	126	11.2	67	192.7	127	999.3	112
ANNUAL	2,973.9	130	75.6	70	2,903.0	128		
APRIL-JULY	1,678.2	130						

Table MTT 20: Water year 2019 hydrologic data for Bighorn Reservoir (Yellowtail Dam). New sediment survey data effective October 1, 2011.



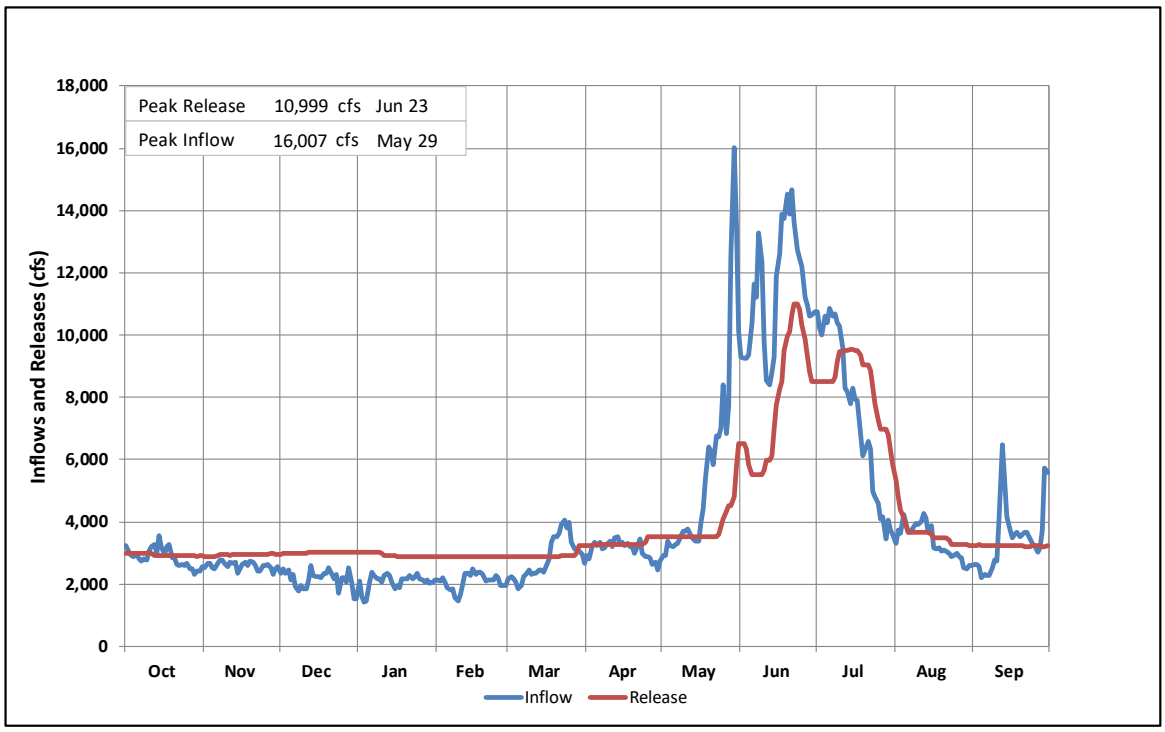


Figure 47: Plots of water year 2019 hydrologic data for Bighorn Reservoir.

Annual Operating Plans for Water Year (WY) 2019 for Reservoirs Under Responsibility of the Dakotas Area Office (DKAO)

Water Year 2019 Weather Summary for North and South Dakota

October precipitation was normal at Heart Butte, Jamestown, and Keyhole Reservoirs; below normal at Dickinson and Deerfield Reservoirs; much below normal at Angostura, Pactola, and Shadehill Reservoirs; very much below normal at Belle Fourche reservoir.

November precipitation was very much above normal at Dickinson Reservoir; much above normal at Deerfield and Heart Butte Reservoirs; above normal at Angostura and Belle Fourche Reservoirs; below normal at Keyhole, Pactola, and Shadehill Reservoirs; much below normal at Jamestown Reservoir.

December precipitation was very much above normal at Angostura, Deerfield, and Keyhole Reservoirs; much above normal at Pactola Reservoir; above normal at Belle Fourche and Heart Butte Reservoirs; normal at Shadehill Reservoir; much below normal at Dickinson Reservoir; and very much below normal at Jamestown Reservoir.

January precipitation was very much above normal at Deerfield and Keyhole Reservoirs; above normal at Heart Butte Reservoir; normal at Pactola and Shadehill Reservoirs; below normal at Angostura and Belle Fourche Reservoirs; much below normal at Jamestown Reservoir; and very much below normal at Dickinson Reservoir.

February precipitation was very much above normal at Belle Fourche, Deerfield, Keyhole, and Pactola Reservoirs; much above normal at Angostura and Heart Butte Reservoirs; normal at Shadehill Reservoir; and very much below normal at Dickinson and Jamestown Reservoirs.

March precipitation was much above normal at Shadehill Reservoir; normal at Angostura Reservoir; below normal at Deerfield, Keyhole, and Pactola Reservoirs; much below normal at Heart Bute Reservoir; and very much below normal at Belle Fourche, Dickinson, and Jamestown Reservoirs.

April precipitation was very much above normal at Belle Fourche Reservoir; above normal at Deerfield and Pactola Reservoirs; normal at Dickinson, Heart Butte and Shadehill Reservoirs; below normal at Angostura and Keyhole Reservoirs; and much below normal at Jamestown Reservoir.

May precipitation was very much above normal at Angostura, Belle Fourche, Deerfield, Keyhole, and Pactola Reservoirs; above normal at Dickinson, Heart Butte, and Shadehill Reservoirs; and below normal at Jamestown Reservoir.

June precipitation was very much above normal at Deerfield Reservoir; above normal at Pactola Reservoir; normal at Belle Fourche, Heart Butte, and Shadehill Reservoirs; below normal at Jamestown and Keyhole Reservoirs; and much below normal at Angostura and Dickinson Reservoirs.

July precipitation was very much above normal at Belle Fourche, Deerfield, Keyhole, and Pactola Reservoirs; much above normal at Jamestown Reservoir; above normal at Angostura and Dickinson Reservoirs; normal at Heart Butte Reservoir; and below normal at Shadehill Reservoir.

August precipitation was very much above normal at Deerfield, Jamestown, and Pactola Reservoirs; much above normal at Belle Fourche Reservoir; above normal at Angostura Reservoir; normal at Heart Butte, Keyhole, and Shadehill Reservoirs; and below normal at Dickinson Reservoir.

September precipitation was very much above normal at Belle Fourche, Dickinson, Heart Butte, Jamestown, and Shadehill Reservoirs; much above normal at Deerfield and Pactola Reservoirs; below normal at Keyhole Reservoir; and much below normal at Angostura Reservoir.

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

Reservoir	2019 Total	Average Total	Percent
Angostura 1/	18.81	17.67	106
Belle Fourche 2/	23.60	15.86	149
Deerfield 3/	25.54	14.38	178
Keyhole 4/	25.17	19.20	131
Pactola	31.41	20.58	153
Shadehill 5/	19.08	17.86	107
Dickinson	17.67	15.77	112
Heart Butte	21.50	16.27	132
Jamestown	21.05	18.77	112

1/ Angostura Reservoir's annual precipitation data is from the Hot Springs, SD, climate station.
2/ Belle Fourche Reservoir's annual precipitation data is from the Newell, SD climate station.
3/ Deerfield Reservoir's annual and average precipitation data is from the Deerfield, Dam flip bucket rain gauge recorded by Hydromet.
4/ Keyhole Reservoir's annual precipitation data is from the Sundance, WY climate station.
5/ Shadehill Reservoir's annual precipitation data is from the Lemmon, SD climate station.

Table DKT 1: Total annual precipitation for Reclamation reservoirs in North Dakota, South Dakota, and Northeastern Wyoming, measured in inches.

Reservoir	Storage September 30, 2018	Storage September 30, 2019	Change in Storage
Angostura	101,605	104,303	2,698
Belle Fourche	128,562	137,476	8,914
Deerfield	15,019	15,035	16
Keyhole	158,110	167,307	9,197
Pactola	53,403	53,628	225
Shadehill	110,832	113,133	2,301
Dickinson	7,236	8,914	1,678
Heart Butte	58,336	62,386	4,050
Jamestown	27,787	31,175	3,388

Table DKT 2: Comparison of end-of-water-year storage contents for reservoirs in North Dakota, South Dakota, and Northeastern Wyoming, measured in Acre-Feet.

Flood Benefits Due to Reservoirs in North Dakota, South Dakota, and Northeastern Wyoming

Several Reclamation Reservoirs in northeastern Wyoming, South Dakota, and North Dakota provided flood relief during WY 2019. They are: E.A. Patterson on the Heart River near Dickinson, North Dakota; Heart Butte on the Heart River near Glen Ullin, North Dakota; Jamestown on the James River near Jamestown, North Dakota; Shadehill on the Grand River near Lemmon, South Dakota; Angostura on the Cheyenne River near Hot Springs, South Dakota; Pactola on Rapid Creek near Rapid City, South Dakota; Keyhole on the Belle Fourche River near Moorcroft, Wyoming.

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

	Local	Main-Stem	2019 Total	Previous Accumulations	1950-2019 Accum Totals
Heart Butte	$683,200	$72,900	$756,100	$16,252,600	$17,008,700
Shadehill	$1,231,200	$92,600	$1,323,800	$12,796,400	$14,120,200
Angostura	$300	$0	$300	$22,600	$22,900
Pactola	$1,104,300	$2,100	$1,106,400	$3,839,400	$4,945,800
Keyhole	$66,700	$46,000	$112,700	$4,788,000	$4,900,800
Jamestown	$186,800	$0	$186,800	$216,305,600	$216,492,400
Total	$3,272,500	$213,600	$3,486,100	$254,004,700	$257,490,800

Table DKT 3: Flood damage prevented in WY 2019 at Reclamation facilities operated by the Dakotas Area Office.

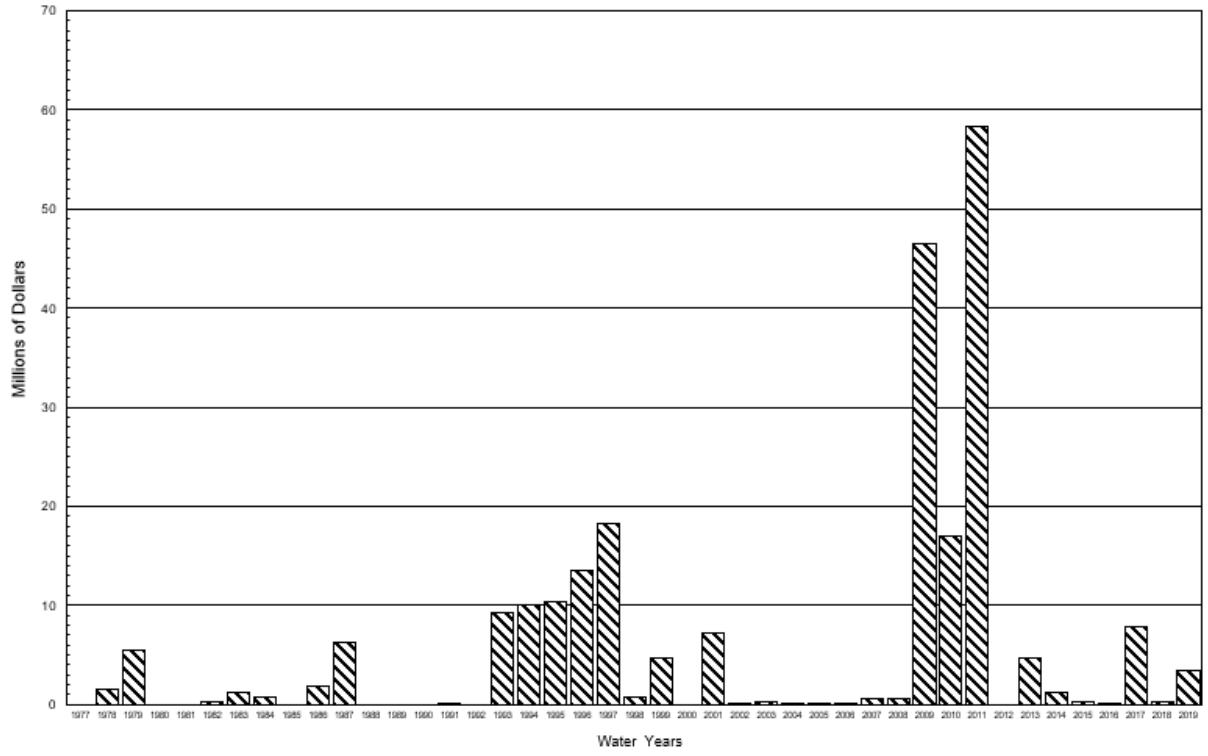


Figure 48: Chart of flood damages prevented by Dakotas Area Office Projects between Garrison Dam and Gavin's Point Dam.

Unit Operational Summaries for Water Year 2019

Dickinson Reservoir

Dickinson Dam and Edward Arthur Patterson Lake (Dickinson Reservoir) is located on the Heart River one mile west of Dickinson, North Dakota. The Reservoir has a dead capacity of 356 AF, an inactive capacity of 100 AF and an active conservation capacity of 8,156 AF (for a total storage capacity of 8,612 AF at the top of conservation elevation 2,420.00 feet). Reservoir water is used 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 2019 Operations Summary

Dickinson Reservoir started WY 2019 at elevation 2,418.78 feet and storage of 7,236 acre-feet, which is 1.22 feet, and 1,376 acre-feet below the top of the conservation pool (elevation 2,420.00 feet and storage 8,612 AF). Dickinson Reservoir peaked at elevation 2,420.88 feet on March 22th with 9,704 acre-feet of storage. The minimum Reservoir elevation for WY 2019 was 2,418.78 feet with storage of 7,098 acre-feet occurred on September 12, 2019. The Reservoir elevation on September 30, 2019 was 2,420.25 feet with storage of 8,914 acre-feet, which is 0.25 feet, and 302 acre-feet above the top of conservation pool.

The maximum instantaneous discharge of 2,418 cfs occurred on March 23, 2019. Reservoir net inflows for water year 2019 were the 18th highest on record for the dam and totaled 32,340 acre-feet, 158 percent of average. The maximum 24 hour computed inflow occurred on March 23, 2019 with 2,873 cfs. Precipitation for the water year totaled 17.67 inches, which is 112 percent of average.

128 Ac/ft of water was released specifically for downstream irrigation.

An Emergency Management program, orientation seminar and communications drill were conducted on March 19, 2019.

On March 20, 2019, E.A. Paterson Reservoir (Dickinson Dam) went into internal alert with a Reservoir elevation over 2,420.67 feet and remained there until June 18th, when the Reservoirs elevation decreased below elevation 2,420.00 feet and normal operations resumed.

An Annual Site Inspection Review (ASI) was conducted on June 25, 2019 by personnel from the Dakotas Area Office.

Monthly Statistics for Water Year 2019

Record and near record monthly inflows in 68 years of record keeping were recorded in the following months: December had its 8th highest inflow, January had its 9th highest inflow, March had its 4th highest inflow, and September had its 3rd highest inflow.

Record or near record monthly end of month content in 68 years of record keeping were recorded in the following months: November had its 9th highest storage, December had its 11th highest storage, January had its 10th highest storage, and September had its 4th highest storage.

Additional statistical information on Dickinson Reservoir and its operations during 2019 can be found on Table DKT4 and Figure 49.

RESERVOIR ALLOCATIONS	ELEVATION (FEET)	TOTAL RESERVOIR STORAGE (AF)	STORAGE ALLOCATION (AF)
TOP OF INACTIVE	2,405.00	438	438
TOP OF ACTIVE CONSERVATION	2,420.00	8,452	8,014
TOP OF JOINT USE			
TOP OF EXCLUSIVE FLOOD CONTROL			

STORAGE-ELEVATION DATA	ELEVATION (FT)	STORAGE (AF)	DATE
BEGINNING OF YEAR	2,418.78	7,236	OCT 01, 2018
END OF YEAR	2,420.25	8,914	SEP 30, 2019
ANNUAL LOW	2,418.78	7,236	OCT 01, 2018
ANNUAL HIGH	2,420.88	9,704	MAR 22, 2019
HISTORIC HIGH	2,422.19	***9,348	MAR 21, 1997

INFLOW-OUTFLOW DATA	INFLOW	DATE	OUTFLOW	DATE
ANNUAL TOTAL (AF)	32,340	OCT 18-SEP 19	30,662	OCT 18-SEP 19
DAILY PEAK (CFS)*	2,873	MAR 23, 2019	2,918	MAR 23, 2019
DAILY MINIMUM (CFS)**	0	**	0	**

* 24 hour daily inflow and 15 minute instantaneous discharge

** 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 2,421.08 feet on June 9, 1982)

	INFLOW		OUTFLOW		CONTENT	
MONTH	AF	% OF AVG	AF	% OF AVG	AF	% OF AVG
OCTOBER	203	33	0	NA	7,439	135
NOVEMBER	77	47	0	NA	7,516	138
DECEMBER	209	161	0	NA	7,725	142
JANUARY	338	119	0	NA	8,063	145
FEBRUARY	114	11	0	NA	8,177	138
MARCH	24,305	354	23,334	406	9,148	130
APRIL	1,135	25	1,491	35	8,792	122
MAY	2,451	101	2,317	91	8,926	125
JUNE	326	14	652	28	8,600	121
JULY	-199	NA	166	12	8,235	125
AUGUST	-277	NA	205	25	7,803	128
SEPTEMBER	3,606	3,339	2,495	612	8,914	155
ANNUAL	32,288	164	30,662	157		
APRIL-JULY	3,713	37				

Table DKT 4: Water year 2019 hydrologic data for Dickinson Dam (E.A. Patterson Lake).

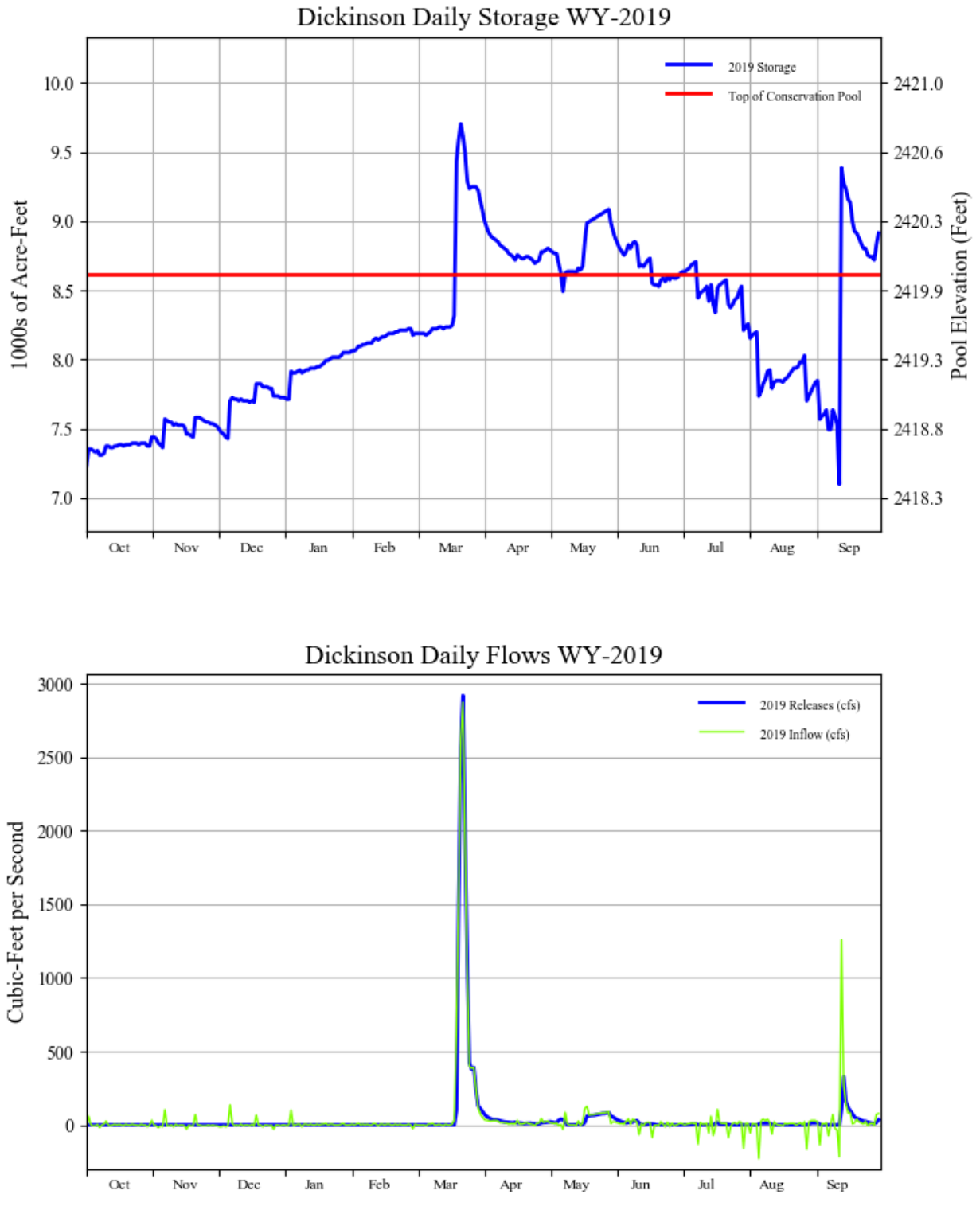


Figure 49: Plots for water year 2019 hydrologic data observed at Dickinson Dam (E.A. Patterson Lake).

Heart Butte Reservoir

Heart Butte Dam and Lake Tschida (Heart Butte Reservoir) is located on the Heart River 15 miles south of Glen Ullin, North Dakota. The Reservoir has a dead storage capacity of 5,227 AF, an active conservation capacity of 61,915 AF (for a total storage capacity of 67,142 AF at the top of active conservation elevation 2,064.50 feet), and an exclusive flood control space of 147,027 AF. Flood control storage is located above the crest of an ungated morning glory inlet 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 2019 Operations Summary

Heart Butte Reservoir started WY 2019 at elevation 2,061.74 feet and storage of 58,366 acre-feet, which is 2.76 feet, and 8,776 acre-feet below the top of conservation pool (elevation 2,064.50 feet and storage 67,142 AF). Heart Butte Reservoir peaked at elevation 2,078.56 feet on March 25th with 123,273 acre-feet of storage. The minimum Reservoir elevation for WY 2019 was 2,061.75 feet and storage of 58,397 acre-feet occurred on October 1, 2018. The Reservoir elevation on September 30, 2019 was 2,063.03 feet with storage of 62,386 acre-feet, which is 1.47 feet and 4,756 acre-feet below the top of conservation pool.

A maximum discharge of 3,637 cfs occurred on March 26th. Reservoir net inflows for water year 2019 were the 14th highest on record for the dam and totaled 154,458 acre-feet, 177 percent of average. The maximum 24 hour computed inflow occurred on March 24, 2019 with 12,303 cfs. Precipitation for the water year totaled 21.50 inches, which is 132 percent of average and 5,950 AF was released specifically for downstream irrigation.

An Emergency Management program, orientation seminar and communications drill were conducted on March 21, 2019.

With a quick spring warm-up on March 22, 2019, Lake Tschida Reservoir (Heart Butte Dam) went from normal operation straight to Response Level 1 with a Reservoir elevation over 2,067.00 feet and remained there until April 7th, when the Reservoirs elevation dropped below elevation 2,067.00 feet and internal alert was resumed, then on April 13th, when the Reservoirs elevation dropped below elevation 2,064.50 feet and normal operations resumed.

On May 27th, 2019, the Reservoir went back into Internal Alert with a reservoir elevation over 2,064.50 feet and remained there until June 8th, when the Reservoirs elevation dropped below elevation 2,064.50 feet and normal operations resumed.

On September 17th, 2019, the Reservoir again went back into Internal Alert with a Reservoir elevation over 2,064.50 feet and remained there until September 21st, when the Reservoirs elevation dropped below elevation 2,064.50 feet and normal operations resumed.

An Annual Site Inspection (ASI) was conducted on July 16, 2019 by personnel from the Dakotas Area Office. The Annual Site Inspection report was transmitted on September 6, 2019.

Monthly Statistics for Water Year 2019

Record and near record monthly inflows in 70 years of record keeping were recorded in the following months: December had its 8th highest inflow, March had its 5th highest inflow, and September had its highest ever inflow.

Record or near record monthly end of month content in 70 years of record keeping were recorded in the following months: March had its 4th highest storage, April had its 19th highest storage, and June had its 17th lowest storage.

Additional statistical information on Heart Butte Reservoir and its operations during 2019 can be found on Table DKT5 and Figure 50.

RESERVOIR ALLOCATIONS	ELEVATION (FEET)	TOTAL RESERVOIR STORAGE (AF)	STORAGE ALLOCATION (AF)
TOP OF INACTIVE AND DEAD	2,030.00	4,328	4,328
TOP OF ACTIVE CONSERVATION	2,064.50	65,091	60,763
TOP OF JOINT USE			
TOP OF EXCLUSIVE FLOOD CONTROL	2,094.50	212,696	147,605

STORAGE-ELEVATION DATA	ELEVATION (FT)	STORAGE (AF)	DATE
BEGINNING OF YEAR	2,061.75	58,397	OCT 01, 2018
END OF YEAR	2,063.03	62,386	SEP 30, 2019
ANNUAL LOW	2,061.75	58,397	OCT 01, 2018
ANNUAL HIGH	2,078.56	123,273	MAR 25, 2019
HISTORIC HIGH	2,086.23	173,203	APR 09, 1952

INFLOW-OUTFLOW DATA	INFLOW	DATE	OUTFLOW	DATE
ANNUAL TOTAL (AF)	154,458	OCT 18-SEP 19	150,438	OCT 18-SEP 19
DAILY PEAK (CFS)	12,303	MAR 24, 2019	3,637	MAR 26, 2019
DAILY MINIMUM (CFS)	0	*	0	*

* Frequently observed during fall and winter months

	INFLOW		OUTFLOW		CONTENT	
MONTH	AF	% OF AVG	AF	% OF AVG	AF	% OF AVG
OCTOBER	737	50	0	NA	59,103	102
NOVEMBER	1,431	113	471	33	60,063	104
DECEMBER	1,590	174	623	48	61,030	106
JANUARY	1,285	109	625	54	61,690	107
FEBRUARY	1,134	31	565	27	62,259	105
MARCH	106,410	380	63,711	365	104,958	150
APRIL	11,961	49	51,383	210	65,536	94
MAY	10,325	102	7,126	66	68,735	100
JUNE	2,849	28	6,535	68	65,049	93
JULY	1,439	35	2,570	33	63,918	97
AUGUST	564	32	5,101	92	59,381	96
SEPTEMBER	14,733	2,947	11,728	413	62,386	104
ANNUAL	154,458	177	150,438	174		
APRIL-JULY	26,574	55				

Table DKT 5: Water year 2019 hydrologic data for Heart Butte Reservoir.

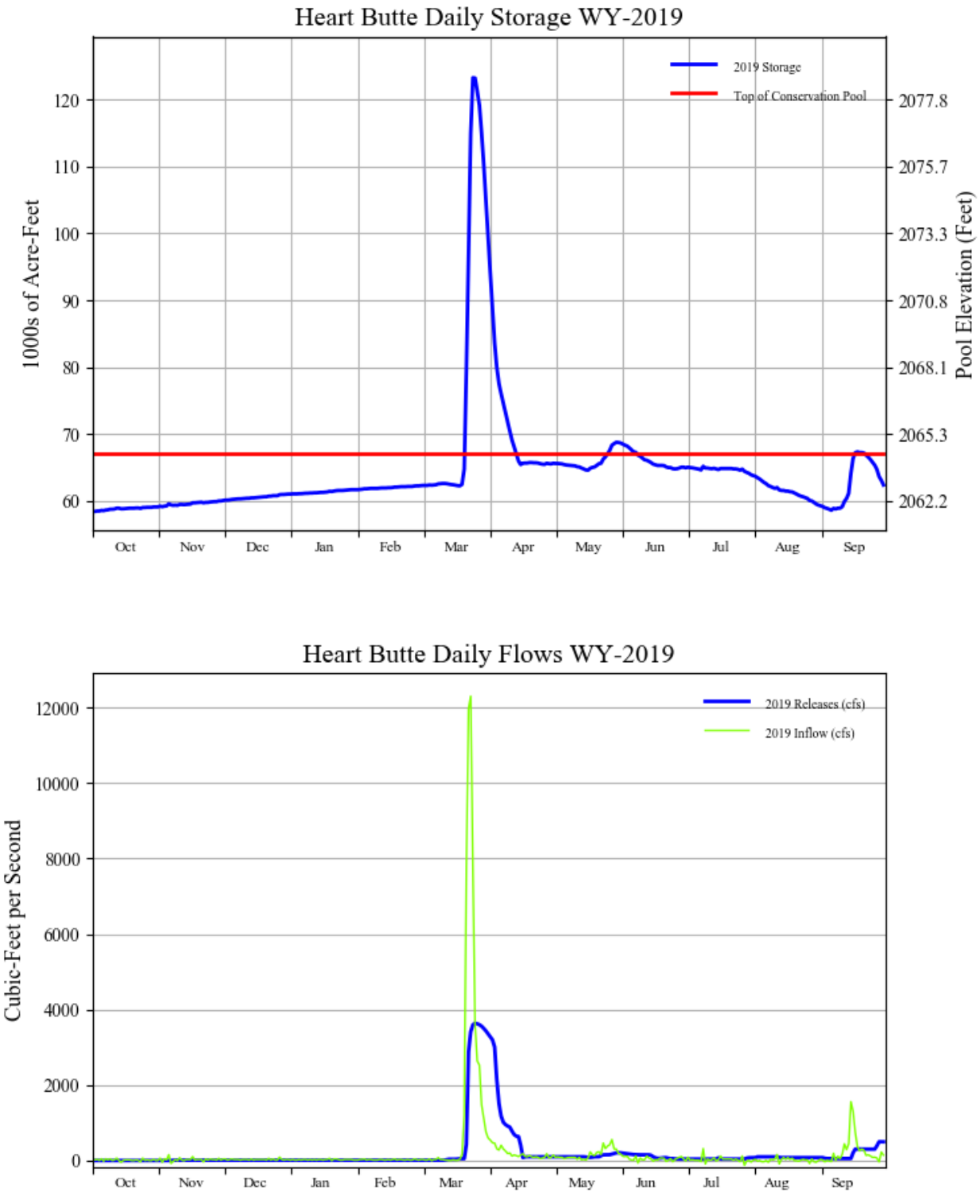


Figure 50: Plots of water year 2019 hydrologic data observed at Heart Butte Reservoir.

Jamestown Reservoir

Jamestown Reservoir is located on the James River just above the city of Jamestown, North Dakota. The Reservoir has a dead capacity of 292 AF, an active conservation capacity of 23,934 AF (for a total top of active conservation capacity of 24,226 AF at elevation 1,428.00 feet), a joint-use capacity of 6,262 AF, and an exclusive flood control space of 190,502 AF. Exclusive flood control storage is located below the crest of an ungated morning glory inlet spillway and flood control releases are controlled by two 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 2019 Operations Summary

Jamestown Reservoir started WY 2019 at elevation 1,429.79 feet and storage of 27,787 acre-feet, which is 1.79 feet, and 3,561 acre-feet above the top of the conservation pool (elevation 1,428.00 feet and storage 24,226 AF). Jamestown Reservoir peaked at elevation 1,438.32 feet on April 25, 2019 with 59,099 acre-feet of storage. The minimum Reservoir elevation for WY 2019 was 1,429.61 feet and storage of 27,408 acre-feet occurred on November 14, 2018. The Reservoir elevation on September 30, 2019 was 1,431.29 feet with storage of 31,175 acre-feet, which is 3.29 feet, and 6,949 acre-feet above the top of active conservation pool.

The maximum instantaneous discharge of 603 cfs occurred on May 30, 2019. Reservoir net inflows for water year 2019 were the 14th highest inflows on record for the dam and totaled 92,703 acre-feet, 162 percent of average. The maximum 24 hour computed inflows occurred on April 17th with 1,490 cfs. Precipitation for the water year totaled 21.05 inches at 112 percent of average.

No water was released specifically for downstream irrigation.

An Emergency Management program, orientation seminar and communications drill were conducted on March 14, 2019.

On March 29, 2019, Jamestown Reservoir (Jamestown Dam) went into internal alert with a Reservoir elevation over 1,431.00 feet and remained there until June 3rd, when the Reservoirs elevation dropped below elevation 1,431.00 feet and normal operations resumed.

On June 22, 2019, the Reservoir went back into internal alert with a Reservoir elevation over 1,431.00 feet and remained there until July 29th, when the Reservoirs elevation dropped below elevation 1,431.00 feet and normal operations resumed.

On September 29, 2019, the Reservoir again went back into internal alert with a Reservoir elevation over 1,431.00 feet and remained there into WY 2020

A Comprehensive Review (CR) was conducted on July 10, 2019 by personnel from the Denver Technical Center, Denver, Colorado; Great Plans Regional office in Billings, Montana; and Dakotas Area Office in Bismarck, North Dakota. The draft CR Inspection report was signed on October 8, 2019.

Monthly Statistics for Water Year 2019

Record and near record monthly inflows in 66 years of record keeping were recorded in the following months: April had its 12th highest inflow, May had its 14th highest inflow, July had its 9th highest inflow, August had its 13th highest inflow, and September had its 3rd highest inflow.

Record and near record monthly end of month content in 66 years of record keeping were recorded in the following months: March had its 15th highest storage, April had its 16th highest storage, and September had its 12th highest storage.

Additional statistical information on Jamestown Reservoir and its operations during 2019 can be found on Table DKT6 and Figure 51.

RESERVOIR ALLOCATIONS	ELEVATION (FEET)	TOTAL RESERVOIR STORAGE (AF)	STORAGE ALLOCATION (AF)
TOP OF INACTIVE AND DEAD	1,400.00	292	292
TOP OF ACTIVE CONSERVATION	1,428.00	24,226	23,934
TOP OF JOINT USE	1,431.00	30,488	6,262
TOP OF EXCLUSIVE FLOOD CONTROL	1,454.00	220,990	190,502

STORAGE-ELEVATION DATA	ELEVATION (FT)	STORAGE (AF)	DATE
BEGINNING OF YEAR	1,429.79	27,787	OCT 01, 2018
END OF YEAR	1,431.29	31,175	SEP 30, 2019
ANNUAL LOW	1,429.61	27,408	NOV 14, 2018
ANNUAL HIGH	1,438.32	59,099	APR 25, 2019
HISTORIC HIGH	1,454.10	222,318	APR 26, 2009

INFLOW-OUTFLOW DATA	INFLOW	DATE	OUTFLOW	DATE
ANNUAL TOTAL (AF)	89,314	OCT 18-SEP 19	92,703	OCT 18-SEP 19
DAILY PEAK (CFS)	1,490	APR 17, 2019	603	MAY 30, 2019
DAILY MINIMUM (CFS)	0	*	0	*

* Frequently observed during fall and winter months

	INFLOW		OUTFLOW		CONTENT	
MONTH	AF	% OF AVG	AF	% OF AVG	AF	% OF AVG
OCTOBER	1,328	114	1,285	39	27,830	109
NOVEMBER	685	70	960	71	27,555	110
DECEMBER	275	65	0	NA	27,830	111
JANUARY	149	89	0	NA	27,979	111
FEBRUARY	86	30	0	NA	28,065	111
MARCH	4,755	74	0	NA	32,820	106
APRIL	44,693	182	20,857	224	56,656	122
MAY	13,096	138	36,373	246	33,379	81
JUNE	4,226	103	6,834	68	30,771	88
JULY	7,829	190	8,530	131	30,070	92
AUGUST	4,353	107	4,399	88	30,024	95
SEPTEMBER	11,228	853	10,077	206	31,175	111
ANNUAL	92,703	162	89,314	158		
APRIL-JULY	69,844	165				

Table DKT 6: Water year 2019 hydrologic data from Jamestown Reservoir.

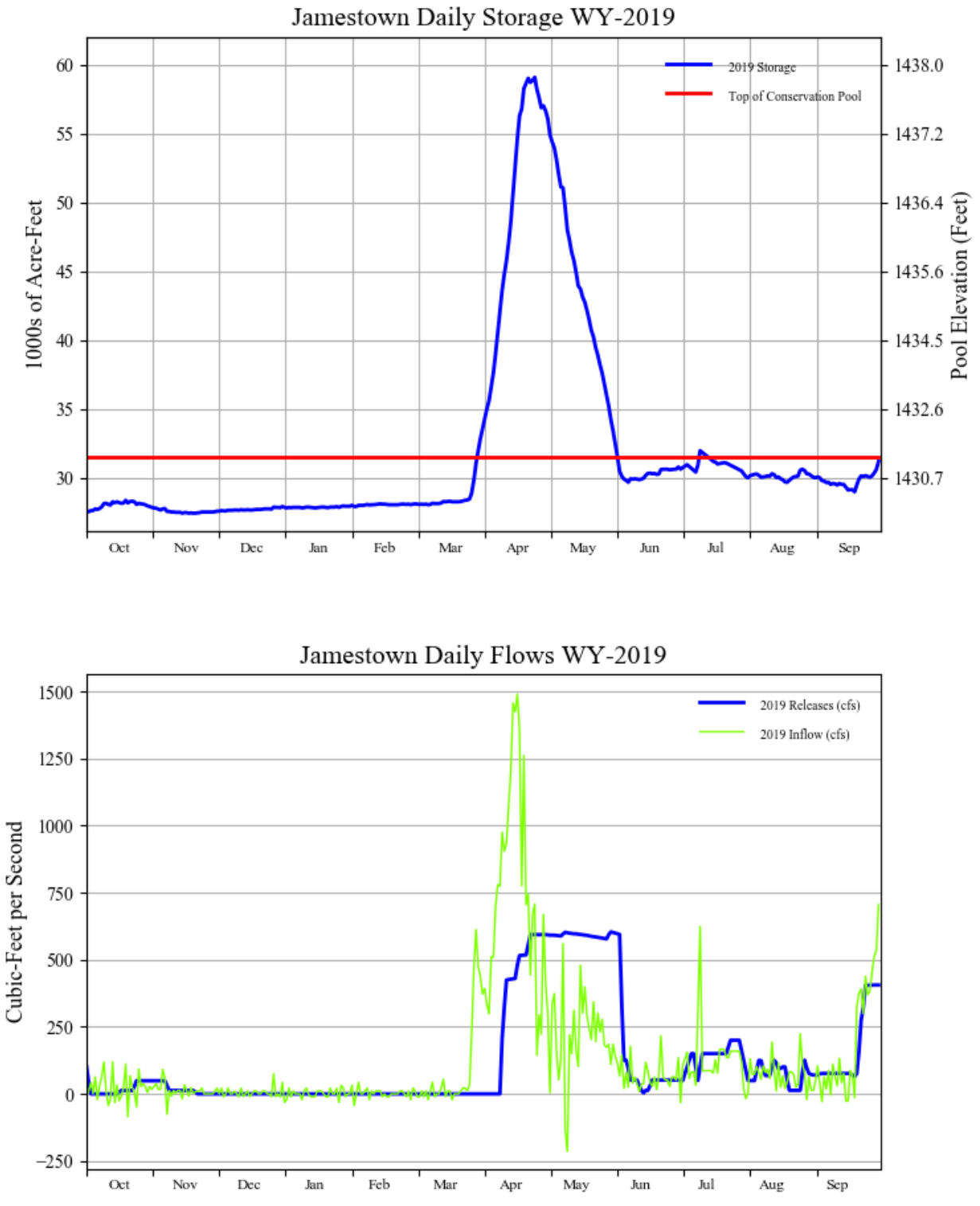


Figure 51: Plots of water year 2019 hydrologic data observed at Jamestown Reservoir.

Deerfield Reservoir

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 (District) and furnish replacement water for a portion of the water used from Rapid Creek by Rapid City. A contract is in place between the United States, Rapid City, South Dakota and the District for the storage space at Deerfield Reservoir. 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 15,654 AF with an additional 26,657 AF of surcharge capacity.

During the winter of 1995-1996 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 SD 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-in bypass is capable of providing.

Water Year 2019 Operations Summary

Deerfield Reservoir started WY 2019 at elevation 5,906.46 feet and with a storage of 15,019 acre-ft, which is 1.54 feet to full and 635 acre-feet below the top of the conservation pool. Precipitation for WY 2019 was 178percent of average. Inflows for WY 2019 totaled 20,895 acre-feet (207percent of average). Peak inflows occurred in July, totaling 20,895 acre-feet for the month. The peak Reservoir elevation for WY 2019 was 5,908.25 feet, storage of 15,771 acre-feet and occurred on May 31, 2019. The minimum elevation for WY 2019 was 5,905.96 feet, storage of 14,812 acre-feet, and occurred on November 13, 2018. WY 2019 ended at elevation 5,906.50 feet and with a storage of 15,035 acre-feet, which is 1.50 feet to full and 619 acre-feet below the top of the conservation pool. Deerfield ended the water year with 14,884 acre-feet in active storage.

Natural flows in Rapid Creek were very high throughout the water season. Rapid Valley Conservation District and the City of Rapid City did need to make water orders in 2019 due to sufficient natural flows to meet the water demands.

Emergency Action Plan Orientation Meeting was held on March 28, 2019.

A Comprehensive Review mechanical examination was performed on June 4 and 5th. A Comprehensive Review civil examination was performed June 18 and 19th. There are no incomplete SOD recommendations and there were no dam safety related incidents.

Deerfield Reservoir entered Internal Alert on May 29, 2019 with Reservoir elevation 5,908.12 feet and inflows of 110 cfs. Left Internal Alert on June 13, 2019 with Reservoir elevation 5,907.52 feet

and inflows of 40 cfs. Internal Alert was declared again July 8, 2019 with Reservoir elevation 5,908.23 feet and inflows of 90 cfs. Normal operations were resumed on August 2, 2019 with Reservoir elevation of 5,907.58 feet and inflows 50 cfs.

No construction contracts occurred at Deerfield Dam in 2019.

Monthly Statistics for Water Year 2019

Record and near record monthly inflows in 67 years of record keeping were recorded in the following months: April had its 5th highest inflow, June had its 4th highest inflow, July had its highest ever inflow, August had its 2nd highest inflow, and September had its 3rd highest inflow.

Record and near record monthly end of month content in 67 years of record keeping were recorded in the following months: May had its 3rd highest storage.

Additional statistical information on Deerfield Reservoir and its operations during Water Year 2019 can be found on Table DKT7 and Figure 52.

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 (end-of-day)
BEGINNING OF YEAR	5,906.46	15,019	OCT 01, 2018
END OF YEAR	5,906.50	15,035	SEP 30, 2019
ANNUAL LOW	5,905.96	14,812	NOV 13, 2018
ANNUAL HIGH	5,908.25	15,771	MAY 31, 2019
HISTORIC HIGH	5,909.05	16,157	FEB 25, 1985

INFLOW-OUTFLOW DATA	INFLOW	DATE	OUTFLOW	DATE
ANNUAL TOTAL (AF)	20,782	OCT 01-SEP 30	20,766	OCT 01-SEP 30
PEAK DAILY (CFS)	110	MAY 29, 2019	95	JUN 02, 2019
MINIMUM DAILY (CFS)	0	MAR 06, 2019	11	DEC 28, 2018

* Frequently observed during fall and winter months

	INFLOW		OUTFLOW		CONTENT (END OF MONTH)	
MONTH	AF	% OF AVG	AF	% OF AVG	AF	% OF AVG
OCTOBER	901	132	1,087	141	14,833	116
NOVEMBER	829	135	833	195	14,829	114
DECEMBER	873	136	770	197	14,932	113
JANUARY	767	120	676	175	15,023	112
FEBRUARY	777	131	611	160	15,189	111
MARCH	1,065	120	938	149	15,202	109
APRIL	2,017	168	1,584	153	15,635	111
MAY	2,777	198	2,641	195	15,771	111
JUNE	3,181	256	3,461	265	15,491	110
JULY	3,856	436	3,860	330	15,487	112
AUGUST	2,294	329	2,487	207	15,294	114
SEPTEMBER	1,558	249	1,817	159	15,035	117
ANNUAL	20,895	207	20,765	204		
APRIL-JULY	11,831	250				

Table DKT 7: Water year 2019 hydrologic data for Deerfield Reservoir.

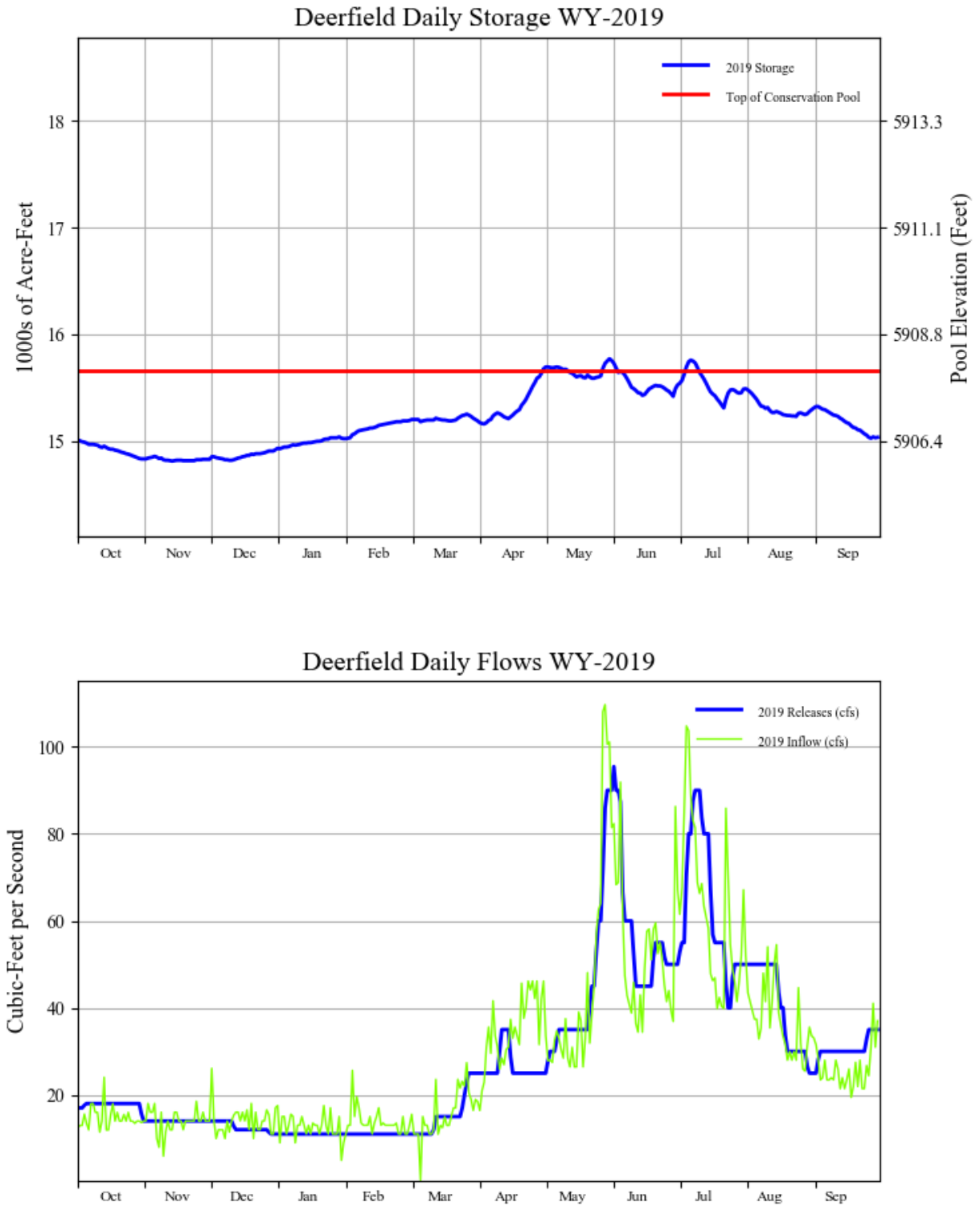


Figure 52: Plots of water year 2019 hydrologic data observed at Deerfield Reservoir.

Pactola Reservoir

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 AF (54,955 AF active) and 43,057 AF 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 Hisega Meadows Water Incorporated 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 SNOTEL (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 1980s 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.

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 AF for the city and 6,000 AF was retained by Reclamation.

Water Year 2019 Operations Summary

Pactola Reservoir started WY 2019 at elevation 4,577.16 feet and with a storage of 53,403 acre-feet, which is 3.04 feet and 2.569 acre-feet below the top of the conservation pool. Precipitation for WY 2019 was 153 percent of average. Inflows for WY 2019 totaled 110,166 acre-feet (292 percent of average). Peak inflows occurred in July, totaling 26,164 acre-feet for the month. The peak Reservoir elevation for WY 2019 was 4,588.63 feet, storage of 63,504 acre-feet, and occurred on June 5, 2019. The peak Reservoir elevation was the second highest annual elevation of record and was also the second highest storage of record. The minimum elevation for WY 2019 was 4,575.88 feet, storage of 52,349 acre-feet, and occurred on December 10, 2018. WY 2019 ended at elevation 4,577.43 feet and storage of 53,628 acre-feet, which is 2.77 feet and 2,344 acre-feet below the top of the conservation pool. Pactola Reservoir ended the water year with 52,611 acre-feet in active storage.

Natural flows in Rapid Creek were very high throughout the water season. Rapid Valley Conservation District and the City of Rapid City did not need to make water orders in 2019 due to sufficient natural flows to meet the water demands.

Emergency Action Plan Orientation Meeting was held on March 28, 2019.

A Comprehensive Review mechanical examination was performed on June 4 and 5th. A Comprehensive Review (CR) civil examination was performed June 18 and 19th. The following SOD recommendation was made in the CR Report:

> **2019-SOD-A**: Perform an Issue Evaluation (IE) that includes a detailed consequences study with 2-dimensional (2D) inundation mapping to better understand the risks associated with the various static potential failure modes at Pactola Dam.

Normal operation: No dam safety related incidents occurred.

The City of Rapid City increased releases from 210 to 245 cfs May 18, 2019 after rain had increased inflows. Pactola Reservoir entered Internal Alert on May 25, 2019 with Reservoir elevation 4,580.67 feet and inflows of 500 cfs. Declared Response Level 1 on May 31, 2019 after reaching 4,586.93 feet elevation and inflows of 825 cfs. Dropped back into internal alert on June 21 with elevation 4,583.70 feet and inflows of 350 cfs. Declared Response Level 1 on July 10, 2019 with Reservoir elevation of 4,585.75 feet and inflows of 700 cfs. Dropped back into internal alert on July 23, 2019 with Reservoir elevation 4,582.76 feet and inflows of 350 cfs. Normal operations were resumed on August 2, 2019 with Reservoir elevation of 4,578.76 feet and inflows of 330 cfs.

No construction contracts occurred at Pactola Dam 2019. Elevator refurbishment was performed by the City of Rapid City and was completed in 2019.

Monthly Statistics for Water Year 2019

Record and near record monthly inflows in 64 years of record keeping were recorded in the following months: April had its 5th highest inflow, May had its 3rd highest inflow, June had its 3rd highest inflow, July had its highest ever inflow, August had its 3rd highest inflow, and September had its 2nd highest inflow.

Record and near record monthly end of month content in 64 years of record keeping were recorded in the following months: May had its highest ever storage.

Additional statistical information on Pactola Reservoir and its operations during Water Year 2019 can be found on Table DKT8 and Figure 53.

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 (end-of-day)
BEGINNING OF YEAR	4,577.16	53,403	SEP 30, 2018
END OF YEAR	4,577.43	53,628	SEP 30, 2019
ANNUAL LOW	4,575.88	52,349	DEC 10, 2018
ANNUAL HIGH	4,588.43	63,504	JUN 05, 2019
HISTORIC HIGH	4,589.43	64,246	JUN 29, 2015

INFLOW-OUTFLOW DATA	INFLOW	DATE	OUTFLOW	DATE
ANNUAL TOTAL (AF)	110,165	OCT 01-SEP 30	109,940	OCT 01-SEP 30
DAILY PEAK (CFS)	1,005	MAY 29, 2019	487	JUL 11, 2019
DAILY MINIMUM (CFS)	20	NOV 09, 2018	38	FEB 13, 2019

	INFLOW		OUTFLOW		CONTENT (END OF MONTH)	
MONTH	AF	% OF AVG	AF	% OF AVG	AF	% OF AVG
OCTOBER	3,244	147	3,921	214	52,726	116
NOVEMBER	2,785	167	2,933	195	52,578	115
DECEMBER	2,504	177	2,594	170	52,488	115
JANUARY	2,616	177	2,452	170	52,652	116
FEBRUARY	2,368	161	2,163	166	52,857	116
MARCH	3,609	144	2,730	151	53,736	116
APRIL	8,920	213	7,033	242	55,623	116
MAY	19,989	297	13,350	238	62,262	127
JUNE	20,934	298	27,230	403	55,966	113
JULY	26,164	660	27,080	457	55,050	115
AUGUST	10,662	380	11,793	274	53,919	118
SEPTEMBER	6,371	284	6,662	229	53,628	119
ANNUAL	110,166	292	109,941	291		
APRIL-JULY	76,007	347				

Table DKT 8: Water year 2019 hydrologic data for Pactola Reservoir.

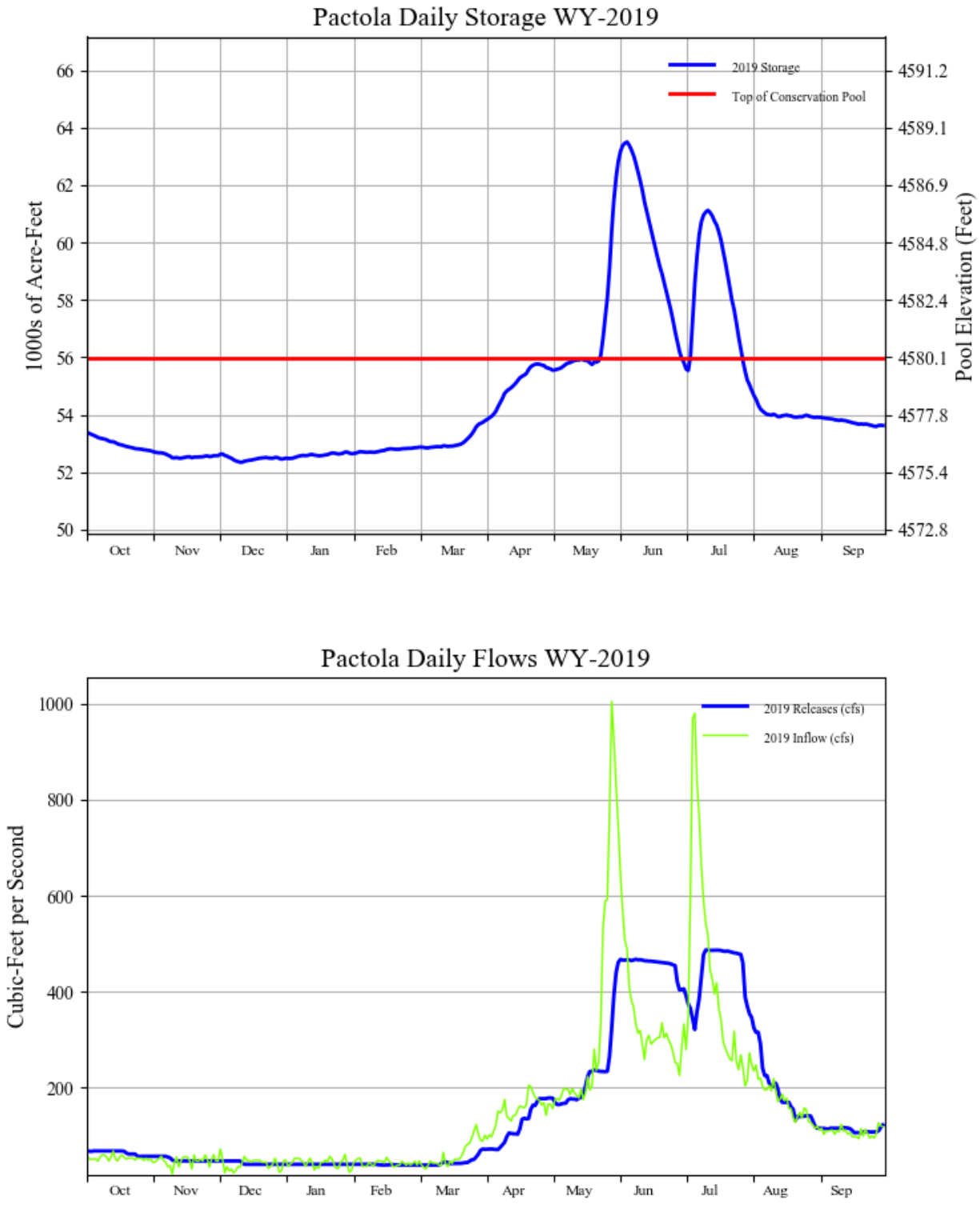


Figure 53: Plots of water year 2019 hydrologic data observed at Pactola Reservoir.

Angostura Reservoir

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 AF with an additional surcharge capacity of 57,308 AF. The 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.

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 previous survey was done in 1979. Angostura Reservoir accumulated 7,716 AF of sediment since the last survey. Since construction in 1949, Angostura has accumulated 36,867 AF of sediment. The sedimentation rate from 1949 - 2004 has averaged 670 AF per year. The new Area and Capacity Tables were first used in WY 2006.

Water Year 2019 Operations Summary

Angostura Reservoir Started WY 2019 at elevation 3,182.25 feet and with a storage of 101,605 acre-feet, which is 4.95 feet and 21,443 acre-feet below the top of the conservation pool. Precipitation for WY 2019 was 106 percent of average. Inflows for WY 2019 totaled 366,587 acre-feet (454 percent of average). Peak inflows occurred in March, totaling 159,689 acre-feet for the month. The peak reservoir elevation for WY 2019 was 3,187.14 feet, storage of 18,745 acre-feet and occurred on March 22, 2019. The minimum elevation for WY 2019 was 3,182.08 feet, storage of 100,918 acre-feet, and occurred on January 15, 2019. WY 2019 ended at elevation 3,187.20 feet, and storage of 104,303 acre-feet, which is 4.29 feet and 18,745 acre-feet below the top of the conservation pool. Angostura Reservoir ended the water year with 62,098 acre-feet in active storage.

The Angostura Irrigation District had a full water allotment for its irrigators. Releases for irrigation began June 17 and reached a peak of 211 cfs on August 26, 2019. The irrigation release was terminated on September 26, 2019. Total irrigation deliveries were 28,816 acre-feet.

An Emergency Action Plan Orientation Meeting was held on March 26, 2019.

An Annual Site Inspection (ASI) for Angostura Dam was conducted on July 16, 2019 alongside the Rope Access Team inspection of the radial gates, concrete walls and spillway. There are no incomplete SOD recommendations.

No dam safety related incidents occurred.

Angostura Reservoir began releasing 500 cfs on March 15, 2019 to head off incoming inflows. Entered Internal Alert on March 17, 2019 with elevation 3,286.2 feet and inflows of 2,500 cfs. Entered Response Level 1 on March 22, 2019 with elevation 3,187.17 feet and inflows of 8,800 cfs.

Internal Alert expired on March 25, 2019 with elevation 3,185.45 feet and inflows of 5,700 cfs. Normal operations were resumed on April 4, 2019 with elevation 3,184.88 feet and inflows of 850 cfs.

Angostura went back into internal alert May 17, 2019 with elevation 3,186.49 feet and inflows 260 cfs. Angostura stayed in internal alert through the summer until dropping out of internal alert August 2, 2019 with elevation 3,183.93 feet and inflows of 130 cfs.

Records were set. In March 2019, several winter storms continued to accumulate snow in the Angostura drainage areas. This resulted in setting the record for March Inflow of 159,689 acre-feet over the past 67 years of record by tripling the previous high of 49,158 acre-feet set in 1978.

April Inflow was in the top three over the past 67 years of record of 27,510 acre-feet. The other two higher inflows for April were 65,401 acre-feet set in 2000 and 49,772 acre-feet in 1955.

There were no large construction contracts at Angostura in 2019. The District had Action Mechanical perform plumbing replacement of the dam bubbler lines for $15,000 and installation of a metal staircase installed by Rushmore Fencing company for safer instrumentation access along the dam left-wing wall for $6,500.

Monthly Statistics for Water Year 2019

Record and near record monthly inflows in 68 years of record keeping were recorded in the following months: October had its 5th highest inflow, November had its 2nd highest inflow, December had its highest ever inflow, January had its 5th highest inflow, March had its highest ever inflow, April had its 3rd highest inflow and July had its 4th highest inflow.

Record and near record monthly end of month content in 68 years of record keeping were recorded in the following months: No storage records were achieved.

Additional statistical information on Angostura Reservoir and its operations during Water Year 2019 can be found on Table DKT9 and Figure 54.

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 (end-of-day)
BEGINNING OF YEAR	3,182.25	101,605	SEP 30, 2018
END OF YEAR	3,187.20	104,303	SEP 30, 2019
ANNUAL LOW	3,182.08	100,918	JAN 15, 2019
ANNUAL HIGH	3,187.14	122,771	MAR 22, 2019
HISTORIC HIGH	3,189.37	**152,228	MAY 20, 1978

** 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 on June 18, 1962)

INFLOW-OUTFLOW DATA	INFLOW	DATE	OUTFLOW	DATE
ANNUAL TOTAL (AF)	366,667	OCT 01-SEP 30	364,130	OCT 01-SEP 30
DAILY PEAK (CFS)	8,818	MAR 22, 2019	9,246	MAR 23, 2019
DAILY MINIMUM (CFS)	-36	JAN 08, 2019	0	APR 19, 2019

	INFLOW		OUTFLOW		CONTENT (END OF MONTH)	
MONTH	AF	% OF AVG	AF	% OF AVG	AF	% OF AVG
OCTOBER	6,113	283	6,316	542	101,402	104
NOVEMBER	6,441	287	6,562	464	101,281	103
DECEMBER	6,128	322	6,088	1,064	101,321	102
JANUARY	4,420	204	4,499	841	101,483	100
FEBRUARY	3,830	86	968	111	104,345	99
MARCH	159,689	1,389	152,336	2,419	111,698	99
APRIL	27,510	367	20,084	492	119,124	103
MAY	68,224	386	70,201	487	117,147	98
JUNE	33,160	164	32,443	156	117,864	99
JULY	33,717	491	42,457	265	109,124	98
AUGUST	13,774	457	15,635	122	107,263	106
SEPTEMBER	3,581	356	6,541	121	104,303	108
ANNUAL	366,587	454	364,130	431		
APRIL-JULY	162,611	311				

Table DKT 9: Water year 2019 hydrologic data for Angostura Reservoir.

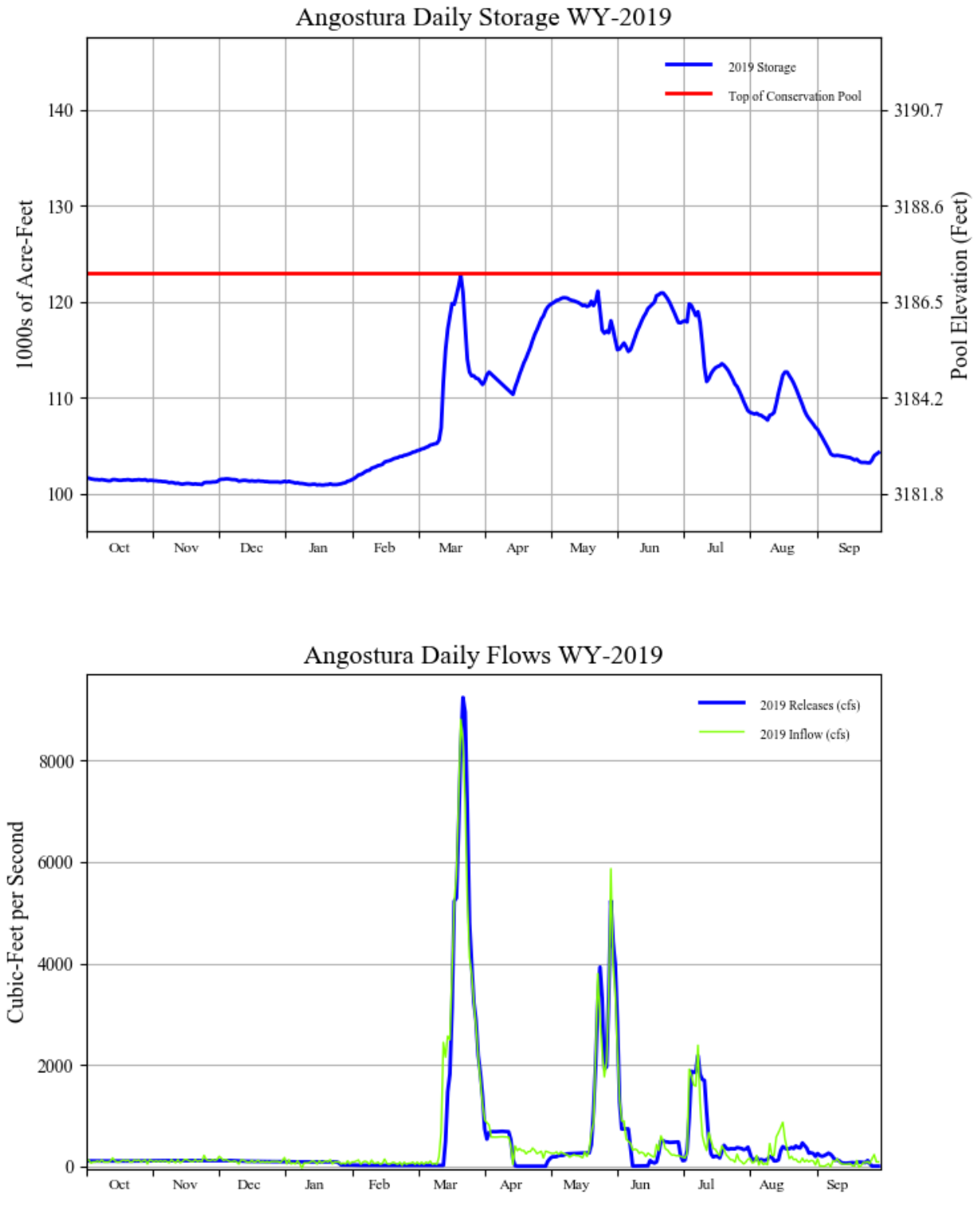


Figure 54: Plots of water year 2019 hydrologic data observed at Angostura Reservoir.

Keyhole Reservoir

Keyhole Reservoir (P-S MBP) located on the Belle Fourche River below Moorcroft, Wyoming, has a conservation capacity of 188,671 AF (182,079 AF active) and 140,463 AF 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 AF 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 to 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.

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 previous survey was done in 1978. Keyhole Reservoir accumulated 5,082 AF of sediment since the previous survey. Since construction in 1952, Keyhole has accumulated 12,495 AF of sediment. The sedimentation rate from 1952 2003 has averaged 240 AF per year. The new Area and Capacity Tables were first used in WY 2006.

Water Year 2019 Operations Summary

Keyhole Reservoir started WY 2019 at elevation 4,095.84 feet and storage of 158,110 acre-feet, which is 3.46 feet and 30,561 acre-feet below the top of the conservation pool. Precipitation for WY 2019 was 131 percent of average. Inflows for WY 2019 totaled 102,484 acre-feet (642 percent of average). Peak inflows occurred in March, totaling 61,556 acre-feet for the month. The peak reservoir elevation for WY 2019 was 4,101.98 feet, storage of 215,098 acre-feet, which occurred on March 28, 2019. The minimum elevation for WY 2019 was 4,095.71 feet, storage of 157,039 acre-feet, which occurred on November 16, 2018. WY 2019 ended at elevation 4,096.93 feet and storage of 167,307 acre-feet, which is 2.37 feet and 21,364 acre-feet below the top of the conservation pool. Keyhole Reservoir ended the water year with 160,715 acre-feet in active storage.

There were no irrigation releases ordered by the Belle Fourche Irrigation District (BFID) or the Crook County Irrigation District (CCID) for WY 2019.

An Emergency Management/Security Tabletop Exercise was held August 21, 2019.

The Annual Site Inspection (ASI) of Keyhole was conducted on June 21, 2019. There are no incomplete SOD recommendations and no dam safety related incidents occurred.

Keyhole Reservoir entered Internal Alert on March 23, 2019 with elevation 4,098.48 feet and inflows of 3,300 cfs. Level 1 response was declared on March 25, 2019 with elevation 4,100.62 feet and

inflows of 5,150 cfs. Reservoir elevation of 4,100.40 feet is the highest on record, therefore Keyhole was in a first fill scenario. Keyhole peaked at elevation 4,102.0 feet on March 29, 2019. Dropped into Internal Alert April 15, 2019 with elevation 4,099.63 feet and inflows of 200 cfs. Normal operations were resumed on June 27, 2019 with elevation 4,098.08 feet and inflows of 35 cfs.

There were no construction contracts at Keyhole in 2019.

Monthly Statistics for Water Year 2019

Record and near record monthly inflows in 68 years of record keeping were recorded in the following months: December had its 3rd highest inflow, March had its highest ever inflow, May had its 4th highest inflow, and July had its highest ever inflow.

Record and near record monthly end of month content in 68 years of record keeping were recorded in the following months: Months of March and May had the highest ever storage contents.

Additional statistical information on Keyhole Reservoir and its operations during Water Year 2019 can be found on Table DKT10 and Figure 55.

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 (end-of-day)
BEGINNING OF YEAR	4,095.84	158,110	SEP 30, 2018
END OF YEAR	4,096.93	167,307	SEP 30, 2019
ANNUAL LOW	4,095.71	157,039	NOV 16, 2018
ANNUAL HIGH	4,101.98	215,098	MAR 28, 2019
HISTORIC HIGH	4,100.38	210,222	MAY 21, 1978

INFLOW-OUTFLOW DATA	INFLOW	DATE	OUTFLOW	DATE
ANNUAL TOTAL (AF)	98,008	OCT 01-SEP 30	88,811	OCT 01-SEP 30
DAILY PEAK (CFS)	5,293	MAR 24, 2019	1,086	MAR 31, 2019
DAILY MINIMUM (CFS)	-795	AUG 23, 2019	0	OCT 01, 2018

	INFLOW		OUTFLOW		CONTENT (END OF MONTH)	
MONTH	AF	% OF AVG	AF	% OF AVG	AF	% OF AVG
OCTOBER	-742	199	0	0	157,368	165
NOVEMBER	-82	25	0	0	157,286	165
DECEMBER	1,153	730	0	0	158,439	166
JANUARY	414	81	0	0	158,853	166
FEBRUARY	914	33	0	0	159,767	162
MARCH	61,556	862	8,688	1,065	212,635	201
APRIL	8,324	343	44,152	3,070	176,807	168
MAY	22,119	459	6,653	425	192,273	177
JUNE	1,890	58	16,363	799	177,800	162
JULY	5,141	-581	3,879	98	179,062	170
AUGUST	-441	24	3,957	111	174,664	175
SEPTEMBER	2,238	-131	5,119	577	167,307	172
ANNUAL	102,484	642	88,811	608		
APRIL-JULY	37,747	389				

Table DKT 10: Water year 2019 hydrologic data for Keyhole Reservoir.

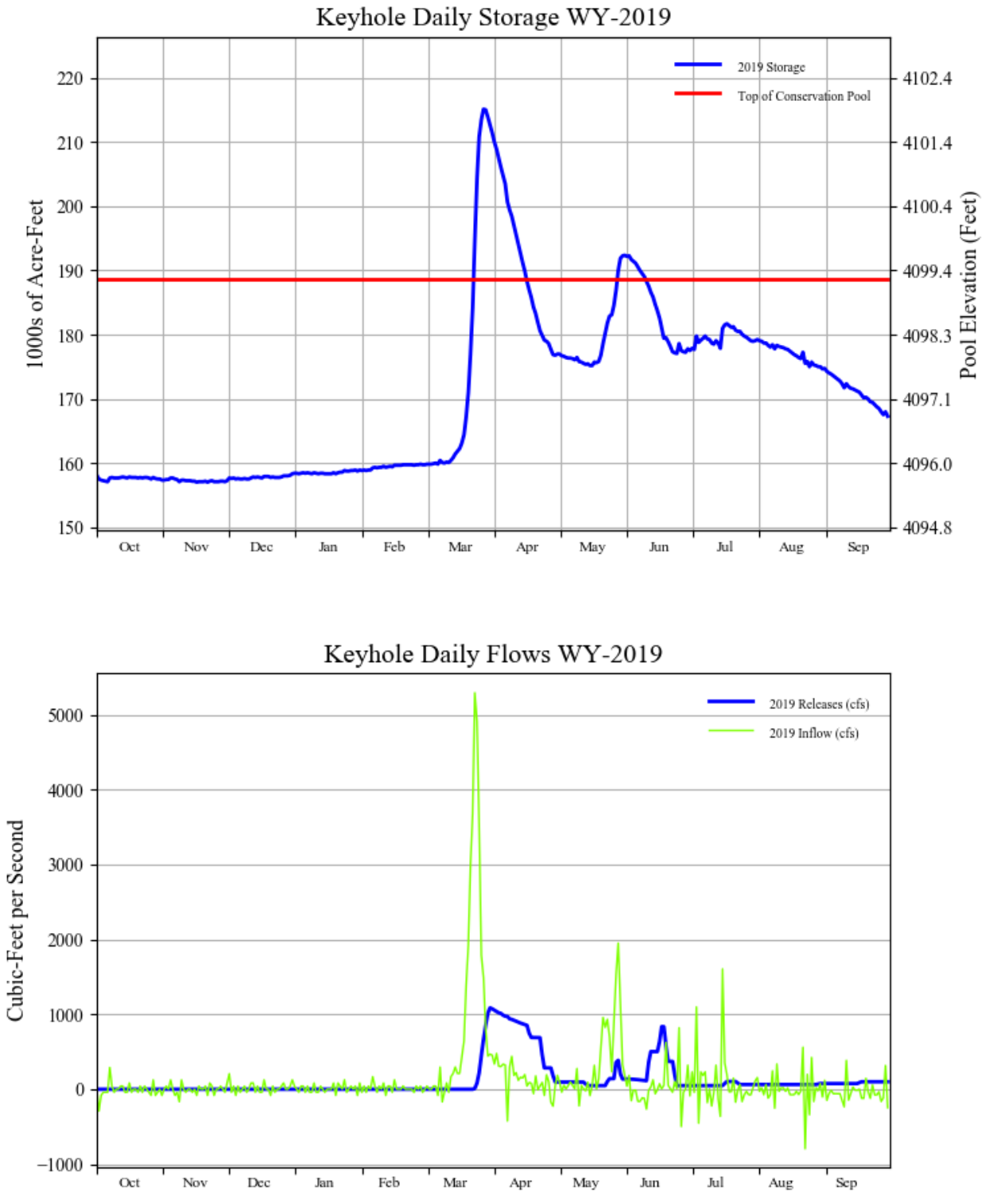


Figure 55: Plots of water year 2019 hydrologic data observed at Keyhole Reservoir.

Shadehill Reservoir

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 AF with an additional exclusive flood control capacity of 230,004 AF and a surcharge capacity of 119,560 AF. 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 had 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 51,500 AF of space between elevations 2,260 feet and 2,272 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 2,260 feet and 2,272 feet, and because the Army Corps of Engineers (Corps) has constructed Bowman Haley Reservoir upstream from Shadehill Reservoir with 53,800 AF 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 2,260 feet and 2,272 feet revert to Reclamation. By a revised field working agreement dated May 15, 1972, it was agreed that the space between elevation 2,260 feet and 2,272 feet (51,500 AF) be reallocated to conservation use. However, space below elevation 2,272 feet will continue to be evacuated before the start of the spring runoff, but to a lesser extent than in the past.

Water Year 2019 Operations Summary

Shadehill Reservoir started WY 2019 at elevation 2,270.09 feet and with a storage of 110,832 acre-feet, which is 1.91 feet and 9,340 acre-feet below the top of the conservation pool. Precipitation for WY 2019 was 107 percent of average. Inflows for WY 2019 totaled 234,489 acre-feet (316 percent of average). Peak inflows occurred in March, totaling 139,143 acre-feet for the month. The peak reservoir elevation for WY 2019 was 2,283.98 ft, storage of 191,784 acre-feet, and occurred on March 29, 2019. The minimum elevation for WY 2019 was 2,269.91 feet, storage of 109,976 acre-feet, and occurred on November 16, 2018. WY 2019 ended at elevation 2,270.57 feet and storage of 113,133 acre-feet, which is 1.43 feet and 7,039 acre-feet below the top of the conservation pool. Shadehill Reservoir ended the water year with 69,264 acre-feet in active storage.

All irrigation demands were met from river maintenance releases. There were no storage releases for irrigation needed during water year 2019.

An Emergency Action Plan Orientation Meeting was held on March 25, 2019.

An Annual Site Inspection (ASI) for Shadehill Dam was conducted on June 25, 2019. There are no incomplete SOD recommendations and no dam safety related incidents occurred.

Shadehill Reservoir entered Internal Alert on March 23, 2019 with reservoir elevation 2,272.5 feet and inflows of 6,700 cfs. Entered Response Level 1 on March 25, 2019 with reservoir elevation 2,277.0 feet and inflows of 14,800 cfs. The morning glory spillway was spilling approximately 4,000 cfs to the Grand River. Bowman-Haley was spilling 1,200 cfs due to snow melt. Reservoir elevation of 2284.0 feet was reached on March 29, 2019. Fell back into Internal Alert on April 15, 2019 with reservoir elevation 2,273.9 feet and inflows of 550 cfs. The reservoir stayed in internal alert all summer until August 2, 2019 when the reservoir returned to normal operations with elevation 2,271.6 feet and inflows of 25 cfs.

Completed recoating of the regulating radial gate and stem within the outlet works conduit with assistance from TSC Denver. Onsite work was performed during the month of September. The agreement to perform the work was approximately $95,000.

Monthly Statistics for Water Year 2019

Record and near record monthly inflows in 68 years of record keeping were recorded in the following months: March had its 2nd highest inflow.

Record and near record monthly end of month content in 68 years of record keeping were recorded in the following months: March had its 2nd highest storage.

Additional statistical information on Shadehill Reservoir and its operations during Water Year 2019 can be found on Table DKT11 and Figure 56.

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 (end-of-day)
BEGINNING OF YEAR	2,270.09	110,832	SEP 30, 2018
END OF YEAR	2,270.57	113,133	SEP 30, 2019
ANNUAL LOW	2,269.91	109,976	NOV 16, 2018
ANNUAL HIGH	2,283.98	191,784	MAR 29, 2019
HISTORIC HIGH	2,297.90	318,438	APR 10, 1952

INFLOW-OUTFLOW DATA	INFLOW	DATE	OUTFLOW	DATE
ANNUAL TOTAL (AF)	234,489	OCT 01-SEP 30	232,633	OCT 01-SEP 30
DAILY PEAK (CFS)	15,418	MAR 24, 2019	4,223	MAY 25, 2018
DAILY MINIMUM (CFS)	-181	SEP 30, 2019	8	SEP 05, 2019

	INFLOW		OUTFLOW		CONTENT (END OF MONTH)	
MONTH	AF	% OF AVG	AF	% OF AVG	AF	% OF AVG
OCTOBER	361	31	1,027	27	110,166	101
NOVEMBER	983	113	888	27	110,261	104
DECEMBER	1,401	183	830	34	110,832	106
JANUARY	1,263	135	835	35	111,260	108
FEBRUARY	2,144	65	753	36	112,651	108
MARCH	139,143	607	65,225	584	186,569	158
APRIL	38,975	192	101,204	552	124,341	103
MAY	27,290	248	24,697	238	126,934	105
JUNE	18,924	209	19,097	224	127,196	104
JULY	3,004	85	11,925	216	118,275	99
AUGUST	-180	-48	2,728	65	115,367	99
SEPTEMBER	1,181	6,216	3,424	95	113,133	100
ANNUAL	234,489	316	232,633	307		
APRIL-JULY	88,193	201				

Table DKT 11: Water year 2019 hydrologic data for Shadehill Reservoir.

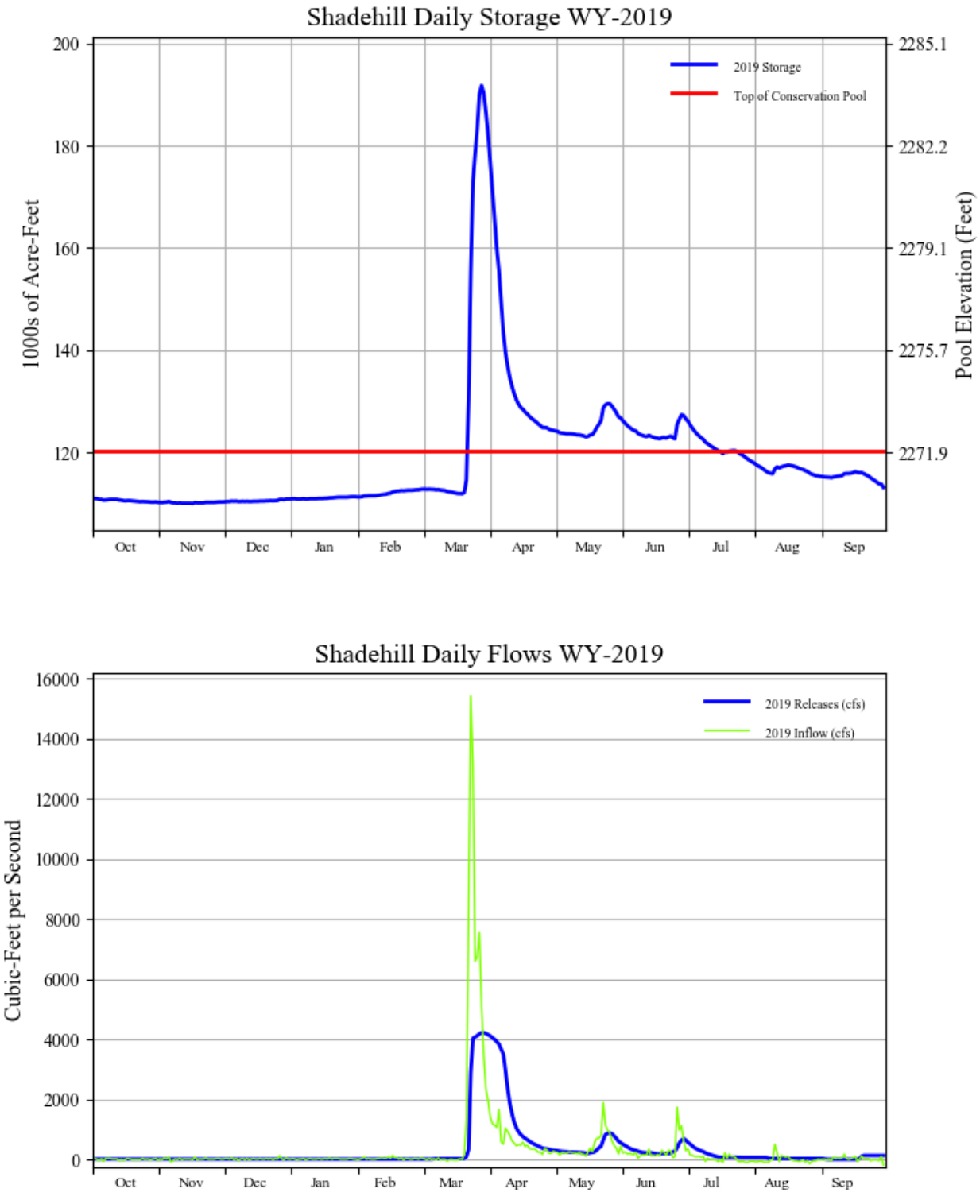


Figure 56: Plots for water year 2019 hydrologic data observed at Shadehill Reservoir.

Belle Fourche Reservoir

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 AF (169,790 AF 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 to May 1977, the active capacity of the reservoir was temporarily limited to 160,300 AF at elevation 2,981.8 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.

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 previous survey was done in 1949. Belle Fourche Reservoir accumulated 19,204 AF of sediment since the 1949 survey and 36,364 AF since the original survey in 1910. The sedimentation rate from 1910 to 2006 averages 375 AF per year. The new Area and Capacity Tables were first used in WY 2008.

Water Year 2019 Operations Summary

Belle Fourche Reservoir started WY 2019 at elevation 2,968.81 feet and with a storage of 126,562 acre-feet of storage, which is 6.19 feet and 46,311 acre-feet below top of conservation pool. Precipitation for WY 2019 was 149 percent of average. Inflows for WY 2019 totaled 100,233 acre-feet (87 percent of average). Peak inflows occurred in May, totaling 16,360 acre-feet for the month. The peak reservoir elevation for WY 2019 was 2,974.65 feet, storage of 170,069 acre-feet, and occurred on May 23, 2019. The minimum elevation for WY 2019 was 2,968.70 feet, storage of 125,810 acre-feet, and occurred on October 23, 2018. WY 2019 ended at elevation 2,970.36 feet and storage of 137,476 acre-feet, which is 4.64 feet and 35,397 acre-feet below the top of the conservation pool. Belle Fourche Reservoir ended the water year with 134,393 acre-feet in active storage.

The Belle Fourche Irrigation District (BFID) had a full water allotment of 24 inches for its irrigators. The North Canal and South Canals were turned on May 22, 2019. Releases reached a peak of 300 cfs on July 5, 2019 for North Canal and a peak of 205 cfs on Aug 21, 2019 for South Canal. The South Canal was shut off October 5, 2019. The North Canal was shut off October 5, 2019. Total irrigation releases for the 2019 season were 85,778 acre-feet.

An Emergency Action Plan Orientation Meeting was held on April 3, 2019.

The Annual Site Inspection (ASI) for Belle Fourche Dam was conducted on May 8, 2019. There are no incomplete SOD recommendations and no dam safety related incidents occurred.

Belle Fourche Reservoir entered Internal Alert on May 22, 2019 with reservoir elevation 2,974.21 feet and inflows of 1,700 cfs. Normal operations were resumed on August 23, 2019 with reservoir elevation 2,973.19 feet and inflows of 95 cfs.

2019 Belle Fourche Road Maintenance contract was awarded to Bachman Construction LLC for $36,631.50 to gravel, water, blade and mow 13 miles of government managed gravel roads at Belle Fourche Reservoir three times during the summer recreation season.

Monthly Statistics for Water Year 2019

Record and near record monthly inflows in 68 years of record keeping were recorded in the following months: October had its 2nd lowest inflow, July had its 3rd highest inflow, and August had its 5th highest inflow.

Record and near record monthly end of month content in 68 years of record keeping were recorded in the following months: July had its 5th highest storage, August had its 2nd highest storage, and September had its 2nd highest storage.

Additional statistical information on Belle Fourche Reservoir and its operations during Water Year 2019 can be found on Table DKT12 and Figure 57.

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 (end-of-day)
BEGINNING OF YEAR	2,968.81	126,572	SEP 30, 2018
END OF YEAR	2,970.36	137,476	SEP 30, 2019
ANNUAL LOW	2,968.70	125,810	OCT 23, 2018
ANNUAL HIGH	2,974.65	170,069	MAY 23, 2019
HISTORIC HIGH	2,975.92	196,792	MAY 30, 1996

INFLOW-OUTFLOW DATA	INFLOW	DATE	OUTFLOW	DATE
ANNUAL TOTAL (AF)	96,364	OCT 01-SEP 30	85,450	OCT 01-SEP 30
DAILY PEAK (CFS)	1,784	MAY 23, 2019	830	MAY 24, 2019
DAILY MINIMUM (CFS)	-273	APR 29, 2019	0	OCT 06, 2018

	INFLOW		OUTFLOW		CONTENT (END OF MONTH)	
MONTH	AF	% OF AVG	AF	% OF AVG	AF	% OF AVG
OCTOBER	4,873	46	1,483	258	126,083	167
NOVEMBER	9,666	99	0	0	135,749	160
DECEMBER	573	6	0	0	136,322	146
JANUARY	288	3	0	0	136,610	134
FEBRUARY	1,733	18	0	0	138,343	124
MARCH	16,354	103	0	0	154,697	122
APRIL	4,223	30	0	0	158,920	113
MAY	16,360	113	11,770	157	163,510	111
JUNE	14,645	127	10,628	64	167,527	117
JULY	14,345	378	16,872	47	165,000	149
AUGUST	11,066	416	23,876	69	152,190	193
SEPTEMBER	6,107	123	20,821	120	137,476	207
ANNUAL	100,233	87	85,450	75		
APRIL-JULY	49,573	113				

Table DKT 12: Water year 2019 hydrologic data for Belle Fourche Reservoir.

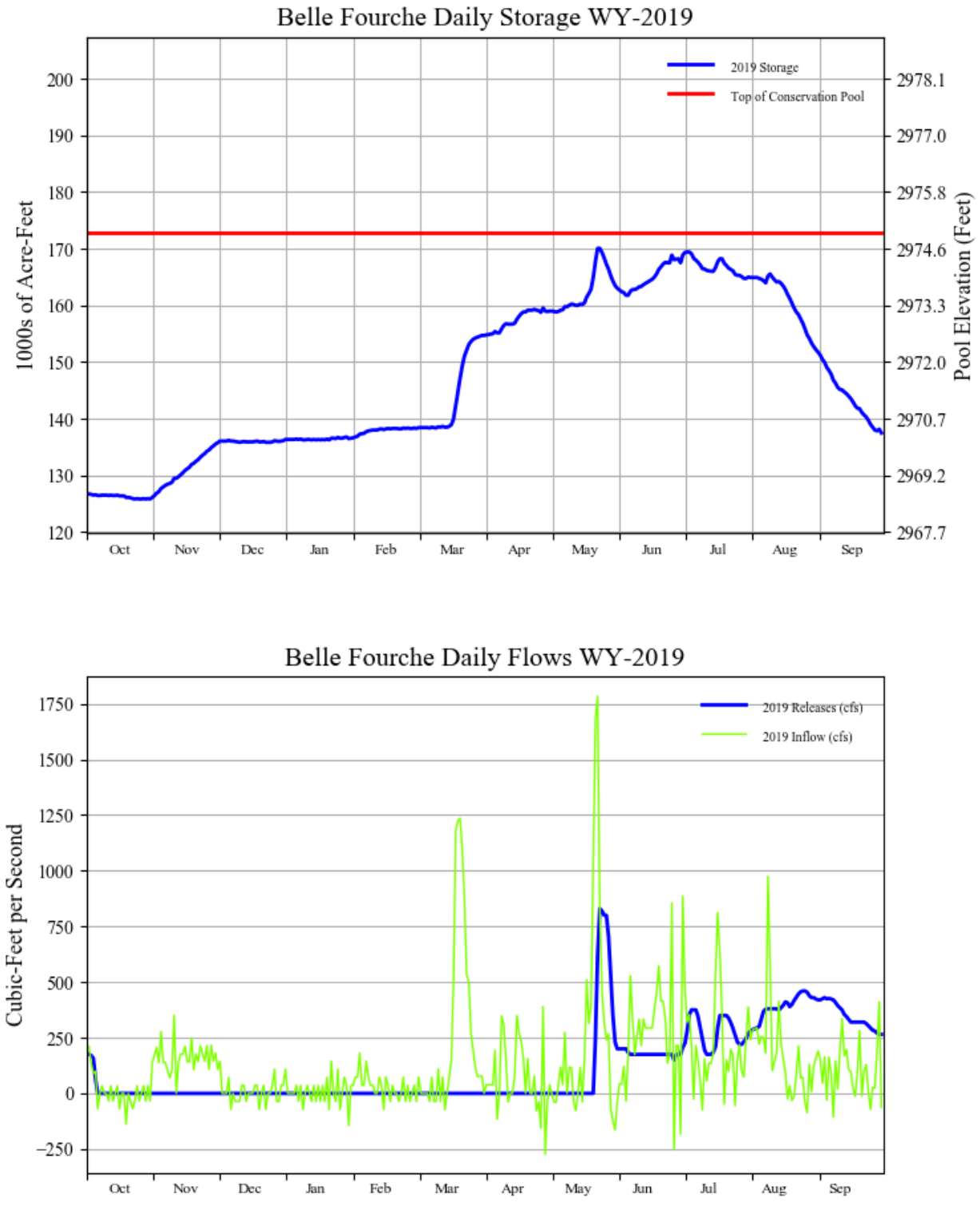


Figure 57: Plots of water year 2019 hydrologic data observed at Belle Fourche Reservoir.

Operating Plans for Water Year 2020 for Reservoirs Under the Responsibility of the Dakotas Area Office (DKAO)

Dickinson Reservoir

At the beginning of WY 2020, Dickinson Dam and E. A. Patterson Lake (Dickinson Reservoir) had an elevation of 2,420.25 feet with a storage of 8,914 AF, which is 0.25 feet and 302 acre-feet above the top of the active conservation pool (elevation 2,420.00 feet at 8,452 AF). 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 2020, Heart Butte Dam and Lake Tschida (Heart Butte Reservoir) had an elevation of 2,063.03 feet with a storage of 62,386 AF, which is 1.47 feet and 4,756 AF below the top of the active conservation pool (elevation 2,064.50 feet at 65,091 AF). 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 2,064.50 feet, the river releases will be maintained at about 10 cfs to ensure a live stream flows 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 2020, Jamestown Reservoir had an elevation of 1,431.29 feet with a storage of 31,175 AF, which is 3.29 feet and 6,949 AF above the top of the active conservation pool (elevation 1,428.00 feet at 24,226 AF). Water releases will be shut off when the reservoir elevation reaches approximately 1,429.60 feet and will continue shut throughout the winter until spring runoff requires 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 1,428 feet and 1,431 feet will be used for seasonal multipurpose regulation. For purposes of flood control storage, the reservoir water elevation

will be no higher than 1,429.8 feet at the beginning of spring runoff period. That portion of the joint-use pool between elevations 1,429.8 feet and 1,431.0 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 1,429.8 feet. msl after September 1 will be evacuated as directed by the Corps.

The Bureau has the option of lowering the reservoir below elevation 1,429.8 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

Elevation 1,429.80 feet (Base of flood control zone) to Elevation 1,431.00 feet (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 1,431 feet at the time inflows cease.

SEASON: SEPTEMBER 1 TO NOVEMBER 1

Make releases necessary to evacuate reservoir to elevation 1,429.80 feet prior to November 1.

SEASON: NOVEMBER 1 TO BEGINNING OF SPRING RUNOFF

Make releases necessary to maintain elevation 1,429.80 feet.

Deerfield Reservoir

Deerfield Reservoir started WY 2020 at elevation 5,906.50 feet and storage of 15,035 AF, which is 1.50 feet and 619 AF below the top of conservation (elevation 5,908 feet at 15,654 AF). The reservoir winter draw down was at 14,498 AF at December 1, 2019. A target of 15,000 AF of storage by March 1 will usually dictate the winter release, which is set near December 1. The winter release is set based on water usage from Deerfield by the Rapid Valley Water Conservancy District (District) and the storage target of 15,000 AF by March 1. The goal is to be near full by May 1 which is the start of the irrigation season. The Rapid Valley Water Conservancy District did not order water from Deerfield for irrigation in WY 2019. The City of Rapid City did not release water from Deerfield for municipal use in WY 2019.

A release of around 13 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 SNOTEL 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 WY 2020.

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 AF 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 2020 at elevation 4,577.43 feet and storage of 53,628 AF, which is 2.77 feet and 2,344 AF below the top of conservation (elevation 4580.2 feet at 55,972 AF). 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 October 1 when the reservoir content is below 29,000 AF and releases of 15 cfs from October 1 to March 1 and 20 cfs from March 1 through October 1 are established for reservoir content above 29,000 AF. Minimum summer conservation releases are 20 cfs at all reservoir contents.

1. Reservoir content less than 29,000 AF (with no water in the U.S. storage)
   October 1 – April 15 7 cfs
   April 15 - October 1 20 cfs

2. Reservoir content greater than 29,000 AF (with no water in the U.S. storage)
   October 1 – March 1 15 cfs
   March 1 - October 1 20 cfs

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 less than 29,000 AF (with water in the U.S. storage)
   October 1 – April 15 15 cfs
   April 15 - October 1 20 cfs

2. Reservoir content greater than 29,000 AF (with water in the U.S. storage)
   Year round 20 cfs

Although it is not mandatory, if possible Pactola Releases can be adjusted during the summer months to aim for 40 cfs passing the gauging station in Founder's Park. Also, if possible, during the cooler fall months the Bureau aims for 30 to 35 cfs passing the gauging station in Founder's Park. Such releases are dependent on U.S. storage and inflows from the watershed below the dam.

The irrigators need to order flows from storage if their demand limits natural flows past Farmingdale to less than 10 cfs. Also, the Bureau of Reclamation has an instream flow right for U.S. storage release flows that is in addition to the 10 cfs minimum required by the state for natural flows past Farmingdale.

The winter release for WY 2020 is approximately 40 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 AF 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 Contact 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 snowpack 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 4,580.20 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 to 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 2020 at elevation 3,182.91 feet and storage of 104,303 AF, which is 4.29 feet and 18,745 AF below the top of active conservation (elevation 3,187.2 feet at 123,048 AF). 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 always operated as full as possible. Water may be released from the facility if the reservoir is expected to fill to meet irrigation demands; ergo, excess water is released through the spillway when the reservoir is nearly full and assured of filling.

A Rope Access Team Inspection of the radial gates was completed in July 2019. The resulting report indicated more cleaning needed to be done on the trunnion pins for Gates 2 and 4 before operating the gates. This work is scheduled to be completed in January 2020 by the Rope Access Team.

Keyhole Reservoir

Keyhole Reservoir started WY 2020 at elevation 4,096.93 feet and storage of 167,307 AF, which is 2.37 feet and 21,364 AF below the top of conservation (elevation 4,099.3 feet at 188,671 AF). At the beginning of WY 2020, South Dakota storage for the Belle Fourche Irrigation District is 13,676 AF and Wyoming storage for the Crook County Irrigation District is 17,275 AF.

Releases from Keyhole Reservoir are made for either irrigation requirements or flood control. Releases are not anticipated from the reservoir from October to 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 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 releases are normally between 125 and 175 cfs.

The Belle Fourche Irrigation District has lands along the inlet canal that during drought conditions can depend entirely on Keyhole Reservoir for storage. These lands are served with flows from the Belle Fourche River and storage from Keyhole. Additionally, water contracted by Belle Fourche Irrigation District may be released from Keyhole Reservoir to supplement storage in Belle Fourche Reservoir if necessary. Finally, Crook Country Irrigation District also contracts irrigation water from Keyhole Reservoir.

Shadehill Reservoir

Shadehill Reservoir started WY 2020 at elevation 2,270.57 feet and storage of 113,133 AF, which is 1.43 feet and 7,039 AF below the top of conservation (elevation 2,272.0 feet at 120,172 AF). The winter release will be maintained at approximately 50 cfs to prepare the reservoir elevation for spring inflows. This release rate will be maintained constant until ice comes out of the channel in the spring to prevent ice jams at crossings. In the spring, after ice comes out of the channel, the release will be adjusted based on inflows and storage in the reservoir. Operation is to fill the reservoir in the spring, maintain a near full reservoir during the summer and position the reservoir in the fall as discussed in the SOP. Releases for irrigation demands will be met by conservation releases.

Shadehill will have the gatehouse shaft ladders and platforms replaced during the winter months. DKAO will contact downstream water users to inform them of any reduction in flows, if necessary, to perform the work.

Belle Fourche Reservoir

Belle Fourche Reservoir started WY 2020 at elevation 2,970.36 feet and storage of 137,476 AF, which is 4.64 feet and 35,397 AF below the top of conservation (elevation 2,975.0 feet at 172,873

AF). Normal operation at the Diversion Dam during the winter is to maintain flows in the Inlet Canal to store water in Belle Fourche Reservoir. A bypass of 5 cfs is 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. 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.

System Description and Annual Operating Plans for Water Year (WY) 2019 for Reservoirs Under Responsibility of the U.S. Army Corps of Engineers

Overview

The Missouri River main stem reservoir system, consisting of six reservoirs located in Montana, North Dakota, South Dakota, and Nebraska, provides for the following beneficial uses: flood control, irrigation, navigation, power, municipal and industrial water supply, water quality control, fish and wildlife, and recreation. Based on information from the Corps' 2019-20 AOP, the capacity and storage allocations of the main stem system were updated to current values and are shown in upstream to downstream order as follows:

Dam	Permanent	Carryover Multiple Use	Flood Control and Multiple Use	Exclusive Flood Control	Storage
Fort Peck, MT	4,088	10,700	2,704	971	18,463
Garrison, ND	4,794	12,951	4,211	1,495	23,451
Oahe, SD	5,315	13,353	3,208	1,107	22,983
Big Bend, SD	1,631	0	118	61	1,810
Fort Randall, SD	1,469	1,532	1,306	986	5,293
Gavins Point, NE	295	0	79	54	428
Totals	17,592	38,536	11,626	4,674	72,428

Table USACE 1: Reservoir storage allocation (in 1,000 Acre-Feet) at U.S. Army Corps of Engineers facilities in the Upper Missouri Basin.

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, MT	5	185,250
Garrison, ND	5	583,300
Oahe, SD	7	786,030
Big Bend, SD	8	494,320
Fort Randall, SD	8	320,000
Gavins Point, NE	3	132,300
Totals	36	2,501,200

Table USACE 2: Generating capacity of powerplants at U.S. Army Corps of Engineers facilities in the Upper Missouri Basin.

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 56.1 million acre feet on the first of March.

Operation of the Missouri River main stem reservoir system provides the following eight beneficial uses: flood control, irrigation, navigation, power, municipal and industrial water supply, water quality control, fish and wildlife, and recreation. Table USACE3 presents the regulation benefit for most of those uses as recorded in 20187-2019, 2017-2018, 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 USACE3 shows damages prevented at September 2019 price levels.

Use of Regulated Water	Period of Use or Season	2019 Totals	2018 Totals	Long-Term
Navigation[1]	Apr. - Dec.[2]	0.479 million tons (2019)	0.7562 million tons (2018)	1.61 million Tons[3]
Flood Damages Prevented	Oct. – Sept.	$8.62 billion (2019)	$ 1.72 billion (2018)	$ 75.7 billion[4]
Energy	Aug. - Jul.	12.2 billion kWh (Aug. '18-July '19)	10.6 billion kWh (Aug. '17-July '18)	9.4 billion kWh[5]

[1]If sand, gravel, and waterway material are included:
4.12 million tons (2019)
4.53 million tons (2018)
6.52 million tons (1967-2019 average)
[2]End of navigation season extended 10 days in 2018 and 10 days in 2019
[3]1967 2019 average. Peak tonnage shipped in 1977 (3.336 million tons)
[4]Total damages prevented (1938-2019)
[5]1968 2019 Average

Table USACE 3: Comparison of present and past benefits provided by main stem reservoirs operated by the U.S. Army Corps of Engineers.

A detailed description of the main stem system operations 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 power plants are owned and operated by Reclamation and have a total capacity of 348,100 kilowatts. The other six are owned and operated by the Corps and have a total

capacity of 2,501,200 kilowatts. Energy generated by the 14 power plants is marketed by the Department of Energy.

Total generation in the combined system in WY 2019 was 14,076.6 million kilowatt hours, 929.8 million kilowatt hours more than in WY 2018. A summary of the past 10 years of energy generation within the Upper Missouri River Basin is shown below.

Year	USBR	USACE	TOTAL
2019	1488.146	12588.448	14076.594
2018	1790.992	11355.785	13146.777
2017	1560.628	9092.514	10653.142
2016	1164.801	7652.168	8816.969
2015	1316.344	9323.682	10640.026
2014	1559.297	8729.9	10289.197
2013	840.209	8183.967	9024.176
2012	1141.904	10779.032	11920.936
2011	1674.806	11267.588	12942.390
2010	1430.618	7422.355	8852.974

Table USACE 4: Reclamation and U.S. Army Corps of Engineers energy generation at powerplant facilities (in millions of kilowatt hours).

A comparison of 2018 and 2019 generation and other data from Missouri Basin Region powerplants is shown on Table USACE5. Tables USACE6, USACE7, and USACE8 show 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 58, 60, and 62, respectively. Monthly generation for each month during the past several years is shown graphically on Figures 59, 61, and 63.

BUREAU PLANTS	INSTALLED CAPACITY (KW)	MILLION KILOWATT-HOURS GENERATED		WATER USED FOR GENERATION IN 2019			RIVER RELEASE	TOTAL RELEASE
		2018	2019	1,000 AF	PERCENT OF TOTAL RELEASE	KW-HOURS PER AF	1,000 AF	1,000 AF
Canyon Ferry	50,000	363.626	372.444	3,029.437	77.66	122.94	3,812.2	3,901.0
Pilot Butte[1]	1,600	0.000	0.000	0.000	0.00	N/A	147.8	147.8
Boysen	15,000	79.325	70.300	894.036	72.86	78.63	1,227.1	1,227.1
Buffalo Bill Reservoir Units								
Shoshone	3,000	19.819	19.920	106.043	9.40	187.85	See below for	total.
Buffalo Bill	18,000	122.743	88.584	396.679	35.15	223.31	See below for	total.
Heart Mountain	6,000	22.678	22.661	106.815	9.46	212.15	See below for	total.
Spirit Mountain[2]	4,500	15.746	17.660	172.518	15.29	102.37	See below for	total.
Total for Buffalo Bill Reservoir[3]	31,500	180.986	148.825	782.056	69.29	190.30	898.8	1,128.6
Yellowtail	250,000	1,167.055	896.497	2,448.732	83.67	366.11	2,903.0	2,926.6
Subtotal	**348,100**	**1,790.992**	**1,488.066**	**7,154.261**	**76.67**	**208.00**	**8,988.8**	**9,331.1**
CORPS PLANTS								
Fort Peck	185,250	1,130.401	1,220.862	7,266.00	90.76	168.02	8,006.0	8,006.0
Garrison	583,300	3,192.614	3,083.226	19,786.00	94.39	155.83	20,962.0	20,962.0
Oahe	786,030	3,351.368	3,994.191	26,206.00	95.56	152.42	27,425.0	27,425.0
Big Bend	494,320	1,198.948	1,400.464	25,776.00	96.81	54.33	26,624.0	26,624.0
Fort Randall	320,000	1,727.288	2,134.539	20,563.00	64.48	103.80	31,889.0	31,889.0
Gavins Point	132,300	755.166	755.166	16,423.00	44.70	45.98	36,744.0	36,744.0
Subtotal	**2,501,200**	**11,355.785**	**12,588.448**	**116,020.00**	**76.51**	**108.50**	**151,650.0**	**151,650.0**
TOTAL MISSOURI BASIN	**2,849,300**	**13,146.777**	**14,076.514**	**123,174.26**	**76.51**	**114.28**	**160,638.8**	**160,981.1**

[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 USACE 5: Annual energy generation statistics at Reclamation and U.S. Army Corps of Engineers facilities in the Upper Missouri Basin for water year 2019.

MONTH	BUREAU OF RECLAMATION PLANTS								
				BUFFALO BILL PLANTS					
	CANYON FERRY	PILOT BUTTE	BOYSEN	HEART MOUNTAIN	SPIRIT MOUNTAIN	BUFFALO BILL	SHOSHONE	YELLOWTAIL	TOTAL
October	28.562	0.000	2.555	1.860	1.658	4.776	1.698	70.421	111.530
November	31.965	0.000	5.215	0.000	0.000	4.364	1.629	65.699	108.872
December	35.747	0.000	4.845	0.000	0.000	1.662	1.688	67.428	111.370
January	29.146	0.000	5.021	0.000	0.000	1.761	1.699	65.005	102.632
February	26.147	0.000	4.677	0.002	0.000	2.010	1.010	53.061	86.907
March	25.489	0.000	4.881	0.000	0.000	5.524	1.233	58.783	95.910
April	35.203	0.000	4.792	3.379	1.545	12.932	1.646	67.529	127.026
May	37.699	0.000	9.360	3.575	2.183	13.566	1.607	81.943	149.933
June	24.607	0.000	9.511	3.408	2.769	13.294	1.820	99.631	155.040
July	36.384	0.000	4.534	3.445	3.309	13.604	2.120	103.617	167.013
August	32.211	0.000	9.029	3.570	3.095	11.730	2.020	86.069	147.724
September	29.284	0.000	5.880	3.422	3.101	3.361	1.750	77.311	124.109
TOTAL	372.444	0.000	70.300	22.661	17.660	88.584	19.920	896.497	1,488.066

MONTH	ARMY CORPS OF ENGINEERS PLANTS							MISSOURI BASIN TOTAL
	FORT PECK	GARRISON	OAHE	BIG BEND	FORT RANDALL	GAVINS POINT	TOTAL	
October	101.024	276.559	372.141	159.260	195.467	79.856	1,184.307	1,295.837
November	107.452	256.347	353.062	154.311	174.339	76.039	1,121.550	1,230.422
December	119.864	193.069	199.300	75.778	113.211	59.511	760.733	872.103
January	120.778	188.400	226.045	87.102	124.429	57.664	804.418	907.050
February	111.686	212.299	178.621	68.868	97.353	44.316	713.143	800.050
March	65.024	156.112	84.919	53.013	78.058	34.462	471.588	567.498
April	60.335	128.601	275.542	92.318	195.669	27.660	780.125	907.151
May	85.647	230.545	342.498	91.151	222.809	70.616	1,043.266	1,193.199
June	91.593	269.603	467.629	127.724	222.818	66.299	1,245.666	1,400.706
July	120.515	396.085	529.733	160.454	221.302	81.367	1,509.456	1,676.469
August	128.971	403.473	524.473	171.143	239.747	78.939	1,546.746	1,694.470
September	107.973	372.133	440.228	159.342	249.337	78.437	1,407.450	1,531.559
TOTAL	1,220.862	3,083.226	3,994.191	1,400.464	2,134.539	755.166	12,588.448	14,076.514

Table USACE 6: Monthly energy generation for U.S. Army Corps of Engineers' and Reclamation power facilities in water year 2019.

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	231.453	31.719	0.000	9.016	25.750	8.641	15.879	177.192	592.000	1,799.000	2,472.000	2,616.000	2,023.000	1,889.000
November	254.301	57.852	0.000	8.647	23.341	0.000	0.000	171.109	638.000	1,665.000	2,392.000	2,507.000	1,956.000	1,550.000
December	287.633	61.546	0.000	8.960	13.190	-0.008	0.000	181.018	715.000	1,259.000	1,350.000	1,216.000	1,199.000	1,253.000
January	239.700	59.917	0.000	9.018	12.685	0.000	0.000	175.706	726.000	1,240.000	1,528.000	1,420.000	1,274.000	1,271.000
February	220.696	55.674	0.000	5.361	12.026	-0.016	0.000	156.751	675.000	1,439.000	1,227.000	1,129.000	952.000	1,055.000
March	216.926	59.948	0.000	6.545	24.972	0.000	0.000	175.656	426.000	1,030.000	583.000	927.000	714.000	787.000
April	301.414	60.255	0.000	8.737	54.242	15.547	17.131	194.770	393.000	797.000	1,740.000	1,830.000	1,758.000	992.000
May	320.071	121.972	0.000	8.530	56.668	16.739	22.569	229.847	506.000	1,443.000	2,205.000	1,780.000	2,025.000	1,234.000
June	193.684	120.820	0.000	9.660	52.200	16.253	26.806	265.374	535.000	1,665.000	2,970.000	2,717.000	2,007.000	1,264.000
July	276.829	74.860	0.000	11.253	52.726	16.593	31.158	280.909	693.000	2,471.000	3,413.000	3,193.000	2,052.000	1,627.000
August	251.915	115.188	0.000	10.722	47.859	16.971	29.580	240.714	743.000	2,553.000	3,414.000	3,324.000	2,261.000	1,846.000
September	234.817	74.285	0.000	9.595	21.020	16.095	29.395	199.686	624.000	2,425.000	2,912.000	3,117.000	2,342.000	1,655.000
TOTAL	3,029.437	894.036	0.000	106.043	396.679	106.815	172.518	2,448.732	7,266.000	19,786.000	26,206.000	25,776.000	20,563.000	16,423.000

Table USACE 7: Water used (in 1,000 Acre-feet) for power generation at Reclamation and U.S. Army Corps of Engineers' facilities in water year 2019. [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.

MONTH	CANYON FERRY	BOYSEN	PILOT BUTTE	BUFFALO BILL	BULL LAKE	ANCHOR	YELLOWTAIL	FORT PECK	GARRISON	OAHE	BIG BEND	FORT RANDALL	GAVINS POINT
October	240.914	61.633	0.000	58.241	1.940	0.109	177.192	724.000	1,799.000	2,823.000	2,616.000	3,216.000	3,458.000
November	254.301	59.183	0.000	32.145	1.886	0.035	171.109	696.000	1,665.000	2,714.000	2,507.000	3,153.000	3,374.000
December	287.633	61.546	0.000	22.312	1.941	0.000	181.018	715.000	1,259.000	1,350.000	1,216.000	1,314.000	1,573.000
January	289.431	61.920	0.000	21.876	1.926	0.000	175.706	726.000	1,240.000	1,528.000	1,420.000	1,274.000	1,422.000
February	271.748	55.674	0.000	19.829	1.729	0.000	156.751	675.000	1,439.000	1,227.000	1,129.000	952.000	1,063.000
March	293.611	61.825	0.000	34.091	1.908	0.000	175.656	426.000	1,030.000	583.000	927.000	714.000	1,879.000
April	507.600	60.255	1.235	90.444	1.982	0.066	194.770	393.000	797.000	1,799.000	1,830.000	2,740.000	3,124.000
May	495.358	122.633	9.447	152.224	5.234	0.001	236.631	506.000	1,443.000	2,205.000	2,541.000	2,938.000	3,527.000
June	351.106	284.573	26.884	210.156	67.068	4.780	478.984	535.000	1,863.000	2,970.000	2,717.000	3,866.000	4,425.000
July	343.726	208.096	40.801	269.751	15.989	3.417	534.363	792.000	2,852.000	3,413.000	3,193.000	3,907.000	4,304.000
August	292.288	115.188	38.335	138.632	45.328	3.556	244.746	927.000	2,845.000	3,504.000	3,324.000	4,018.000	4,304.000
September	273.277	74.539	31.077	78.941	49.773	0.513	199.686	891.000	2,730.000	3,309.000	3,204.000	3,797.000	4,291.000
TOTAL	**3,900.993**	**1,227.063**	**147.780**	**1,128.642**	**196.704**	**12.477**	**2,926.612**	**8,006.000**	**20,962.000**	**27,425.000**	**26,624.000**	**31,889.000**	**36,744.000**

Table USACE 8: Total water releases (in 1,000 Acre-feet) from Reclamation and U.S. Army Corps of Engineers' facilities in water year 2019.

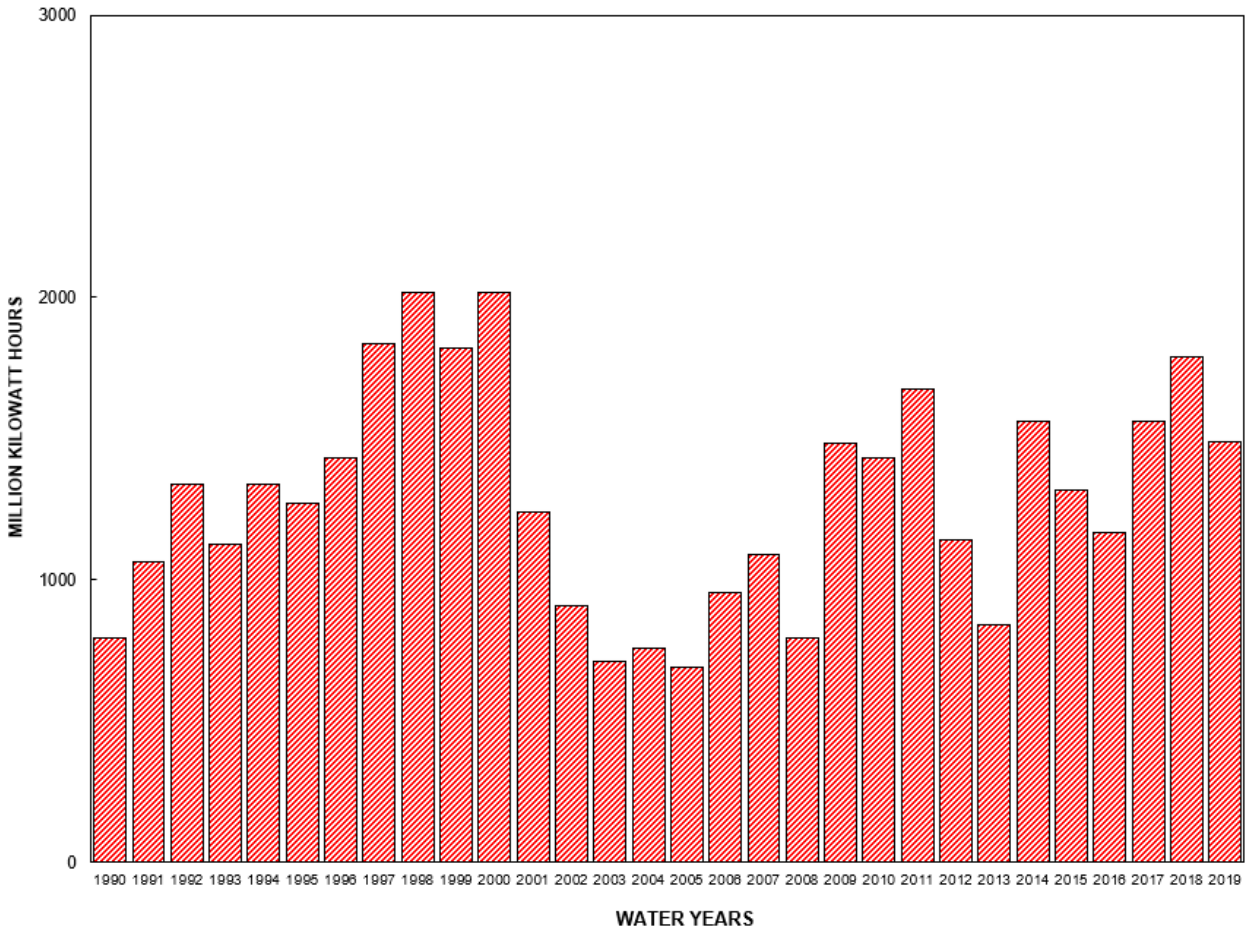


Figure 58: Annual power generation (in million kilowatt hours) at Reclamation facilities located in the Upper Missouri Basin between the water years 1990 and 2019.

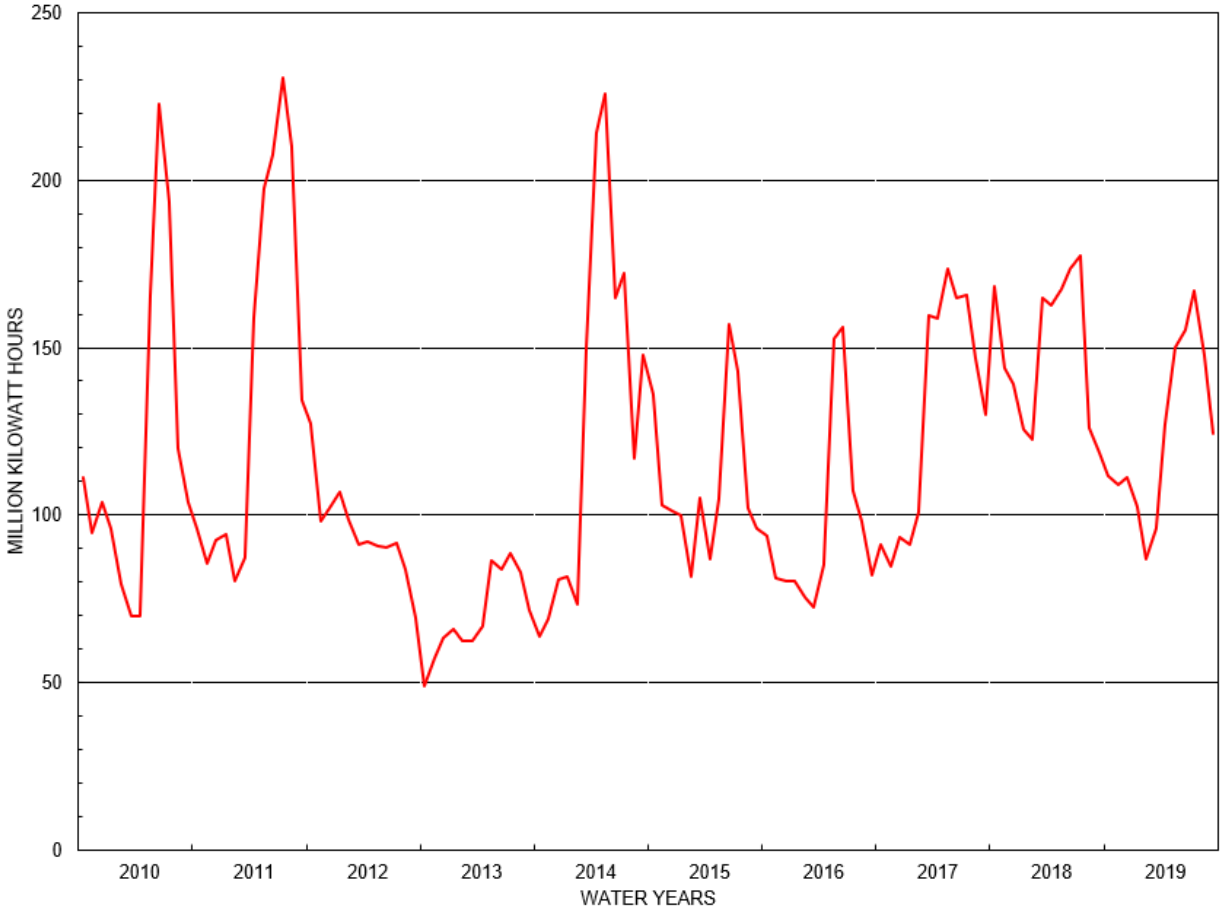


Figure 59: Monthly power generation (in million kilowatt-hours) at Reclamation power facilities in the Upper Missouri Basin between the water years 2010 and 2019.

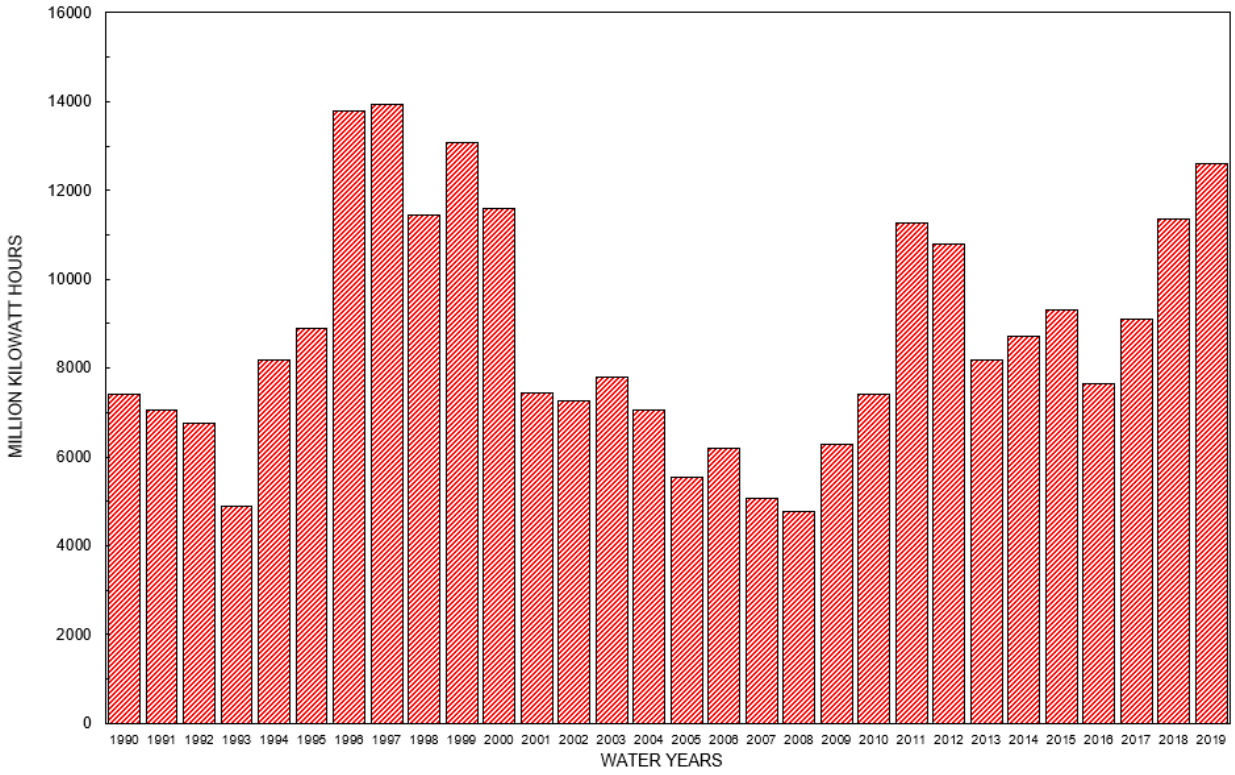


Figure 60: Annual power generation (in million kilowatt hours) at U.S. Army Corps of Engineers' facilities located in the Upper Missouri Basin between the water years 1990 and 2019.

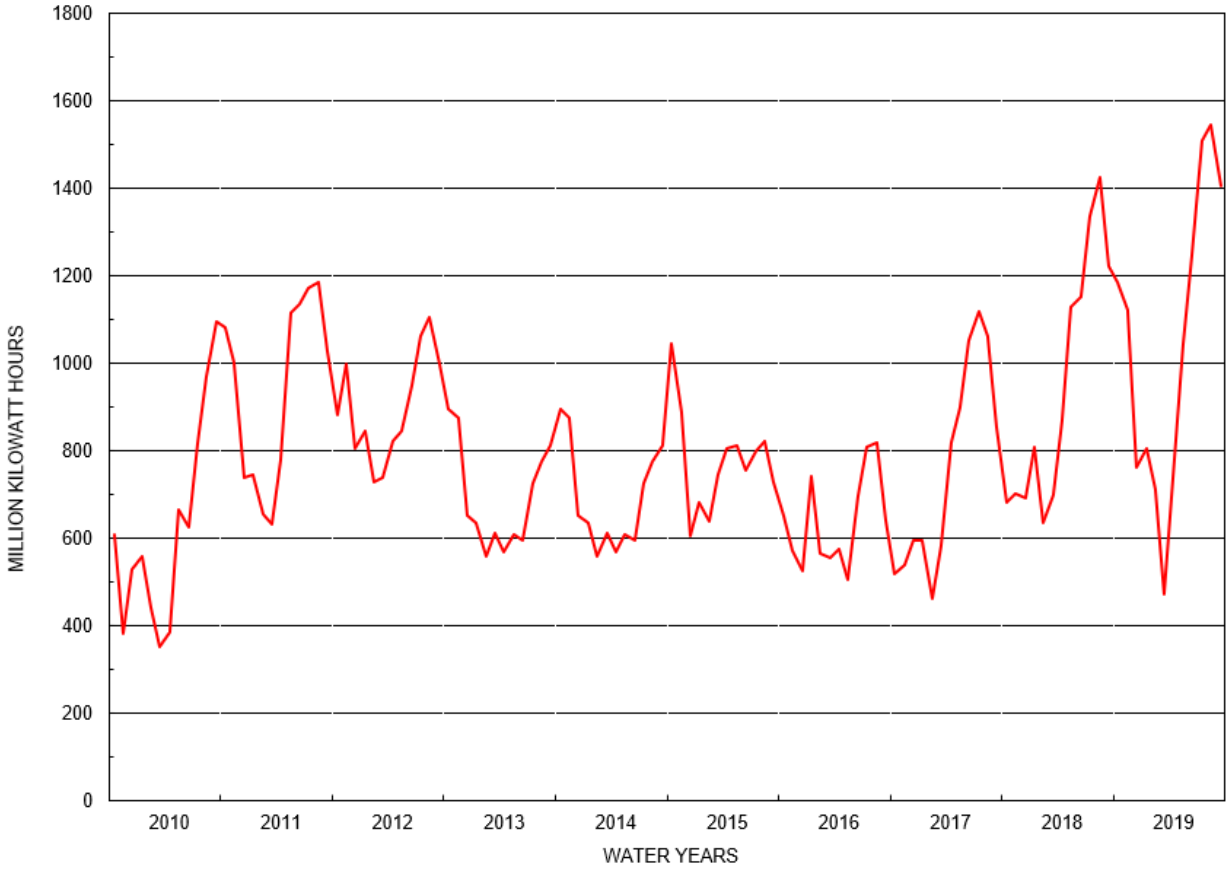


Figure 61: Monthly power generation (in million kilowatt-hours) at U.S. Army Corps of Engineers' power facilities in the Upper Missouri Basin between the water years 2010 and 2019.

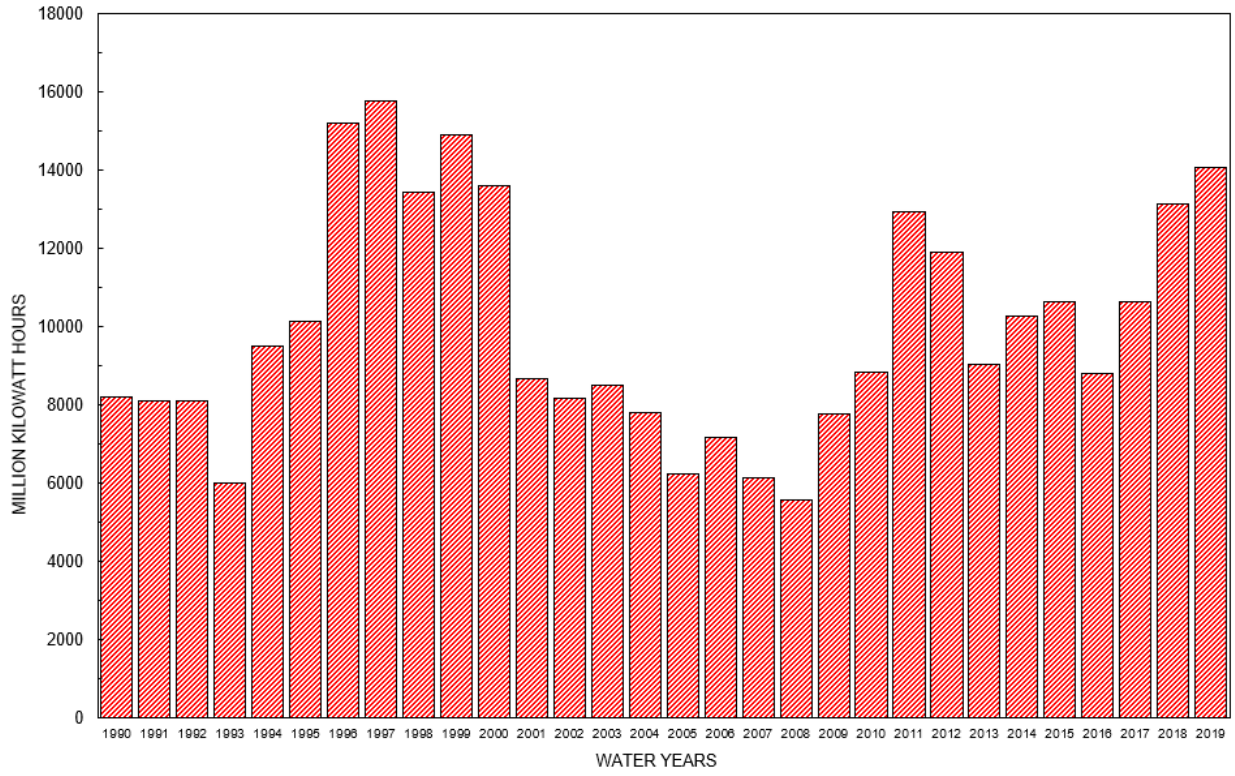


Figure 62: Total annual power generation (in million kilowatt hours) at Reclamation and U.S. Army Corps of Engineers' facilities located in the Upper Missouri Basin between the water years 1990 and 2019.

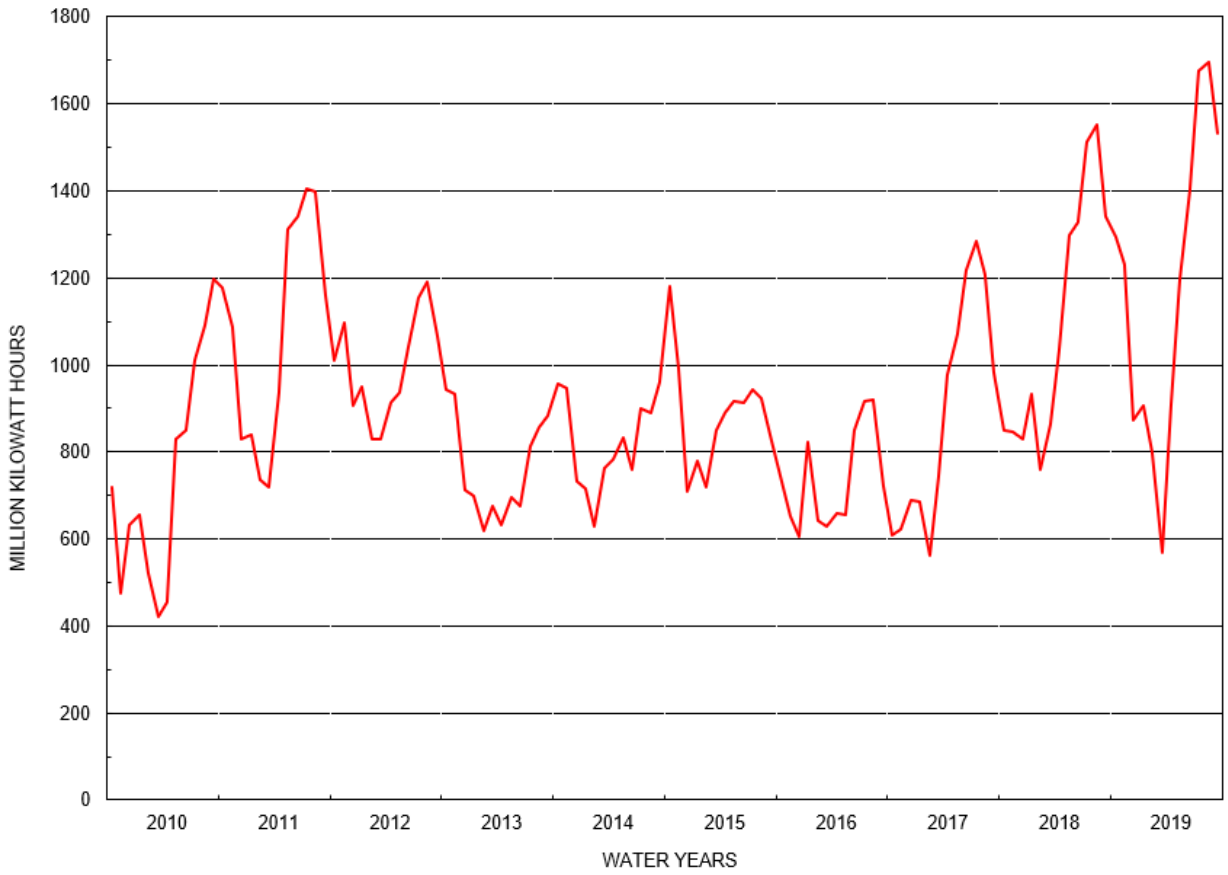


Figure 63: Total monthly power generation (in million kilowatt-hours) at Reclamation and U.S. Army Corps of Engineers' power facilities in the Upper Missouri Basin between the water years 2010 and 2019.

For a more detailed account of powerplants operation at Reclamation facilities during the year, refer to the 2019 operation summaries. Information on the Corps' powerplants operations can be obtained from the annual operating reports prepared by and available for distribution from the Missouri River Basin Water Management Division, U.S. Army Corps of Engineers, Northwestern Division, Omaha, Nebraska.