

2020 Water Management Plan

Seasonal Update

January 21, 2021

1. Introduction

The annual Water Management Plan (WMP) is developed prior to the U.S. Army Corps of Engineers (Corps), Bureau of Reclamation (Reclamation), and Bonneville Power Administration (BPA), collectively referred to as the Action Agencies (AAs), implementation of Columbia River System (CRS) operations identified in the following documents: 1) 2019 NOAA Fisheries CRS Biological Opinion (2019 BiOp); 2) U.S. Fish and Wildlife Service (USFWS) 2000 Federal Columbia River Power System (FCRPS) BiOp and 2006 Libby BiOp (collectively referred to as the 2000/2006 BiOp); 3) AA’s 2018 CRS Proposed Action (2018 CRSPA); 4) 2019-2021 Spill Operation Agreement (2019-2021 Agreement), and; 5) 2020 Fish Operations Plan (2020 FOP). The WMP is also developed prior to the receipt of any seasonal information that may determine how many of the operation measures are implemented. The Seasonal Update is intended to supplement the WMP with more detailed information on operations as the water year progresses. Each section of the Seasonal Update will be updated when information is available and finalized when no further information is available.

The first update for the primary elements of Fall and Winter will be posted by November 1 of each year. The first update for the primary elements of Spring and Summer will be posted by March 1 of each year. The elements and operations included in the Seasonal Update are generally the same as have been previously presented in the Fall/Winter and Spring/Summer Updates to the WMP. The intent of updating in this manner is to track operations as they change throughout and across each season.

The elements and operations described in the Seasonal Update and the approximate schedule for updates and finalization are as displayed in Table 1.

Table 1. Schedule for update and finalization of Seasonal Update elements and operations.

Section	Element	Begins	Finalized	Last Updated
2.1	Current Conditions (e.g., WSF, Streamflows)	October	July	December 17, 2020
2.2	Seasonal Flow Objectives	April	August	December 17, 2020
2.3	Flood Control	January	June	December 17, 2020
2.4	Storage Project Operations	September	September	December 17, 2020
2.5	Water Quality (Spill Priority Lists)	January	December	January 21, 2021
	Specific Operations	Start Date	End Date	Last Updated
2.6	Burbot spawning temperature management (Libby)	November	December 30	February 27, 2020
2.7	Lake Pend Oreille Kokanee (Albeni Falls)	September 1	December 30	January 21, 2021

Section	Element	Begins	Finalized	Last Updated
2.8	Upper Snake Flow Augmentation	April 1	August 31	January 21, 2021
2.9	Chum Flows (Bonneville Dam)	November 1	April 10	December 17, 2020
2.10	Hanford Reach Fall Chinook Protection	November	June	February 27, 2020
2.11	Snake River Zero Generation	December	February	December 17, 2020
2.12	Minimum Operating Pool	April 3	September 1	January 21, 2021
2.13	Spill Operations	April 3	September 1	January 21, 2021
2.14	Transport Operations	May 1	-	January 21, 2021
2.15	Fish Passage Research	March	October	January 21, 2021

2. Seasonal Update Elements and Specific Operations

2.1. Current Conditions

Water Supply Forecasts – NWRFC

The final water supply forecast (WSF) is defined as the forecast posted on NOAA’s Northwest River Forecast Center (NWRFC) website at 5:00 pm Pacific Standard Time on the 3rd business day of the month. NWRFC water supply forecasts are available on the following website.

<http://www.nwrfc.noaa.gov/ws/>

Table 2. The Dalles Dam Final Water Supply Forecasts for Runoff during the Forecast Periods of January–July and April–August.

Forecast Issue Date	January-July		April-August	
	Volume (MAF)	% of 30-year Average (101.4 MAF)	Volume (MAF)	% of 30-year Average (87.5 MAF)
January 6, 2020	102.7	101%	86.9	99%
February 5, 2020	104.3	103%	92.6	106%
March 4, 2020	97.9	99%	87.0	99%
April 3, 2020	94.2	93%	84.4	96%
May 5, 2020	96.0	95%	82.8	100%
June 3, 2020	102.6	101%	93.4	107%
July 6, 2020	101.7	101%	93.4	107%

Table 3. Grand Coulee Dam Final Water Supply Forecasts for Runoff during the Forecast Periods of January–July and April–August.

Forecast Issue Date	January-July		April-August	
	Volume (MAF)	% of 30-year Average (59.6 MAF)	Volume (MAF)	% of 30-year Average (56.8 MAF)
January 6, 2020	62.7	105%	58.5	103%
February 5, 2020	66.9	112%	63.0	111%
March 4, 2020	63.6	107%	61.3	108%
April 3, 2020	60.3	101%	58.7	103%
May 5, 2020	61.5	103%	60.1	106%
June 3, 2020	66.3	111%	65.1	115%
July 6, 2020	64.8	107%	63.6	112%

Table 4. Lower Granite Dam Final Water Supply Forecasts for Runoff during the Forecast Periods of January–July and April–August.

Forecast Issue Date	January-July		April-August	
	Volume (MAF)	% of 30-year Average (27.4 MAF)	Volume (MAF)	% of 30-year Average (21.1 MAF)
January 6, 2020	25.3	92%	20.7%	96%
February 5, 2020	27.2	99%	20.5	97%
March 4, 2020	22.6	82%	17.9	85%
April 3, 2020	21.8	80%	17.5	83%
May 5, 2020	22.5	82%	18.3	87%
June 3, 2020	24.1	88%	19.8	94%
July 6, 2020	25.2	92%	21.0	100%

Water Supply Forecasts - Corps

Water supply forecasts for Libby and Dworshak dams are produced by the Corps’ Seattle and Walla Walla Districts, respectively. Corps’ forecasts are available on the following website.

<http://www.nwd.usace.army.mil/Missions/Water/Columbia/Flood-Control/>

Table 5. Libby Dam Water Final Water Supply Forecasts for Runoff during the Forecast Period of April–August.

Forecast Issue Date	April-August 2020	
	Volume (KAF)	% of 78-year (1929-2008) Average (6,282 KAF)
December	5,050	80%
January	5,481	87%
February	6,386	102%
March	6,349	108%
April	6,324	107%
May	5,759	98%
June	5,795	98%

Table 6. Dworshak Dam Final Water Supply Forecasts for Runoff during the Forecast Period of April–July.

Forecast Issue Date	April-July 2020	
	Volume (KAF)	% of 30 year (1981-2010) Average (2,438 KAF)
December	1,789	67%
January	1,532	63%
February	2,095	79%
March	2,355	97%
April	2,333	96%
May	1,960	80%
June	2,187	90%

Water Supply Forecasts – Bureau of Reclamation

Water supply forecasts for Hungry Horse Dam are produced by the Bureau of Reclamation.

Table 7. Hungry Horse Dam Final Water Supply Forecasts for Runoff during the Forecast Periods of April–August, January–July, and May–September.

Forecast Issue Date	April-August 2020		January-July 2020		May-September 2020	
	Volume (KAF)	% of 30-yr Average (2,070 KAF)	Volume (KAF)	% of 30-yr Average (2,224 KAF)	Volume (KAF)	% of 30-yr Average (1,835 KAF)
January	1,842	95%	1,992	95%	1,582	93%
February	2,044	106%	2,151	106%	1,778	105%
March	2,070	107%	2,160	109%	1,830	108%
April	2,120	109%	2,040	109%	1,890	112%
May	2,200	114%	1,850	117%	1,970	116%
June	2,440	126%	1,100	128%	2,200	130%

Weekly Weather and Precipitation Retrospectives

Week	Weekly Weather / Precipitation Retrospective
October 1, 2019	Temperatures: Well below average initially, then gradually recovered to near average. Precipitation: Below average. Streamflow: Mostly flat.
October 7, 2019	Temperatures: Below average to much below average. Precipitation: Below average. Streamflow: Mostly flat, except for typical, early October rises on a few low elevation streams in BC, western MT and ID.
October 14, 2019	Temperatures: Starting below average but rising to about average Precipitation: Dry until mid-week, then much above average west side with wet weekend basin wide. Streamflow: Mostly flat with minor rises in response to late week precipitation
October 21, 2019	Temperatures: Near average west, below average east. Precipitation: Above average initially, then fell to below average as a blocking jet stream pattern developed. Streamflow: Brief rises Mon-Tue in the mid-Cs, Clearwater and Spokane. Otherwise, mostly flat.
October 28, 2019	Temperatures: Well below average, with numerous record lows east of Cascades. Temperatures then recovered to near average this weekend. Precipitation: Little precipitation in what is normally a wet time of year. Streamflow: Flat or receding. Some river ice formation noted in in Western MT/ID headwaters.
November 4, 2019	Temperatures: Above average, except for a few cold spots the eastern valleys. Precipitation: Well below average, although some precip fell northwest half this weekend. Streamflow: Flat.
November 11, 2019	Temperatures: Above average. Precipitation: Below average, south and west; near average north and east. Streamflow: Mostly flat, although brief rises began overnight in BC, Clearwater and Spokane basins due to significant weekend precip and high snow levels.
November 18, 2019	Temperatures: Above average initially, then cooled to near average. Precipitation: Below average, except closer to average in BC and western MT. Streamflow: Brief rises in BC, Clearwater and Spokane basins early in the week, otherwise flat or receding.
November 25, 2019	Temperatures: Below average with unusually low snow levels. Precipitation: Well below average north; slightly above average south. Streamflow: Flat or receding. Some ice formation noted in headwater areas this weekend.

Week	Weekly Weather / Precipitation Retrospective
December 2, 2019	Temperatures: Began below average and ends week above average. Precipitation: Well below average. Streamflow: Flat or receding.
December 9, 2019	Temperatures: Above average. Precipitation: Ranged from well below average north, to well above average in the upper Snake basin. Streamflow: Flat or receding with very small rises at end of the week in lowest elevation basins
December 16, 2019	Temperatures: Above average, especially south where a few record highs were noted on Thu-Fri. Precipitation: Well above average northwest half (200-300% of normal), with 4-6ft of snow noted in the BC mountains. Well below average southeast. Streamflow: Notable, but brief rises on the Willamettes, Bonneville local inflows, mid C-s and Spokane basins. Flat elsewhere.
December 23, 2019	Temperatures: Above average, dropping to just about average Precipitation: Well below average, except closer to average in BC Streamflow: Mostly flat and receding after modest rises from weekend storm.
December 30, 2019	Temperatures: Well above average, with near record warmth on Wed. Precipitation: Well above average in BC and western MT; near average elsewhere Streamflow: Minor rises Wed-Fri in Clearwater, Spokane, mid-Cs and lower Columbia which then receded. Mostly flat elsewhere.
January 6, 2020	Temperatures: Above average initially, then fell to below average. Precipitation: Well above average (200-300% of normal), especially US basins. Streamflow: Flat or receding due to much colder weather.
January 13, 2020	Temperatures: Well below average, but moderated over the weekend. Snow levels near valley floors early in the week. Precipitation: Near average south; below average north. Streamflow: Flat or receding due to much colder weather.
January 20, 2020	Temperatures: Well above average. Near record late January warmth Fri-Sun. Precipitation: Above average, especially Western WA and BC. Streamflow: Minor rises in the Clearwater, Spokane, mid-Cs, Lower Columbia, lower Snake and Willamettes as rain combined with residual low elevation snowmelt. Flat elsewhere.
January 27, 2020	Temperatures: Well above average, with record warmth Fri-Sat, flowed by a sharp drop on Sunday. Precipitation: Well above average (200-400% of normal) with significant snowpack gains. Streamflow: Elevated flows on the Clearwater, Spokane, mid-Cs, Lower Columbia, lower Snake and Willamettes, followed by fairly rapid recessions. Mostly flat elsewhere.
February 3, 2020	Temperatures: Below average Mon-Tue, near record warmth Wed-Fri, then fell to near average Sat-Sun. Precipitation: Well above average (200-400% of normal), with record rainfall in NE OR Streamflow: Major flooding in the McNary, John Day and lower Snake tributaries. Significant flow spikes in the lower Snake/lower Columbia which are now in rapid recession. Minor flow increases in the Clearwater, Spokane, and mid-Cs which are also now receding. Mostly flat elsewhere.
February 10, 2020	Temperatures: Near average, with seasonably low snow levels. Precipitation: Below average. Streamflow: Flat or receding back to baseflows
February 17, 2020	Temperatures: Near average. Precipitation: Below average. Streamflow: Mostly flat.

Week	Weekly Weather / Precipitation Retrospective
February 24, 2020	<p>Temperatures: Near average.</p> <p>Precipitation: Below average initially, then turned wetter this weekend, mostly in BC and western WA.</p> <p>Streamflow: Mostly flat.</p>
March 2, 2020	<p>Temperatures: Above average initially, then cooled to near average.</p> <p>Precipitation: Near average in BC and western WA. Below average elsewhere.</p> <p>Streamflow: Mostly flat, then minor rises on the Clearwater, Spokane and lower Columbia.</p>
March 9, 2020	<p>Temperatures: Fell to well below average, especially in BC, with near record cold this weekend.</p> <p>Precipitation: Increased to near average, with light/moderate snow near valley floors this weekend.</p> <p>Streamflow: Flat, or receding due to colder temperatures</p>
March 16, 2020	<p>Temperatures: Recovered to slightly above average, with mild day but chilly nights.</p> <p>Precipitation: Below average, especially in BC where it was mostly dry.</p> <p>Streamflow: Mostly flat, except very minor rises on the Clearwater, Spokane and lower Snake as temperatures warmed.</p>
March 23, 2020	<p>Temperatures: Below average, with low snow levels.</p> <p>Precipitation: Increased to above average northwest half. Remained below average southeast half.</p> <p>Streamflow: Very minor rises on the Clearwater, Spokane and lower Snake early in the week, which then receded due to colder weather. Flat elsewhere.</p>
March 30, 2020	<p>Temperatures: Below average, with unusually low snow levels.</p> <p>Precipitation: Above average, especially in US basins where significant snowpack gains were noted.</p> <p>Streamflow: Minor rises on the Clearwater, Spokane, lower Snake and Willamettes, which then receded due to colder weather. Flat elsewhere</p>
April 6, 2020	<p>Temperatures: Slightly above average, but with cool nights. Cooled to below average BC/MT/ID this weekend.</p> <p>Precipitation: Below average.</p> <p>Streamflow: Another round of minor snowmelt rises and cycling on the Clearwater, Spokane, lower Snake and Willamettes which have mostly rolled over already this morning and have begun to recede. Flat elsewhere</p>
April 13, 2020	<p>Temperatures: Rose to above average in WA/OR, but remained below average in BC/ID/MT with cold nights.</p> <p>Precipitation: Below average, but some valley rain and high elevation snow fell this weekend.</p> <p>Streamflow: Flat or receding due to cool and dry weather in key snowpack regions. However, minor rises began again yesterday in the Clearwater, Spokane, mid-Cs and lower Salmon basins</p>
April 20, 2020	<p>Temperatures: Slightly above average.</p> <p>Precipitation: Below average overall, then increased to above average NW half.</p> <p>Streamflow: Minor rises resumed on the Clearwater, Spokane, Snake, mid-Cs and lower Columbia, with minor rises also beginning in the Pend Oreille/Flathead/Clark Fork basins. Unregulated flows at The Dalles rose above 200 kcfs.</p>
April 27, 2020	<p>Temperatures: Above average, then cooled to slightly below average this weekend.</p> <p>Precipitation: Above average, although precipitation in the southeast half was more spotty.</p> <p>Streamflow: Spring snowmelt got underway on schedule. Widespread rises, with unregulated flows at The Dalles rising over 300 kcfs, and at Lower Granite rising to around 125 kcfs.</p>

Week	Weekly Weather / Precipitation Retrospective
May 4, 2020	<p>Temperatures: Rose to well above average, with record warmth this weekend.</p> <p>Precipitation: Above average northwest half, below average southeast half.</p> <p>Streamflow: Widespread high snowmelt flows. Unregulated flows at The Dalles hovered between 350-400kcfs, which is slightly above average for early May.</p>
May 11, 2020	<p>Temperatures: Cooled to near average, with some high elevation snow in BC.</p> <p>Precipitation: Well above average (150-250% of normal), except below average extreme SE ID and above Revelstoke, BC.</p> <p>Streamflow: Widespread high snowmelt flows, which briefly leveled off due to cooler weather. Unregulated flows at The Dalles hovered near 400 kcfs, which is near average for early May.</p>
May 18, 2020	<p>Temperatures: Rose to well above average, then dropped sharply to near average this weekend.</p> <p>Precipitation: Mostly dry initially, then increased to above average. Locally heavy rain from scattered thunderstorms</p> <p>Streamflow: After a brief lull, re-rises redeveloped due to both warm temperatures and locally heavy rains. Unregulated flows at The Dalles rose back to around 600kcfs</p>
May 25, 2020	<p>Temperatures: Rose to well above average, then dropped sharply to near average this weekend.</p> <p>Precipitation: Mostly dry initially, then increased to above average. Numerous, damaging severe thunderstorms and isolated flash flooding in eastern OR, eastern WA and ID Panhandle on Sat.</p> <p>Streamflow: After a brief lull, basinwide rises redeveloped due to warm temperatures, followed by heavy rains this weekend. Unregulated flows at The Dalles rising back toward 600kcfs.</p>
June 1, 2020	<p>Temperatures: Hovered around average most of the week at load centers. On east side, below average for all but the Snake basin.</p> <p>Precipitation: Mostly below average with a number of storms concentrating over Canadian portion of the basin</p> <p>Streamflow: Most streams were in recession from large snowmelt and precipitation driven rises over the previous weekend. There were some isolated small rises over this past weekend.</p>
June 8, 2020	<p>Temperatures: Load centers started cool and finished slightly above average before returning to a cooler pattern for the weekend</p> <p>Precipitation: Average to below average northern portion of basin. Significantly wetter in southern portion of basin.</p> <p>Streamflow: Most streams were in recession with minor rises forecast for the weekend.</p>
June 15, 2020	<p>Temperatures: Rose from below average to above average.</p> <p>Precipitation: Above average in US basins; below average in BC.</p> <p>Streamflow: Re-rises in most streams as scattered, heavy rain fell on remaining snowpacks. Gradual recessions commenced on the lower Snake, mid-C and lower Columbia tributaries as remaining snowpacks continue to deplete.</p>
June 22, 2020	<p>Temperatures: Above average through Fri, then cooled to below average</p> <p>Precipitation: Well above average in BC during the week, with heaviest rains shifting into ID/MT over the weekend. Below average elsewhere.</p> <p>Streamflow: Very high flows in BC where heavy precip fell on still sizeable snowpacks. Slow recessions in western MT/ID, with more rapid recessions in the Snake and lower Columbia.</p>
June 29, 2020	<p>Temperatures: Below average.</p> <p>Precipitation: Well above average east; below average west.</p> <p>Streamflow: Secondary flow peaks in most basins, followed by gradual recessions. Unregulated flows peaked again near 500kcfs before receding late in the week.</p>
July 6, 2020	<p>Temperatures: Below average.</p> <p>Precipitation: Above average in BC; seasonably dry elsewhere.</p> <p>Streamflow: Basinwide recessions.</p>

Week	Weekly Weather / Precipitation Retrospective
July 13, 2020	<p>Temperatures: Large temperature swings, with typical summer heat Monday-Tuesday and yesterday broken up by cool and windy weather Thu-Fri.</p> <p>Precipitation: Near average in BC. Well below average elsewhere, but with isolated strong thunderstorms in ID/MT on Thu, and some drizzle near the coasts.</p> <p>Streamflow: Basinwide recessions, but remaining well above normal for July.</p>
July 20, 2020	<p>Temperatures: Large temperature swings, with well above average temperatures Monday-Tuesday and yesterday broken up by cool and windy weather Thu-Fri.</p> <p>Rainfall: Continued above average in BC. Below average elsewhere, but with isolated strong thunderstorms in ID/MT.</p> <p>Streamflow: Basinwide recessions, but remaining well above normal for July.</p>
July 27, 2020	<p>Temperatures: Well above average, but just short of 1-in-2 year heat wave criteria.</p> <p>Rainfall: Near average in BC. Typical summer dryness elsewhere with isolated thunderstorms.</p> <p>Streamflow: Basinwide recessions, but remaining well above normal for late July.</p>
August 3, 2020	<p>Temperatures: Near average.</p> <p>Rainfall: Increased to above average in BC and NW WA. Isolated thunderstorms elsewhere.</p> <p>Streamflow: Basinwide recessions, except for brief flow spikes on Fri in BC from locally heavy rain.</p>
August 10, 2020	<p>Temperatures: Briefly fell to below average before climbing to well above average and near 1-in-2 year near heat wave criteria this weekend.</p> <p>Rainfall: Near average above Revelstoke BC, otherwise seasonably dry with isolated mountain thunderstorms</p> <p>Streamflow: Basinwide recessions.</p>
August 17, 2020	<p>Temperatures: Above average.</p> <p>Rainfall: Above average NW WA, near average in BC, and seasonably dry elsewhere with isolated thunderstorms.</p> <p>Streamflow: Basinwide recessions, except in BC where snowmelt cycling and brief rises were noted due to warmer temperatures and spotty rainfall</p>
August 24, 2020	<p>Temperatures: Near average NW WA and BC; above average elsewhere</p> <p>Rainfall: Below average, but with scattered thunderstorms in BC, ID and western MT.</p> <p>Streamflow: Basinwide recessions.</p>
August 31, 2020	<p>Temperatures: Well above average, then cooled sharply with damaging winds across the region yesterday.</p> <p>Rainfall: Scattered strong thunderstorms and heavy rain on BC Tue, with first light mountain snow of the season in western MT yesterday.</p> <p>Streamflow: Basinwide recessions, except for a brief rain-driven spike above Arrow, BC.</p>
September 7, 2020	<p>Temperatures: Above average, but gradually fell to near average due to dense, spreading wildfire smoke.</p> <p>Rainfall: Dry and windy, especially early in the week, which exacerbated catastrophic wildfire conditions across OR/WA.</p> <p>Streamflow: Flat or receding.</p>
September 14, 2020	<p>Temperatures: Near average, with temperatures held down by dense smoke.</p> <p>Rainfall: Increased to above average US basins. Below average in BC. Fall rainy season getting underway earlier than usual.</p> <p>Streamflow: Flat as rains went into rewetting soils.</p>
September 21, 2020	<p>Temperatures: Below average west; above average east.</p> <p>Rainfall: Widespread, heavy precip, with several records broken west of Cascades and first significant mountain snowfall in BC.</p> <p>Streamflow: Minor rises in BC, mid-Cs and Clearwater Basin. Flat elsewhere as rains went into rewetting soils.</p>
September 28, 2020	<p>Temperatures: Well above average.</p> <p>Precipitation: Mostly dry.</p> <p>Streamflow: Flat or receding.</p>

2.2. Seasonal Flow Objectives

Project	Planning Dates	Seasonal Flow Objectives (kcfs)	Season Average Flow to date (kcfs)
Priest Rapids	Spring 4/10–6/30	135	179.7
McNary	Spring 4/10–6/30	234.8 ⁱ	280.3
	Summer 7/1–8/31	200	189.3
Lower Granite	Spring 4/3–6/20	90.6 ⁱ	89.8
	Summer 6/21–8/31	52.1 ⁱⁱ	44.7

i. Varies according to NWRFC April forecast.

ii. Varies according to NWRFC June forecast.

2.3. Flood Control

Flood Control Elevations and April 10 objective elevations per each forecast period are listed in the table below. Forecasted flood control elevations will be calculated beginning in December after the Libby and Dworshak water supply forecasts are available. Subsequent forecasted flood controls will be updated after the final water supply forecasts are available January-April.

Grand Coulee and all Canadian projects will be operated for standard flood control. Hungry Horse and Libby will be operated for Variable Q (VARQ) Flood Control. Beginning in January, the Corps calculates Upper Rule Curve elevations based on the monthly official final forecasts. Projects are operated using these elevations as an upper limit, with the objective of reaching their spring refill elevations. Detailed flood control operations are available at the following website. <http://www.nwd-wc.usace.army.mil/report/colsum>.

The April 10 elevations shown in the table below are calculated by linear interpolation between the March 31 and April 15 forecasted flood control elevations.

Project	Elevation Date Objective	Jan	Feb	Mar	Apr
Libby	Jan 31	2426.7			
	Feb 28	2436.4	2404.2		
	March 31	2441.3	2402.3	2404.1	
	April 10	2441.4	2402.3	2404.1	
	April 15	2441.4	2402.3	2404.1	2404.1
	April 30	2441.4	2402.3	2404.1	2405.3
Hungry Horse	Jan 31	3547.8			
	Feb 28	3546.5	3540.3		
	March 31	3545.0	3535.5	3532.8	
	April 10	3544.5	3533.9	3531.9	
	April 15	3544.3	3533.1	3530.0	3526.4
	April 30	3543.6	3530.7	3527.1	3522.9
Grand Coulee	Jan 31	1290.0			
	Feb 28	1290.0	1289.9		
	March 31	1271.5	1262.9	1549.8	
	April 10	1260.2	1249.6	1556.9	
	April 15	1254.5	1243.0	1560.4	1270.8
	April 30	1239.4	1233.0	1538.4	1253.9

Project	Elevation Date Objective	Jan	Feb	Mar	Apr
Brownlee	Jan 31	2077.0			
	Feb 28	2047.2	2048.7		
	March 31	2042.1	2043.6	2053.4	
	April 15	2039.8	2041.4	2056.7	2060.9
	April 30	2039.1	2039.4	2056.7	2061.6
Dworshak	Jan 31	1564.3			
	Feb 28	1572.6	1553.0		
	March 31	1587.5	1565.4	1549.8	
	April 10	1594.1	1572.1	1556.9	
	April 15	1597.4	1575.4	1560.4	1540.8
	April 30	1597.4	1563.7	1538.4	1540.8

2.4. Storage Project Operations

Libby Dam

Bull Trout Flows: Bull trout minimum flows are specified in the 2006 USFWS Libby Sturgeon Biological Opinion (2006 BiOp) and may be found in Table 8 on page 25 of the Water Management Plan on the following website.

http://pweb.crohms.org/tmt/documents/wmp/2020/Final/20191220_WMP_2019_Final.pdf

April 10 and Refill Objectives:

From September 2019 through April 2020, the project was operated to meet minimum bull trout flows and FRM requirements. On 17 April 2020, Libby Dam reached its minimum elevation for the year of 732.46 m (2,403.1 ft) then operated to its minimum flow until the onset of refill 22 April 2020, when operations went to the Variable Flow (VarQ) FRM rules until the start of the sturgeon pulse.

Sturgeon Pulse:

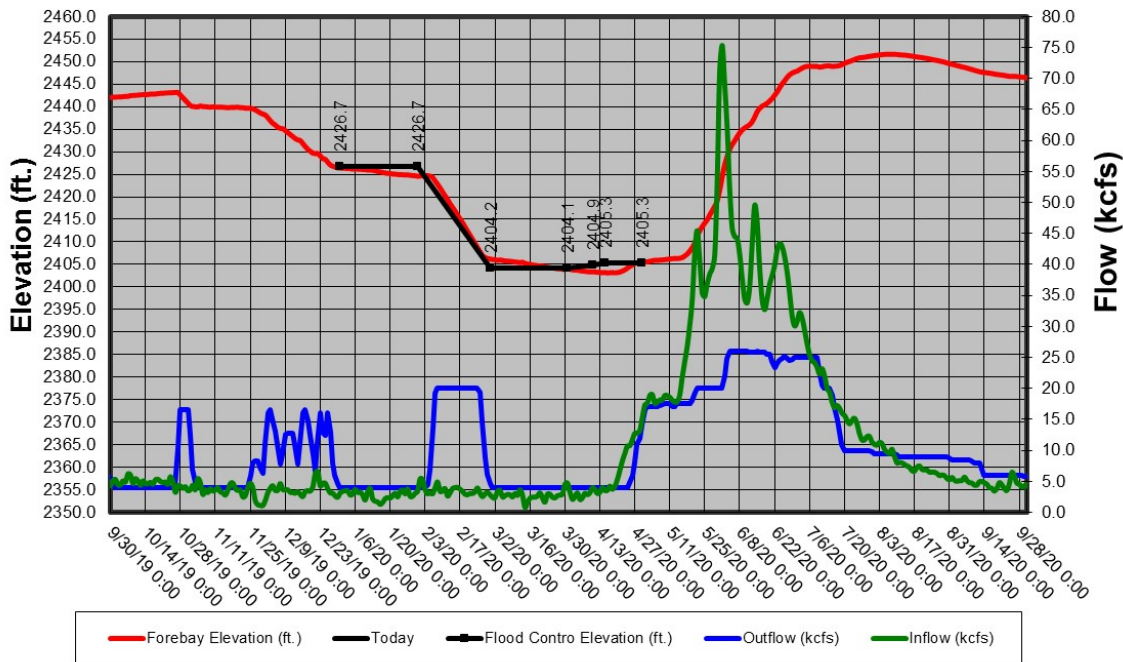
The sturgeon pulse began on 21 May. This was a Tier 2 year with an associated sturgeon volume of 0.92 MAF. The outflows were set to 20,000 cfs at the beginning of the pulse operation. The long-term Libby outflow plan, as well as the sturgeon flow plan, were adjusted due to planned maintenance on the transformer that would require Units 3-5 to be taken offline beginning on 20 July. To manage refill in anticipation of this work, flows were kept at powerhouse capacity from 3 June until 11 July when outflows were decreased to 20,000 cfs. Beginning on 15 July, outflows were stepped down to reach 10,000 cfs on 19 July. The sturgeon volume was expended on 14 June.

Summer Draft Limit: The AAs will coordinate with TMT on the actual operation to reach the 2019 BiOp September 30 elevation of either 2439 or 2449 feet based on water supply.

The operation at Libby Dam from 20 July through 30 September was to maintain outflow in the 9,000-10,000 cfs range through the end of August and to reach an end of September elevation

within 3 feet of the 2449.0 feet target, as coordinated with the Technical Management Team on the 17 June 2020 conference call. On 9 August 2020, Lake Koocanusa reached its maximum elevation for the year of 2451.7 feet MSL. Libby releases gradually stepped down across August and September to maintain the end of September lake elevation above 2446.0 feet. Observed end of September elevation was 2446.49 ft.

WY20 Libby Operations



Hungry Horse Dam

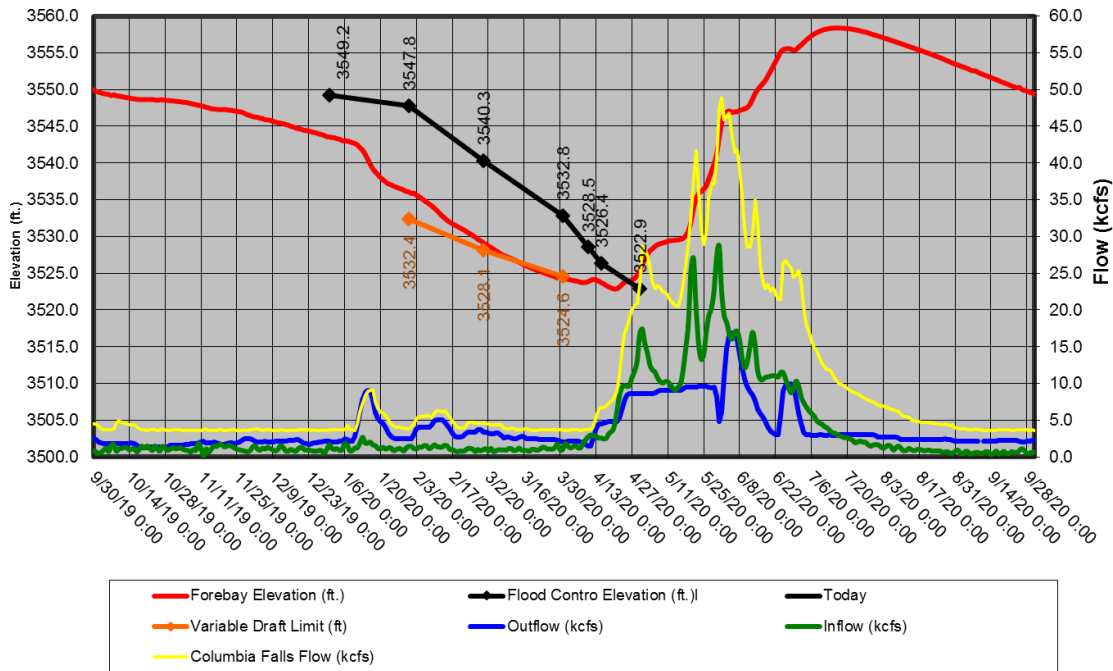
Water Supply Forecast and Minimum Flows: The minimum flow requirements are measured at two locations in the South Fork Flathead River below Hungry Horse Dam and the Flathead River at Columbia Falls. The minimum flows will be determined monthly, beginning in January, with the Bureau of Reclamation’s WSF forecast for Hungry Horse Reservoir for the period of April 1 to August 31. The final flow levels for the remainder of the calendar year are based on the March Final forecast.

April 10 and June 30 Refill Objectives: The Bureau of Reclamation computes Hungry Horse’s final April 10 elevation objective by linear interpolation between the March 31 and April 15 forecasted flood control elevations based on the March Final WSF.

Summer Draft Limit: The summer reservoir draft limit at Hungry Horse is 3550 feet (10 feet from full) by September 30, except in the lowest 20th percentile of water years (The Dalles April-

August < 72.2 MAF) when the draft limit is elevation 3540 feet (20 feet from full) by September 30. The RFC’s May Final April-August forecast is used to set the official draft limit.

WY20 Hungry Horse Operations



Grand Coulee Dam

April 10 and June 30 refill Objective: The Bureau of Reclamation computes Grand Coulee’s final April 10 elevation objective by linear interpolation between the March 31 and April 15 forecasted flood control elevations based on the March Final WSF for The Dalles.

The Lake Roosevelt Incremental Storage Release Program:

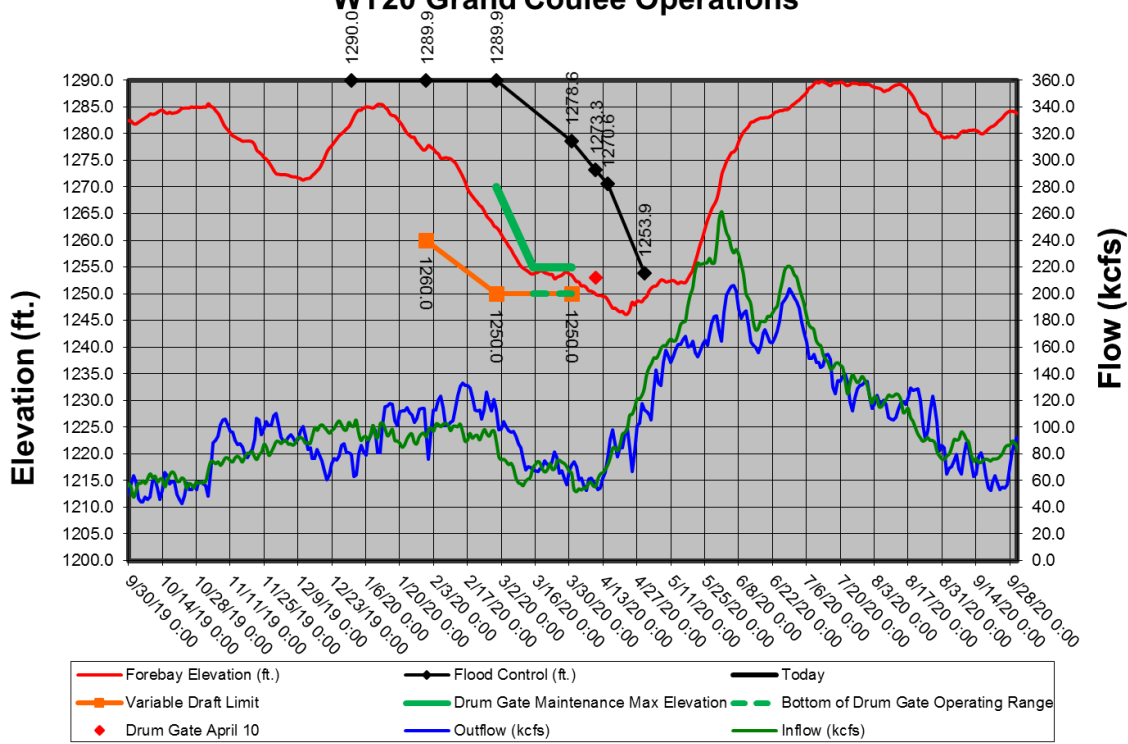
Table 8. Lake Roosevelt releases requested for 2020.

“Bucket”	2020 Releases (acre-feet)	Total Lake Roosevelt Incremental Storage Releases Program (acre-feet)
Odessa		
M&I		
Instream Flow		

Summer Draft Limit: The Grand Coulee summer draft limit is set by the magnitude of the RFC's July Final April-August WSF at The Dalles Dam.

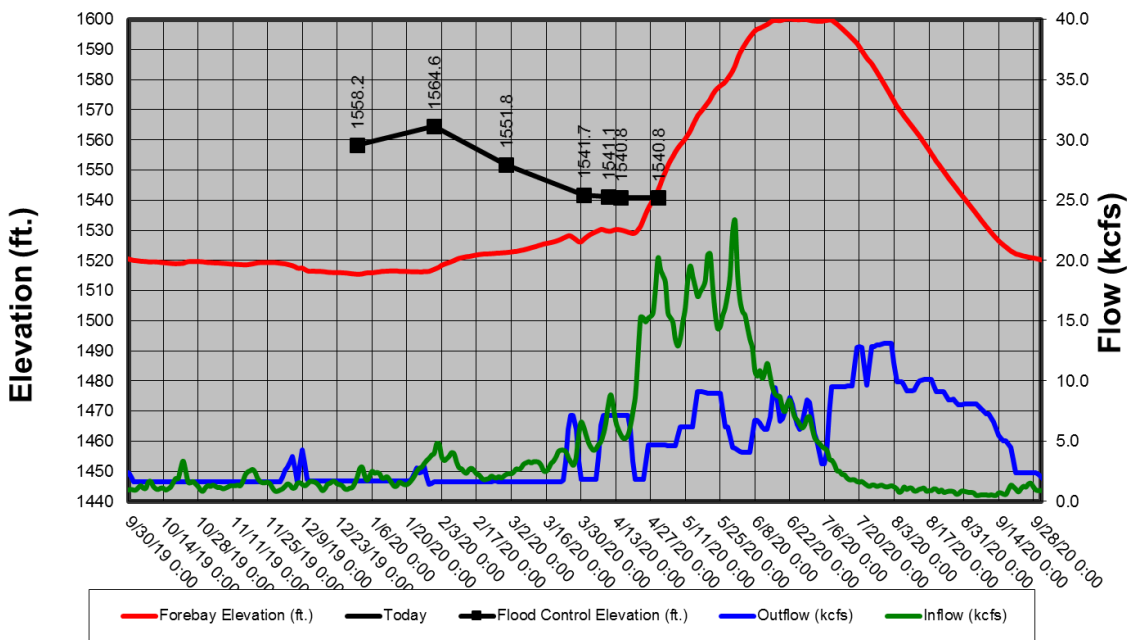
Drum Gate Maintenance: The April 30 FRM elevation for Grand Coulee based on the February Final WSF is 1233.0 feet. This is below the trigger of 1265 feet. Drum gate maintenance is now scheduled for 2020. The reservoir must be no higher than elevation 1255 feet from March 15 to May 15.

WY20 Grand Coulee Operations



Dworshak Dam

Dworshak Operations



2.5. Water Quality

The AAs have coordinated the following spill priority lists with the TMT to date, and they may be found on the following website.

<http://pweb.crohms.org/tmt/documents/spill-priority/>

2.6. Burbot Spawning Flows (Libby Dam)

Under the terms of a Memorandum of Understanding (MOU) prepared in 2005 by the Kootenai Valley Resource Initiative (KVRI) and signed by the Corps, the selective withdrawal gate system at Libby Dam was set to release the coldest water available in the forebay starting in late September, before reservoir isothermy prevents temperature control capability. The purpose of this operation is to provide river temperatures that are closer to normative thermal conditions to optimize spawning conditions for burbot in the Bonners Ferry reach of the Kootenai River.

2.7. Lake Pend Oreille Kokanee Spawning Elevation (Albeni Falls Dam)

Regarding the 2019-2020 operation the the AAs implemented an MCE of 2051 feet (operating range of 2051-2052 feet) to facilitate IDFG habitat restoration work on the Clark Fork River Delta, near Clark Fork, Idaho.

2.8. Upper Snake Flow Augmentation

This section will be updated throughout the season as new information becomes available.

2.9. Chum Operation

Date	TMT Coordination Summary
October 23, 2019	The TMT coordinated a tentative chum operation to start no sooner than November 4. The date was selected based on the lack of precipitation in the 10-day NWRFC forecast and there have been no chum observed to date in the Ives/Pierce Island Complex.

Date	TMT Coordination Summary
October 30, 2019	<p>The TMT coordinated to begin the chum operation on Tuesday, November 4, at 0600 hours, as described below. Precipitation for the month of October is below average and forecasts indicate below average precipitation for at least the next 10 days. The long-term climate forecasts indicate the same. No surveys have been conducted since October 22 due to windy conditions. Approximately 6 chum have been counted passing Bonneville Dam (count and survey data unavailable due to technical difficulties with the FPC website).</p> <p>BPA, reported observations from a site visit yesterday. The springs are flowing and there is enough water for chum to access Hamilton Creek. Some Chinook and two chum were observed in Hamilton Creek. Due to the ongoing dry conditions, there is not enough water in the aquifer to provide the hyporheic flows in the gravel that chum key in on for spawning. With the forecast for continuing dry conditions, it's likely Hamilton Creek flows will diminish and prevent access at some point.</p> <p>As part of the coordinated operation, the AAs agreed to make best efforts to maintain the Bonneville tailwater below 11.0 feet during all hours as a soft constraint until the chum operation begins on November 4. The intent of this operation is to minimize spawning at higher elevations that could occur with fluctuating tailwater elevations.</p> <p>The operation coordinated to begin November 4 at 0600 is as follows:</p> <ol style="list-style-type: none"> 1) Maintain the Bonneville tailwater in the range of 11.3–13.0 ft during all hours, with subsequent steps to pass increasing levels of flow; 2) If necessary to increase project outflow, the tailwater may be increased up to 16.5 feet during nighttime hours (1700-0600), with the highest elevations concentrated around midnight; 3) Then, if necessary to increase project outflow, the tailwater may be increased up to 18.5 feet during nighttime hours (1700-0600), with highest elevations concentrated around midnight; 4) If increasing inflows preclude the ability to manage the tailwater within the steps above, the tailwater may be operated in the range of 13.0-16.5 feet during daytime hours (0600-1700) and up to the maximum within project ramp rate limits during nighttime hours (1700-0600).

Date	TMT Coordination Summary
November 6, 2019	<p>The Corps, began by reminding the group that the summary of the 2019 chum operation, coordinated at the October 30th TMT meeting is posted on the TMT website. Bonneville Dam project tailwater elevation at 0100 hours was 11.3 feet. Yesterday, the tailwater ranged from a minimum of 11.3 to a maximum of 11.8 feet, averaging at 11.5 feet, with an average total outflow of 132 kcfs. The Corps noted that when the chum operation started on November 6 at 0600 hours, Bonneville tailwater elevation was 11.4 feet, which was within the coordinated range of 11.3 – 13 feet. BPA, suggested that in future years TMT coordinate a 6-hour window for the operation start time, to allow for water travel time. Inflow forecasts at Bonneville Dam reflect more of the same patterns of low to no precipitation in the Lower Columbia River Basin. The NWRFC 5 and 10 day forecasted precipitation summary shows the continued pattern of 25% or less and 25-50% of forecasted precipitation throughout the Columbia Basin observed since the October 23 TMT meeting. Today’s precipitation summary with 10-days QPF forecasts 25% or less than average precipitation throughout the Columbia Basin with the exception of some localized above average forecasted precipitation in Northwestern Montana. The 5-day outlook shows predominantly 25%-50% of average forecasted precipitation throughout the Columbia Basin. The 8-10 day, as well as the 14-day, outlooks show above average temperatures and below average precipitation. The 30-day outlook shows predominantly above average temperatures with an equal chance of above or below average precipitation. BOR, reported that Grand Coulee Dam is drafting at 0.5-feet per day for chum operations. Currently project forebay elevation is at 1,284.6 feet. In response to the precipitation and inflow forecasts, the project anticipates a significant draft to protect the minimum elevation of 11.3 feet for chum. It is anticipated that maintaining the current operation through end of month will result in a project elevation of 1,271 feet by the end of November. BOR suggested that the TMT check-in on potential impacts on drafting below 1,275 feet and probability of meeting the April 10 elevation target next spring. BPA, noted that high-pressure systems and east winds will also have an impact on Grand Coulee.</p> <p>WA, reported that decisions are best made on a week-by-week basis, as only roughly 3-5 chum have been counted in the Ives Island area and survey results from this week have not been posted yet. WA noted that Washington would prefer to maintain the minimum of 11.3 feet and remain as close as possible to that moving forward. Counts in the Ives area as of last Friday were no chum, 758 Chinook, and 45 Coho.</p> <p>After deliberating, Salmon Managers decided to schedule a FPAC call to continue the conversation and to review additional survey results for a more accurate chum count.</p> <p>→ ACTION: FPAC will check-in on Thursday, November 7 at 4:00 PM to review additional survey results for chum counts, and determine whether they recommend a change in current operations.</p> <p>→ ACTION: A TMT call will be scheduled for Friday, November 8 at 9:00 AM to discuss FPAC results. The Corps will notify the TMT if this meeting is cancelled. Until then, the operation will continue as coordinated at TMT on October 30.</p>

Date	Chum Water Management Summary
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Date	Chum Water Management Summary
November 20, 2019	<p>The Corps, began by reminding the group that the summary of the 2019 chum operation, coordinated at the October 30 TMT meeting, is posted on the TMT website. Current chum operations seek to maintain a Bonneville tailwater elevation range between 11.3 – 13.0 feet. BPA, clarified that the threshold numbers noted in each stage of the chum operation stem from research done in the Ives Island area on chum spawning elevations and habitat.</p> <p>Bonneville Dam project tailwater elevation (Tanner Creek gauge) at 0700 hours on November 20 was 11.5 feet. Yesterday, the tailwater ranged from a minimum of 11.4 feet to a maximum of 11.6 feet, averaging at 11.5 feet.</p> <p>The NWRFC reported dry conditions for the current month and season, with cold temperatures in October. There was precipitation over the weekend in British Columbia, but warm temperatures make snow accumulation unlikely. Moving forward, it looks like the pattern is changing, with a few dry days early on in the next 10-day period and with precipitation moving in towards the latter part of the 10-day period. BPA noted that the range in forecasted inflow volumes is significant, and although they are lower than normal, the NWRFC suggested flows could be above normal in the spring. According to today's NWRFC The Dalles Dam Official Water Supply Forecast for April through August (10-day QPF) is 91% of average, while the Experimental Water Supply (15-day QPF) is 92%, and the ESP Reference (0-days QPF) is below 95%. Coming off of a weak El Niño year, the current state is neutral, although some model outcomes show a 20% chance for El Niño developing. Runoff at The Dalles is neutral, ranging from -.5 to .5 (currently at 1.0), showing a trend between climate signal and runoff. The current Oceanic Niño Index (ONI) is about 10% below normal for The Dalles.</p> <p>Grand Coulee Dam has record level forebay elevations well below the 10% mark, and if dry trends continue, the project might have to make some hard decisions regarding chum operations. Hanford Reach is expected to maintain minimum flows. BOR, noted the project elevation is about 5 feet below normal for this time of year.</p> <p>NOAA, reported chum counts from November 12, with 46 live chum, 2 dead and 8 redds in the Ives/Pierce Island complex. During an 11/18/19 site visit, BPA, observed good connectivity into Hamilton Creek and noted that spawning habitat looked good. WA, expressed the State's desire to ensure that chum have good access to spawning grounds now, given that there may be a chance that there may be a need to increase flows in the future. NOAA also wants to be sure connectivity is good for chum to access the tributaries. NOAA plans to visit the site Monday and will share an update with the TMT. Additionally, NOAA noted more chum are passing over Bonneville than usual, with 231 YTD; NOAA would like to revisit chum operations lessons learned at a future TMT process meeting (targeting for early January).</p>

Date	Chum Water Management Summary
December 4, 2019	<p>The Corps, began by reminding the group that the 2019 chum operation is posted on the TMT website. Currently, Bonneville tailwater elevation is being managed between 11.3 and 13.0 feet. Bonneville Dam project tailwater elevation as of December 4, at 0600 hours, was 11.9 feet. Project elevation has generally been on the low side, averaging yesterday at 11.96 feet.</p> <p>The NWRFC forecast shows inflows of 120-135 kcfs at Bonneville over the next 10-day period. Looking ahead at the end of the 10-day, the precipitation forecast shows some improvements, with 125-150% of average precipitation in the Cascades and Eastern Columbia River Basin, and 90-110% of average in the Lower Columbia River Basin. The 5-day QPF forecasts below average precipitation (less than 25-50% of average); however, there are some areas in the Upper Snake that are expecting precipitation in the range of 125-150% of average.</p> <p>The NWRFC 6-10 day climate outlook shows generally normal precipitation conditions throughout the basin, with above average temperatures in the western Columbia River Basin, near normal in the southern portion, and below average in the eastern portion. The 30-day outlook shows a probability of above average temperatures and precipitation throughout the basin.</p> <p>The Corps highlighted the current month summary graphics that show November 1 to December 3 precipitation has been below 50% of normal throughout the entire basin and temperatures of 1-6 degrees F above normal. The western Cascades have been the exception, with temperatures below average. The months of October and November were dry. The Snake River above Ice Harbor Dam got .66 inches of precipitation (25% of normal) in November; the Columbia River above The Dalles Dam got 1.12 inches (33% of normal).</p> <p>The BOR, reported that at the end of November, Grand Coulee Dam forebay elevation was at 1,274.4 feet, below the target of 1,275 feet. The project continues to limit power operations to meet the April 10 target. The BOR noted that this is one of the lowest pool elevations going back to 1950 for this time of year. The project will maintain an elevation of 1,272 feet for another week or so, while working to stay above 1,270 feet by the end of the month. If precipitation forecasts for the next 10-day period don't hold up, elevations could get as low as 1,265 feet. Reclamation recommends that it is still too early to abandon chum given the current reported numbers, however, expressed concern around April 10 targets.</p> <p>NOAA, provided updated spawning numbers from Washington as of November 26; 543 live, 18 dead, 135 redds, with numbers increasing nightly. At the Ives/Pierce Island complex, Chinook counts are up as well. NOAA was able to visit the Ives Island and Hamilton Creek spawning channels to observe effects of the low precipitation, especially on flows in Hamilton Creek. The springs are still providing sufficient water for spawning in the constructed channels, but a hydraulic log-stop below the adult trap is creating a barrier preventing fish from moving through the trap into the channels. NOAA is working with the field crews to improve flows over the log to allow access to the spawning channels. The field crew has begun placing sand bags to consolidate the flow, which has helped, but there isn't good depth to allow the fish enough velocity to get up and over the log. Another idea proposed was to place a ramp for fish to get up, and NOAA is waiting on an update on this. Chum operations look good, with steady flows below Bonneville, and good spawning in the Ives area. NOAA and BPA, will share photos of these operations at the upcoming YER.</p>

Date	Chum Water Management Summary
December 18, 2019	<p>The Corps reminded the group that the 2019 chum operation coordinated on October 30 is posted on the TMT website. The Corps noted that operations have stayed within the first step (11.3-13.0 feet) for the entire operation to date. At 0700 hours, Bonneville Dam project tailwater elevation was 11.6 feet, with outflows of 134.4 kcfs.</p> <p>The 10-day inflow forecast shows an increase of flows to 140 kcfs over the next 3 days, which will decrease back down to 125 kcfs. The Corps noted that precipitation for October and November were way below average for the water year, and the NWRFC shows seasonal precipitation below 50% for the entire basin. Temperatures are above normal throughout the Columbia River Basin.</p> <p>The water year (October 1 through December 17) precipitation as measured at the Snake River Basin above Ice Harbor Dam observed 3.1 inches, which is well below normal. The water year precipitation as measured at the Columbia River mainstem above The Dalles observed 4 inches, and western Oregon in the Willamette Basin above Portland observed 7.8 inches, or 36% of normal. Precipitation for the month of December shows improvement: seeing areas 130% of normal precipitation in the southern and northern parts of the basin.</p> <p>The 10-day precipitation forecast shows heavy precipitation, about 150-175% of normal in the NW Columbia basin. The 5-day precipitation forecast is 150-175% of normal, with more than 3 inches of precipitation in the Cascades. This will likely cause an increase in tailwater elevation at Bonneville Dam due to flow increases throughout the Willamette.</p> <p>The NWRFC 6-10 day climate outlook shows a probability of below average temperatures in the western part of the basin, near normal in the central, and a probability of above average in the east. There should be a significant drop in snow level later in the period, so precipitation could fall in form of snow, and further precipitation in Canada will help local snowpack.</p> <p>NOAA, provided yesterday's spawning numbers from the Ives area; 72 live, 12 dead, 37 redds and 75 Chinook. Washington recommended an end date of chum operations for December 24, as spawning has been observed to be winding down. BPA concurred and noted the tailwater elevation of 11.3 feet would be maintained, allowing for continued spawning, however, 11.3ft minimum tail water elevation would be the only operational constraint. NOAA supported Washington's recommendation, pending any additional reports from the field of spawning at higher elevations.</p> <p>New counts next week will depend on weather conditions and visibility. Salmon Managers expressed a desire for more discussion if spawning at higher elevations is indeed observed with higher tailwater levels. BPA clarified, as there are no further TMT meetings scheduled until after the holidays and as spawning winds down, setting a date to shift to the incubation phase is necessary. BPA explained that December 24th was chosen based on past chum spawning behavior, forecasted dry conditions, and work schedules. BPA also thought that if spawning is observed at the 12-foot level, those fish will be supported with up-welling ground water.</p> <p>WDFW, noted that Washington was comfortable with the proposed operation to shift to incubation phase on December 24th and will keep in touch with survey crews onsite for further data counts. OR, noted apprehension of ending the chum spawning phase of the operation prior to knowing more about adult use of Ives Island area.</p> <p>→ ACTION: WA and NOAA will reach out to the Corps and BPA if further discussions need to be scheduled regarding the timing of shifting to the chum incubation operation.</p> <p>NOAA reported that this has been a good chum year for adults counted passing over Bonneville Dam. NOAA noted a strange data point on Coho, and that the FPC is looking into the issue. Additionally, NOAA added that the DART website is having a lag in data uploads, so suggested people double check that the data posted are current.</p>

Date	Chum Water Management Summary
January 8, 2020	The Corps reported that the chum incubation operation that was coordinated at the December 18th TMT meeting is still being implemented. Briefly, the operation calls for a Bonneville tailwater minimum elevation of 11.3ft at all times. Additional details of the operation are available on the TMT website. This morning at 0700 hours the tailwater was 12.7ft, with 132.6kcfs outflow. NOAA, reported that co-managers coordinated over the holiday week and no additional actions were needed to support the end of the chum spawning operation. Chum are no longer being observed passing Bonneville; there are still some steelhead and Coho passing. NOAA noted that the high Coho counts over Bonneville in December have been verified.
January 22, 2020	The Corps, reported that the chum incubation operation that was coordinated at the December 18 TMT meeting is still being implemented. The operation calls for a Bonneville Dam minimum tailwater elevation of 11.3 feet at all hours. A detailed summary of the operation is available on the TMT website. The end of this operation is expected to coincide with the commencement of spring spill operations on April 10. This morning at 0700 hours the Bonneville total outflow was 159.3 kcfs, with a tailwater elevation of 14.4 feet. BPA, noted that they are not anticipating any issues maintaining the 11.3ft minimum tailwater elevation for the rest of the incubation operation.
February 19, 2020	The current Bonneville tailwater elevation at 0700 hours was 17.1 feet, with a total outflow of 218.8 kcfs. After a high of 200 kcfs today, the RFC inflow forecast gradually recedes to 170 kcfs by the end of the 10-day period. The Corps plans to continue the current tailwater operation for chum incubation through April 9; spring spill operations for juvenile fish passage start on April 10. NOAA, reported that chum incubation has been going well, and emergence is expected to start in late February/early March and continue until May.
March 18, 2020	In December, TMT coordinated an 11.3 ft. minimum tailwater at Bonneville Dam at all hours for chum incubation protection. Looking at the hourly data for today, the tailwater has ranged from 11.5 ft. to 11.8 ft. with an average of 11.6 ft. The 10-day inflow forecast calls for steady flows between 124 kcfs and 135 kcfs, which should help maintain that minimum tailwater elevation. BPA, noted that the draft for drum gate maintenance at Grand Coulee Dam was achieved, so releases from Grand Coulee are being managed to meet the chum minimum and April 10 objective. So last week the tailwater at Bonneville Dam has dropped to a range close to the chum incubation minimum (11.3 ft.). Drum gate maintenance at Grand Coulee is currently under way and is scheduled to be completed by May 8. Until natural stream flows increase in the lower river, the Action Agencies will continue to manage Grand Coulee's discharge to meet the chum tailwater minimum at Bonneville Dam through the end of chum protection, typically the first day of spill at Bonneville Dam, which is April 10.
March 25, 2020	The Corps reported that the TMT coordinated chum incubation operation is still being implemented (Bonneville Dam at a minimum tailwater elevation of 11.3 feet at all hours); the operation is posted to the TMT website. The current Bonneville tailwater elevation is fluctuating between 11.3-11.7 feet, averaging at 11.4 feet. The 10-day RFC inflow forecast shows a slight drop over the next week, to between 120-125 kcfs, with increasing flows up to about 155 kcfs around April 1.
April 1, 2020	In December, TMT coordinated an 11.3 ft. minimum tailwater at Bonneville Dam at all hours for chum incubation protection. Total outflow at 0400 was 134.9 kcfs and tailwater was 12.6 ft. Precipitation over the past few days has been evident in the hourly data with respect to discharge. Grand Coulee has been operating to meet the chum minimum but incremental discharges from unregulated streams below Grand Coulee and also the Willamette have increased the Bonneville tailwater. The forecast calls for inflows increasing to 140 kcfs on April 2, decreasing to 120 kcfs by the end of the 10-day period. The chum incubation operation will end when spill starts on April 10, unless otherwise recommended by NOAA. Fish managers will report back soon if that changes. There is a potential for a change, especially for the operation post-April 10. That decision will be made before next Wednesday, said the USFWS. BPA urged managers to report back as soon as possible so that Bonneville can plan for that operation.

Date	Chum Water Management Summary
April 8, 2020	The Corps reported that the TMT coordinated chum operation is still being implemented (operate the Bonneville Dam tailwater no lower than a minimum elevation of 11.3 feet at all hours); the operation is posted to the TMT website. The current project tailwater elevation at 0600 hours was 11.6 feet with a total outflow of 127.2 kcfs. The 10-day RFC inflow forecast ranges between 127-150 kcfs; with a low of 130 kcfs on April 9, peaking on April 13 at 150 kcfs, and back down to 140 kcfs by the end of the 10-day period. The USFWS, updated the TMT on SOR-2020; as posted on the TMT website. Salmon Managers discussed and agreed on a chum operation request for Bonneville Dam to hold a minimum tailwater elevation of 12.5 feet at all hours, from April 10-20 (a couple of extra hours have been added to ensure enough water is present when spill starts). This request is to mitigate for the impacts of spill and total dissolved gas during lower than average flows in the Lower Columbia by providing additional depth over redds at the Ives Island complex and in the mainstem. BPA, noted no issues with implementing the SOR, and the impact on Grand Coulee elevation is expected to be insignificant, as the Snake River will provide most of the flow. The BOR noted it's desire to not draft Grand Coulee below 1,240 feet. All TMT members present supported the SOR, and Action Agencies will move forward with implementation.
April 15, 2020	In December, TMT coordinated an 11.3 ft. minimum tailwater at Bonneville Dam at all hours for chum incubation. At the April 8 TMT, the Action Agencies agreed to implement SOR-2020-1. Effective, Thursday, April 9, at 2200 hours, through Monday, April 20 at 2359 hours, the Bonneville Dam tailwater elevation minimum will be 12.5 feet during all hours. This will be the last chum update for this year. Today, at 0500 the tailwater was tailwater 12.5 ft. The RFC 10-day inflow forecast calls for increasing inflows of 140 kcfs to 165 kcfs at the end of the 10-day period.

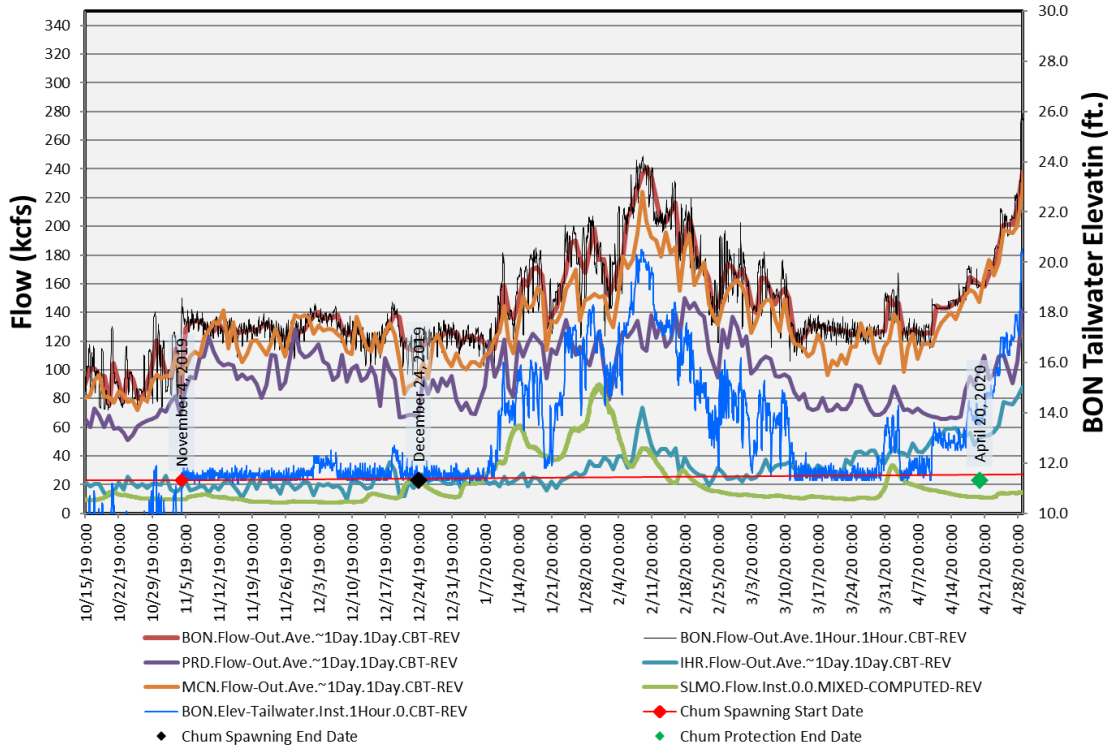
Dates	Chum Water Management Summary
November 4, 2019	Chum operation begins at 0600 November 4. Grand Coulee forebay was at ~1285 on in preparation for augmentation required to meet the chum tailwater. Conditions leading up to the chum operation have been very dry. Hamilton Creek and Springs had only just started running in last few days of October. The Corps STP forecasts showed Grand Coulee drafting to approximately elevation 1275 feet by the end of November to support the chum operation.
November 4-18, 2019	<p>Chum Operation begins November 4. Releases from Grand Coulee of ~90 are required to meet the chum tailwater minimum of 11.3 feet. Operating to 11.5 feet (buffer above min for uncertainty) requires ~130 kcfs day average flow at Bonneville Dam. The Willamette River is not contributing to the water surface with below average flow at Albany of 4-8 kcfs. Snake River flow has had ranged from 15-23 kcfs with an average of ~18 kcfs since the start of the chum operations. Grand Coulee was as high as elevation 1285.6 feet just prior to the start of the chum operation on November 3. Since the start of the chum operation Grand Coulee has been drafting approximately 0.5' per day to elevation 1278.5 on November 18.</p> <p>Chum are showing up in the Ives area but conditions have been too windy for the normal pace of monitoring. Hamilton Creek is still running thin but reports from the field are that there is still access to Hamilton Springs and some fish have entered the springs.</p> <p>The extremely dry pattern is forecasted to break down with waves of precip in the 0-5 day timeframe and again in the 10-14 day timeframe.</p>
November 18-30, 2019	Continued dry conditions. The forecasted precipitation and associated rise in streamflows came in much less than previously forecasted. Near term weather forecast show some precipitation in the 7-14 day timeframe but below average. The Water Supply Forecast (WSF) for The Dalles continued to slow drop. The project tailwater (Tanner Creek Gauge) has been held between 11.3 and ~11.8 since the start of the operation. Grand Coulee's draft to support chum had leveled off on some increases in natural streamflow but began a similar ~0.5' draft per day after the event passed. The flow in the Willamette River has been near historic lows for this time of year.

Dates	Chum Water Management Summary
December 1-7, 2019	<p>This week there was a 10 kcfs per day NTS release that was stopped after three days. This water was passed above that needed for chum starting Monday 12/2/2019 with BON TW up to 12.4 feet. After the release was halted the remaining water to be released over the remainder of the week and shaped out of BON with TW not exceeding 12.5 feet.</p>
December 8-18, 2019	<p>During this period the tailwater was held between 11.3 and 12.0. A brief and limited west side precipitation event added water to Hamilton Creek and gave the Willamette River a slight rise (from 8 kcfs to 13 kcfs). This bump in flow allowed GCL to start the recovery of the GCL forebay. The forebay was at ~1273 feet on the 12/18.</p> <p>At the end of this period a significant atmospheric river aimed for the NW was forecasted drop ~7 inches of rain over 3-5 day. This was forecasted to arrive on the 12/19. Early forecasts for the resulting Willamette River Flows were in the 90 kcfs range but forecasts updating as the storm approached continued to drop that forecast with the onus of the river aimed a little further North and combined with snow levels at ~5000 feet.</p> <p>The resulting drop in water needed to support the 11.3 TW is forecasted to allow GCL to recover to ~ 1278 feet.</p> <p>At TMT on Wednesday December 18 the end of the spawning phase of the chum operation was set to be December 24 with a protection elevation of 11.3 feet. TMT left discussed that if the impending storm allowed any redds to be built above 11.3 that they may want to revisit the protection elevation.</p>
December 19-27, 2019	<p>Just ahead of the forecasted atmospheric river event work upstream at LWG on the Spillway PIT array required an unplanned draft of LWG and LGS moving a slug of water downstream resulting in the BON TW exceeding 12.5 feet on a few hours across the first few days of this period.</p> <p>The spawning phase of the operation ended on December 24. The operation now is an 11.3 minimum TW at BON on all hours until ~April 10. Streamflow conditions and current water supply forecasts indicate that managing the river to remain close to the chum protection tailwater will likely be the plan for the week ahead. Short term single trace forecast run on the 12/27 showed GCL filling to ~1282 in January and finishing the month at ~1277. Current WSF compute the April 30 FRM elevation to be well above the drum gate trigger of elevation 1265 feet.</p> <p>The atmospheric river just missed Portland, Willamette Valley and the Gorge moving north a few miles. Astoria and Scappoose experienced significant precipitation demonstrating the high level of uncertainty with these types of events. The Willamette River was forecasted prior to the storm to peak at ~90 kcfs but came at ~25 kcfs.</p> <p>The increase in Willamette River flow reduced the amount of flow required at BON to meet the protection TW to ~120 kcfs. This reduction helped with recovering the forebay at Grand Coulee to 1279.5 feet. The most recent chum survey done on the 24th showed 18 live chum but were reported to all be older fish. Rick Heitz, indicated that spawning was complete and that no redds were observed above an 11.3 TW.</p>

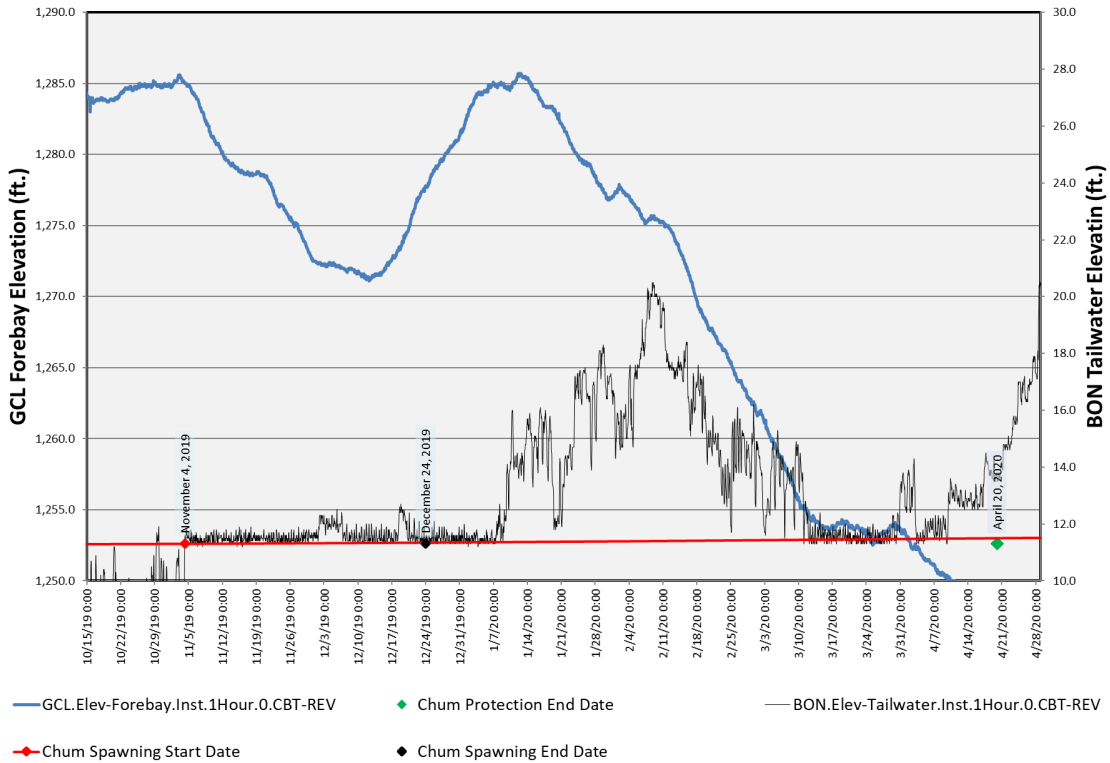
Dates	Chum Water Management Summary
December 28, 2019, - January 7, 2020	<p>The precipitation during this period increased over the very dry conditions to date but still less than typical. What did fall incrementally lowered the amount of water needed from storage.</p> <p>Outflow from BON during this period tracked the chum minimum closely with day average flow of ~122 kcfs. Grand Coulee outflow during this period average ~81 kcfs with inflow averaging ~103 kcfs. This allowed Grand Coulee to recover the full volume of water released to support the Tailwater November- December. The peak elevation of Grand Coulee's forebay just prior the start of the chum operation was 1285.5 feet. The forebay at midnight on January 7 was at elevation 1285.0 feet.</p> <p>On January 6 the official WSF for The Dalles came in 10 maf above the December forecast and just under the average at 86.9 MAF. The forecasted April 30 FRM elevation for Grand Coulee dropped significantly with this increase in WSF down to 1239.4 feet and the April 10 objective elevation at elevation 1260 feet. With the April 30 FRM elevation well below the 1265' trigger the likelihood of drum gate maintenance is now much higher. If drum gate maintenance is schedule (based on Feb final WSF) the April 10 objective elevation at Grand Coulee can be no higher than elevation 1253.0 feet.</p> <p>Official VDL's computed are 1260 for Jan, 1257.6 for Feb, and 1259.2 for March.</p> <p>The forecast for the next two weeks has significant precipitation that is expected to fall as snow across the US portion of the basin. Temperatures across the Columbia Basin are forecasted to be -6 to -25 degrees below average.</p> <p>Operations over the next two weeks will manage Grand Coulees forebay elevation for the uncertainty around the likelihood of drum gate maintenance. Additionally, the increase in WSF has provided more power flexibility January-March. As a result of Grand Coulee's will likely draft across the next few weeks to utilize the power flexibility which will result in the outflow at BON be higher than seen to date.</p>
January 7-31, 2020	<p>Precipitation across the basin increased significantly resulting in increased Willamette River flow and water supply forecasts. Grand Coulee's forebay was managed to begin the draft toward the drum gate elevation. Early in the month there was still relative uncertainty about with water supply conditions as it relates to the likelihood of hitting the drum gate maintenance trigger. In the last week of January water supply forecasts continued to increase to above average.</p> <p>The average flow at Bonneville dam increased across this period to 150-180 kcfs with associate TW elevations above 20 feet. The Willamette River peaked near the end of this period at close to 100 kcfs. The Snake River during this period increased to as high as ~40-50 kcfs.</p>
February 1 – March 15	<p>Precipitation was above average for the first week of February the tailed off with ~average precip with a below average week or two. The Willamette River receded across this period from a peak of ~90 kcfs down to 11 kcfs by the end of this period. The Snake also had a peak in early February at ~70 kcfs. Across this period the Snake receded and by the last two weeks of February and through mid-March Snake river flow ranged from 20 to 35 kcfs.</p> <p>Grand Coulee continued the draft the the drum gate elevation arriving at elevation 1254 by March 15. Inflow to Grand Coulee ranged from 80 to 105 kcfs across this period.</p> <p>The tailwater elevations below Bonneville Dam peaked at ~20 feet in early February and tailed off by mid March coincident with the completed draft at Grand Coulee. By March 15 the tailwater below Bonneville ran close to the minimum with a range of elevations from 11.3 to 11.8 feet.</p>

Dates	Chum Water Management Summary
March 15 – April 8	The Bonneville tailwater continued to stay close to the minimum until the end of the March when precipitation resulted in a bump in the Willamette and Snake River flow. Once this passed in the first few days of April operations resumed to manage the tailwater close to the minimum.
April 9-20	The implementation of the SOR increased Bonneville tailwater to 12.6 feet. During this period inflow to Grand Coulee increased from 60 kcfs to 90 kcfs. By April 17 the freshet was on the rise and the tailwater rose to over 14 feet. By April 20 the outflow at Bonneville was over 160 kcfs.

2019-2020 Bonneville Chum Operations



2019 - 2020 BON TW and GCL FB



Chum survey data gathered by WDFW at the Ives/Pierce Island Complex will be summarized in the table below. Data from all chum survey areas, including the Ives/Pierce Island Complex, are provided to the Fish Passage Center for posting online and available on the following website.

http://www.fpc.org/spawning/spawning_surveys.html

Table 9. Chum Data from Surveys of the Ives/Pierce Island Complex.

Date	Lives	Dead ⁱ	Redds ⁱⁱ	Visibility (feet)
September 16, 2019	0	0	0	3-4 ft.
September 23, 2019	0	0	0	6 ft.
September 30, 2019	0	0	0	6 ft.
October 3, 2019	0	0	0	6 ft.
October 8, 2019	0	0	0	6 ft.
October 10, 2019	0	0	0	8 ft.
October 16, 2019	0	0	0	7 ft.
October 22, 2019	0	0	0	6 ft.
November 1, 2019	0	0	0	5 ft.
November 5, 2019	4	0	0	6 ft.
November 7, 2019	-	0	-	5 ft.
November 12, 2019	46	2	8	5 ft.
November 14, 2019	-	0	-	6 ft.
November 18, 2019	-	0	-	6 ft.
November 19, 2019	164	30	52	4.5 ft.
November 21, 2019	-	18	-	6.5
November 25, 2019	-	0	-	4.5 ft.
November 16, 2019	543	124	135	7 ft.
December 2, 2019	-	0	-	5 ft.
December 3, 2019	436	13	87	6 ft.
December 10, 2019	225	15	108	5 ft.
December 13, 2019	-	7	-	6.5 ft.
December 17, 2019	72	12	37	4.5 ft.
December 23, 2019	19	6	26	6 ft.
December 30, 2019	8	10	12	5 ft.

i. Dead are newly sampled fish only.

ii. Redds are an instantaneous count for the day, not cumulative.

2.10. Vernita Bar/Hanford Reach Fall Chinook Protection Program Operations (Non-BiOp Action)

The Hanford Reach Fall Chinook Protection Agreement (Agreement) establishes the obligations of the Parties with respect to the protection of fall Chinook in the Hanford Reach of the Columbia River. The Parties agree that during the term of the Agreement these flow regimes address all issues in the Hanford Reach with respect to fall Chinook protection and the impact of operation of the seven dams operating under Mid-Columbia Hourly Coordination, including the obligations of Grant, Chelan, and Douglas under any new licenses issued by the Federal Energy Regulatory Commission (FERC).

Beginning in mid-October, under the terms of the Hanford Reach Fall Chinook Protection Program Agreement, river flows are reduced every Sunday morning (day of lowest power demand) to the Priest Rapids Dam minimum operating discharge of 36,000 cubic feet per second (ft³/s) [1000 cubic meters per second (m³/s)]. This allows the Agency and Utility Party Monitoring Team to manually survey for redd distribution at Vernita Bar just downstream of Priest Rapids Dam. These drawdowns occur every Sunday morning until the initiation of fall Chinook spawning has been set both above and below the 50,000 ft³/s (1,416 m³/s) flow elevations. A final drawdown is conducted on the Sunday prior to Thanksgiving to establish the minimum critical flow needed to protect pre-emergent fall Chinook. Given the previously described limitations, this weekly reduction in river flow affords the best viewing conditions for aerial flights. Aerial flights are therefore scheduled to be conducted concurrent with the Sunday morning drawdowns, when possible.

Date	Summary
October 1, 2019	<p>Operations to support the Hanford Reach Fall Chinook Protection Program began on October 15, 2019. Reverse Load Factoring began at 0000 hours on Tuesday, October 15, and will continue through the end of the Spawning Period. The Spawning Period is scheduled to end at 24:00 hours on November 24, 2019 (last Sunday prior to Thanksgiving), but may be extended if spawning activity is observed during the redd survey on that day.</p> <p>During Reverse Load Factoring, discharge from Priest Rapids Dam (as measured at the USGS gage) must target between 55 and 70 kcfs during daylight hours. The goal during the Spawning Period is to limit spawning to the area below the 70 kcfs elevation on Vernita Bar.</p> <p>Reduced daytime flows (38 kcfs) below Priest Rapids Dam on Sundays during the Spawning Period will be required to support redd counts on Vernita Bar. The first redd count will be conducted on Sunday, October 20. Specific details for operational support during Vernita Bar redd counts will be updated throughout the season and will be provided in individual flow requests.</p>
October 20, 2019	<p>On Sunday, October 20, 2019, representatives from Grant PUD and the Washington Department of Fish & Wildlife conducted the first 2019 Vernita Bar spawning ground survey. One redd was observed on Vernita Bar. Five redds are required for the Initiation of Spawning, therefore the date for the Initiation of Spawning has not been set. A second spawning ground survey will be conducted Sunday, October 27.</p>

Date	Summary
October 27, 2019	On Sunday, October 27, 2019, representatives from Grant PUD and WDFW conducted the second 2019 Vernita Bar spawning ground survey. A total of 17 redds were observed on Vernita Bar, all below the 50 kcfs elevation. Five redds are required above and below the 50 kcfs elevation to determine the Initiation of Spawning date for each zone, therefore the Initiation of Spawning date for the below 50 kcfs elevation has been set as October 23 (the Wednesday prior to the survey). A third spawning ground survey will be conducted Sunday, November 3, to count redds above the 50 kcfs elevation.
November 3, 2019	On Sunday, November 3, 2019 representatives from Grant PUD and the Washington Department of Fish & Wildlife conducted the third 2019 Vernita Bar spawning ground survey. This survey was to determine the Initiation of Spawning date above 50 kcfs. Only the area on the bar above 50 kcfs was surveyed. A total of 15 redds were observed above the 50 kcfs elevation (Table 1). Five redds are required above and below the 50 kcfs elevation to determine the Initiation of Spawning date for each zone, therefore the Initiation of Spawning date for the above 50 kcfs elevation has been set as October 30. The next survey will be on Sunday, November 24 to determine the Critical Elevation.
November 24, 2019	<p>On Sunday, November 24, 2019 representatives from Grant PUD and the Washington Department of Fish & Wildlife conducted the fourth 2019 Vernita Bar spawning ground survey. The intent of this week's survey was to determine the Critical Elevation for the 2019-2020 protection season and to determine if spawning had ended.</p> <p>The results from today's redd count is provided below in Table 1. Using these data the Critical Elevation for the 2019-2020 Protection Season is 65 kcfs. Based on observations during the survey it was determined that Spawning Period has ended today, November 24</p>
December 2, 2019	<p>On December 4, 2019 the Post-Hatch Protection Period for the below 50 kcfs zone will begin. During this period, the water level at Vernita Bar must be no less than 15 cm below the 50 kcfs elevation at all times and may be reduced below the Critical Elevation (65 kcfs) for up to 8 hours on weekdays and 12 hours on weekends with no two consecutive periods below the Critical Elevation.</p> <p>We are projecting that the Post-Hatch Protection Period for the above 50 kcfs zone will begin on December 16. When that occurs the water level at Vernita Bar must be no less than 15 cm below the Critical Elevation at all times.</p>
December 16, 2019	<p>On December 4, 2019 the Post-Hatch Protection Period for the below 50 kcfs zone will begin. During this period, the water level at Vernita Bar must be no less than 15 cm below the 50 kcfs elevation at all times and may be reduced below the Critical Elevation (65 kcfs) for up to 8 hours on weekdays and 12 hours on weekends with no two consecutive periods below the Critical Elevation.</p> <p>On December 16, 2019 the Post-Hatch Protection Period for the above 50 kcfs zone will begin. During this period the water level at Vernita Bar must be no less than 15 cm below the Critical Elevation at all times.</p>
February 4, 2020	We continue to be in the Post-Hatch Period for the above the 50 kcfs elevation zone. This Period requires no less than 15 cm below the Critical Elevation (65 kcfs) at all times. We are projecting that the Emergence and Rearing Periods will be begin on March 11, 2020. During the Emergence and Rearing Periods the minimum flow below Priest Rapids Dam will be the Critical Elevation (65 kcfs) and flow fluctuations will be constrained based on Wanapum inflow.

Date	Summary
March 9, 2020	We continue to be in the Post-Hatch Period for the above the 50 kcfs elevation zone. This Period requires no less than 15 cm below the Critical Elevation (65 kcfs) at all times. We are projecting that the Emergence and Rearing Periods will begin on March 10, 2020. During the Emergence and Rearing Periods the minimum flow below Priest Rapids Dam will be the Critical Elevation (65 kcfs) and flow fluctuations will be constrained based on Wanapum inflow.
March 31, 2020	We continue to be in the Emergence and Rearing Periods. This Period requires no less than the Critical Elevation (65 kcfs) at all times and flow fluctuation constraints from Priest Rapids Dam. We are projecting that the enhanced weekend minimum flow constraints (CJAD II) will begin on Saturday, April 18. The enhanced weekend constraints will continue for four consecutive weekends ending on Sunday, May 10. During the CJAD II weekends, the minimum flow below Priest Rapids Dam must be no less than the average of the daily hourly minimum from Monday through Thursday of the current week.
April 13, 2020	We continue to be in the Emergence and Rearing Periods. This Period requires no less than the Critical Elevation (65 kcfs) at all times and flow fluctuation constraints from Priest Rapids Dam. We are projecting that the enhanced weekend minimum flow constraints (CJAD II) will begin on Saturday, April 18. The enhanced weekend constraints will continue for four consecutive weekends ending on Sunday, May 10. During the CJAD II weekends, the minimum flow below Priest Rapids Dam must be no less than the average of the daily hourly minimum from Monday through Thursday of the current week.
April 30, 2020	We continue to be in the Emergence and Rearing Periods. This Period requires no less than the Critical Elevation (65 kcfs) at all times and flow fluctuation constraints from Priest Rapids Dam. We are projecting that the Emergence Period will end on May 6 and the Rearing Period will end on June 9. There remain two more weekends of enhanced weekend minimum flow constraints (CJAD II), ending on Sunday, May 10. During the CJAD II weekends, the minimum flow below Priest Rapids Dam must be no less than the average of the daily hourly minimum from Monday through Thursday of the current week.
May 5, 2020	We continue to be in the Emergence and Rearing Periods. These periods require no less than the Critical Elevation (65 kcfs) at all times and flow fluctuation constraints from Priest Rapids Dam. We are projecting that the Emergence Period will end on May 7 and the Rearing Period will end on June 9. There remain two more weekends of enhanced weekend minimum flow constraints (CJAD II), ending on Sunday, May 10. During the CJAD II weekends, the minimum flow below Priest Rapids Dam must be no less than the average of the daily hourly minimum from Monday through Thursday of the current week.
June 1, 2020	We continue to be in the Rearing Period. This period requires flow fluctuation constraints from Priest Rapids Dam based on inflow from Rock Island Dam. We are projecting that the Rearing Period will end on June 10.
June 10, 2020	We continue to be in the Rearing Period. This period requires flow fluctuation constraints from Priest Rapids Dam based on inflow from Rock Island Dam. We are projecting that the Rearing Period will end on June 11.

2.11. Snake River Zero Generation (Non-BiOp Action)

According to the Lower Snake projects' operating manuals, from December 1 through February 28, zero minimum project discharge is permitted on a limited basis. Under an agreement between the Corps of Engineers and the fishery agencies, zero river flow is allowed for water storage during low power demand periods (at night and on weekends) when there are few, if any, actively migrating anadromous fish present in the Snake River. Water stored under zero river flow conditions may maximize power production from the Columbia River Basin system, but

zero river flow operations are not recommended at Lower Snake projects when fish are actively migrating in the Snake River.

Salmon Managers submitted System Operations Request (SOR) 2005-22 Snake River Zero Nighttime and Weekend Flow, to the Action Agencies (AA) on December 6, 2005. The SOR may be found on the following website.

<http://pweb.crohms.org/tmt/sor/2005/2005-22.pdf>

In the SOR, the Salmon Managers provided the AAs with the following table to define the criteria of “... few, if any ...” prior to the implementation of the Zero Generation Operation.

The few migrating adult criterion trigger will be defined on a sliding scale outlined in the following table. The table applies to both “wild” and “total” categories of returning adult steelhead.

Run to date>#	Run to date≤#	Few criteria< #
0	30,000	10
30,000	60,000	20
60,000	100,000	35
100,000	150,000	50
150,000	200,000	65
200,000	250,000	80
250,000		100

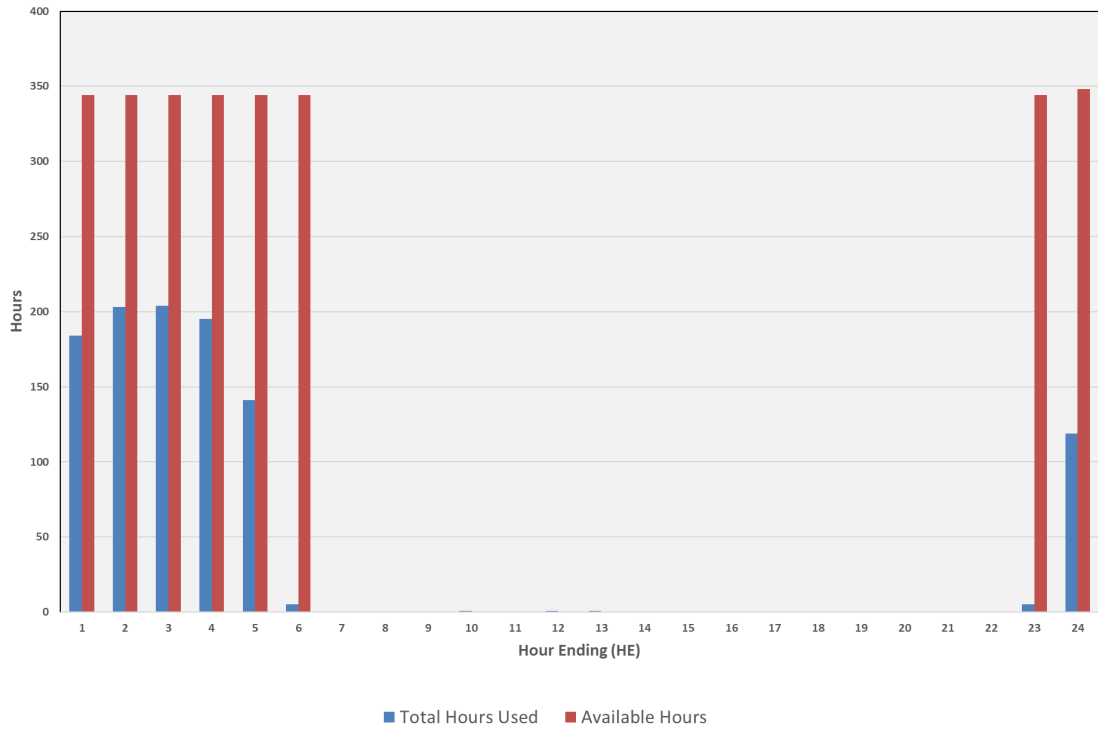
The AAs implemented the Snake River Zero Nighttime Generation Operation on the Lower Snake River during winter of 2019/2020 in coordination with the TMT.

December 4, 2019, TMT Meeting. BPA, reminded the group that the triggers for the Snake River zero generation criteria are less than 10 wild steelhead (less than 20 total steelhead on a rolling 3-day average). The trigger has still not been hit yet, but will most likely happen in the next couple of days as temperatures have dropped into the 42 degree F zone. NOAA Fisheries will notify Action Agencies via email once the trigger is hit, and report back to the TMT on results at the next meeting.

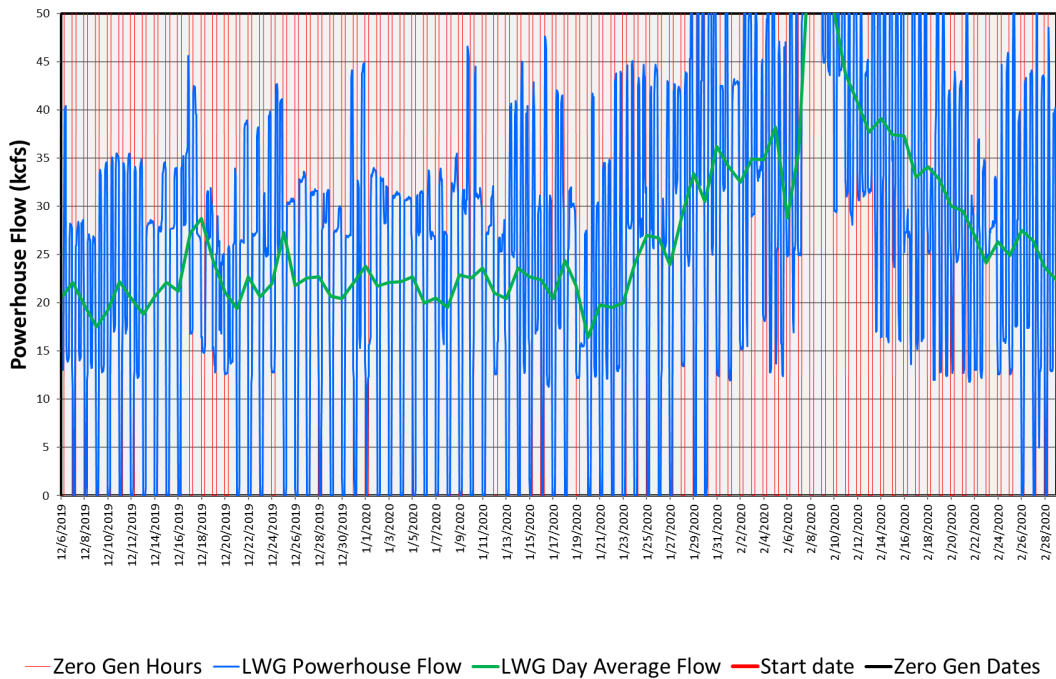
December 6, 2019, TMT Meeting. NOAA Fisheries provided the BPA and Corps with a memo indicating the the criteria had been achieved on December 5, 2019. Based on this memo the AA’s implemented the Snake River Zero Generation operation December 6, 2019, through February 29, 2020. This years Lower Granite Dam adult steelhead criteria (rolling 3-day average of less than 10 wild and less than 20 combined) was achieved on December 5, 2019, because the 3 day rolling average (12/2 to 12/4/19) wild steelhead passage was 5 and combined 16.

From December 6th through the end of February zero generation was utilized 59% of the days at Lower Granite Dam, 64% of the days at Little Goose Dam, 63% of the days at Lower Monumental Dam and 51% of the days at Ice Harbor Dam. The distribution of hours used was on average the first 4 hours of the day with significant usage in hour 5 and 24. Across the period 38% of the total available hours (2200-0600) were used for a total of 1056 hours.

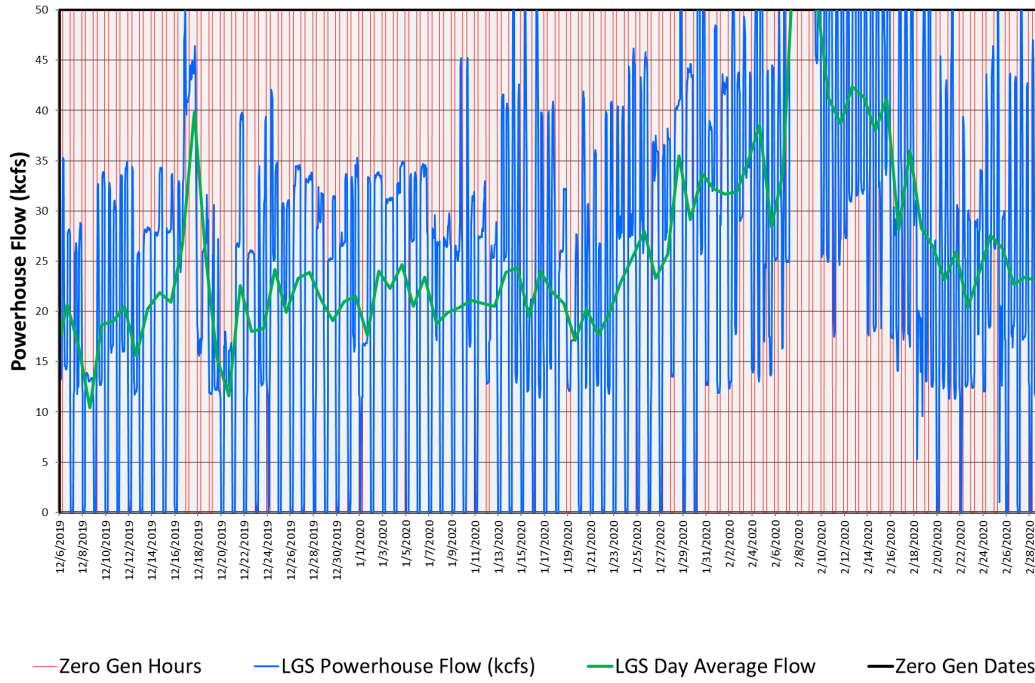
Hourly Distribution of Zero Generation Used between 12/7/2020 and 2/29/2020



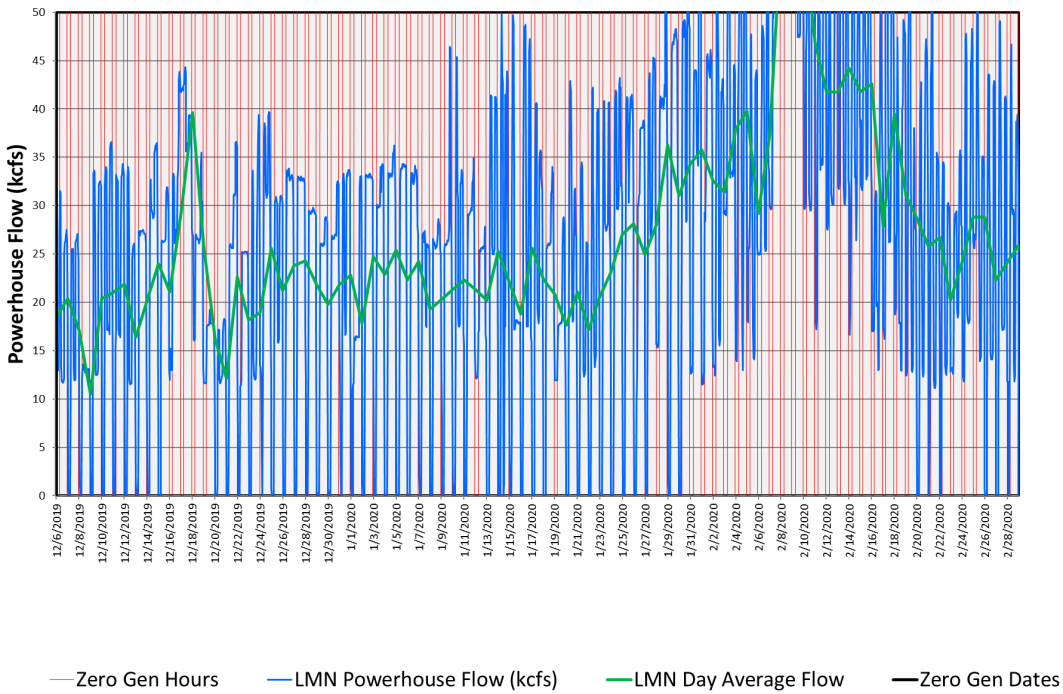
LWG Zero Gen Operations

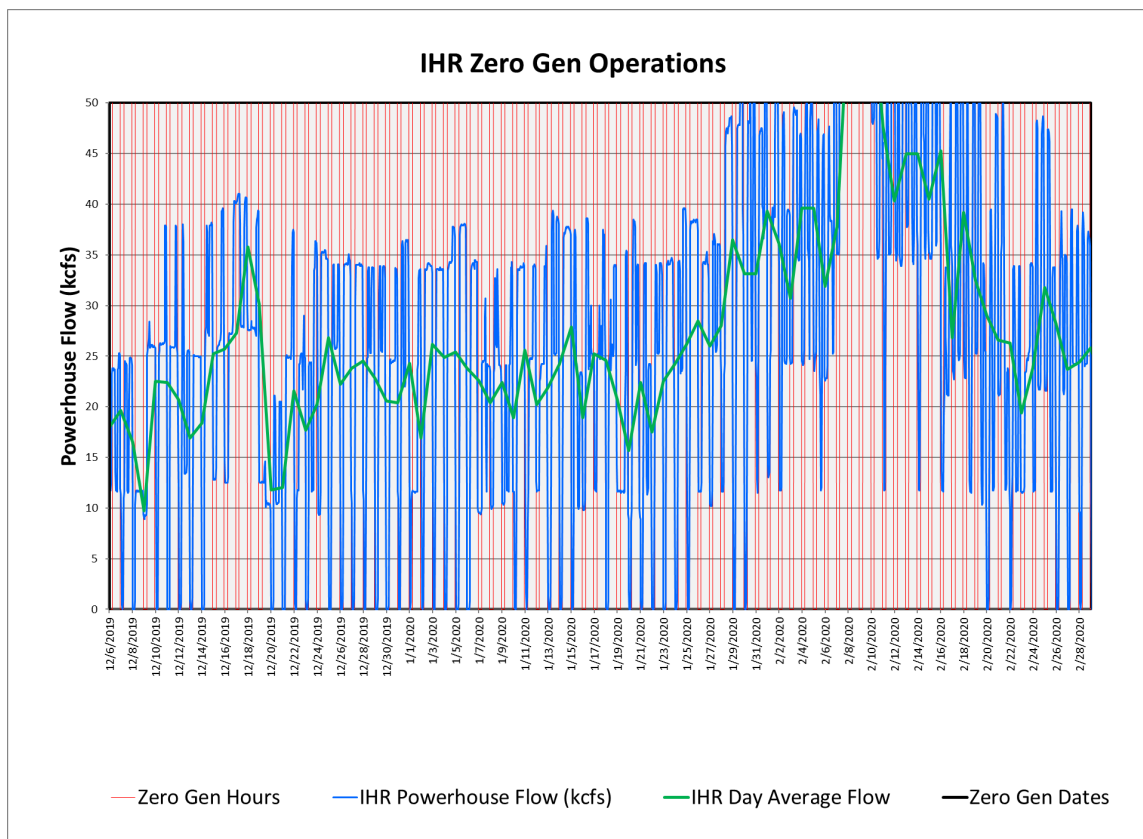


LGS Zero Gen Operations



LMN Zero Gen Operations





2.12. Minimum Operating Pool (MOP) – Lower Snake River Projects

The Spill Operation Agreement and the 2019 BiOp describe MOP at the lower Snake River projects as a 1.5-foot range above the minimum forebay elevation (Table 2). The term “MOP+1.5” was previously used in the 2019 BiOp to describe this operation that is intended to provide 1.0 foot of actual operational range with a 0.5 foot buffer. In order to clearly communicate the implementation of this operation, the term “MOP” will refer to the 1.5-foot operating range above the minimum forebay elevation at the lower Snake River projects (i.e., “MOP” is a 1.5-foot operating range).

Table 2.— Normal and minimum operating pool (MOP) elevation ranges for lower Snake River projects^A.

Project	Normal Operating Elevation Range (ft) ^B		MOP Elevation Range (ft) ^C	
	Minimum	Maximum	Minimum	Maximum
Lower Granite	733.0	738.0	733.0	734.5
Little Goose	633.0	638.0	633.0	634.5
Lower Monumental	537.0	540.0	537.0	538.5

Ice Harbor	437.0	440.0	437.0	438.5
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- A. MOP elevations provided in feet above mean sea level (NGVD29).
- B. September 1 – April 2.
- C. April 3 – August 31.

Additional information regarding MOP operations are described in the 2020 FOP (page FOP-15) on the following website.

http://pweb.crohms.org/tmt/documents/fpp/2020/final/FPP20_AppE_FOP.pdf

2.13. Minimum Irrigation Pool (MIP) – John Day Dam

From April 10 through September 30, John Day Dam will be operated to minimize water travel time for downstream-migrating juvenile salmon by operating the forebay within the 2.0-foot minimum irrigation pool (MIP) range of 262.5 to 264.5 feet, which is the lowest pool elevation range that allows irrigation withdrawals.

2.14. Spill for Juvenile Fish Passage

Table 3 below is a summary of the 2020 spring target spill levels at lower Snake River and lower Columbia River projects, as described in the 2020 Fish Operations Plan (2020 FOP). Additional information on spring spill operations may be found in the 2020 FOP on the following website.

http://pweb.crohms.org/tmt/documents/fpp/2020/final/FPP20_AppE_FOP.pdf

Table 3.— Summary of 2020 spring target spill levels at lower Snake River (April 3 – June 20) and lower Columbia River (April 10 – June 15) projects.

PROJECT	FLEX SPILL (16 hours per day)^{A, B, C, E}	PERFORMANCE STANDARD SPILL (8 hours per day)^{B, D, E}
Lower Granite ^E	125% Gas Cap	20 kcfs
Little Goose ^{F, G}	125% Gas Cap	30%
Lower Monumental	125% Gas Cap (uniform spill pattern)	30 kcfs (bulk spill pattern ^H)
Ice Harbor	125% Gas Cap	30%
McNary	125% Gas Cap	48%
John Day	120% TDG target	32%
The Dalles ^I	40%	40%
Bonneville ^J	125% Gas Cap	100 kcfs

A. Attempts should be made to minimize in-season changes to the proposed operations; however, if serious deleterious impacts are observed, existing adaptive management processes may be employed to help address serious issues that may arise in-season as a result of implementing these proposed spill operations.

B. Spill may be temporarily reduced at any project if necessary to ensure navigation safety or transmission reliability. In order to operate consistently with state water quality standards, spill may be also reduced if observed Gas Bubble Trauma (GBT) levels exceed those identified in state water quality standards (see WASH. ADMIN. CODE §173-201A-200(l)(f)).

C. 125% Gas Cap spill is spill to the maximum level that meets, but does not exceed, the TDG criteria allowed

under state laws. This includes a criterion for not exceeding 126% TDG for the average of the two greatest hourly values within a day.

D. The 8 hours of performance standard spill may occur with some flexibility (with the exception of Little Goose and Lower Granite operations described in the next key points). Other than at TDA, performance standard spill occurs in either a single 8-hour block or up to two separate blocks per calendar day. No more than 5 hours of performance standard spill may occur between sunset and sunrise, as defined in Fish Passage Plan (FPP) Table BON-5. Performance standard spill is not be implemented between 2200-0300 hours. No ponding above current MOP assumptions except as noted below.

E. Lower Granite Exception One - If adult passage delays are observed at Lower Granite Dam, the Corps may implement performance standard spill at Lower Granite Dam for at least 4 hours in the AM (beginning at 0500 hours). Implementation of this modification may also trigger in-season reevaluation of options to balance power principle.

F. Little Goose Exception One - As soon as practicable (and, in any event, no more than 24 hours) after a cumulative total of 25 adult spring Chinook salmon (not including jacks) pass Lower Monumental Dam, operate Little Goose spill at 30% spill for 8 consecutive am hours (April 3-15 start at 0500 hours; April 16-June 20 start at 0400 hours).

G. Little Goose Exception Two - During periods of involuntary spill, spill at 30% for 8 hours/day during the hours described in footnote F above and store additional inflows that exceed hydraulic capacity in the forebay above MOP if necessary. When it is necessary to pond water to achieve the lower spill levels due to high inflow, water stored above MOP should be drafted out over the remaining hours by increasing spill to pass inflow from 1200-1600 hours (or 1300-1700 hours from April 3-15), then increasing spill as necessary from 1600-0400 (or 1700-0500 hours from April 3-15) to draft the pool back to MOP. If it is forecast that the drafting spill will generate TDG levels in the tailrace in excess of 130% TDG, use all 16 hours to return the pool to MOP.

H. If the specified spill level at bulk pattern exceeds the gas cap, then spill pattern will be changed to uniform.

I. Fish passage spill at The Dalles should be limited to spillbays 1-8 unless river flow exceeds 350 kcfs, then spill outside the spillwall is permitted. TDG levels in The Dalles tailrace may fluctuate up to 125% TDG prior to reducing spill at upstream projects or reducing spill below 40% at The Dalles.

J. Fish passage spill at Bonneville Dam should not exceed 150 kcfs due to erosion concerns.

Table 4 below is a summary of the 2020 summer target spill levels at lower Snake River and lower Columbia River projects, as described in the 2020 FOP.

Table 4.— Summary of 2020 summer target spill levels at lower Snake River and lower Columbia River projects.

PROJECT	2020 SUMMER SPILL^A (June 21/16 – August 14) (24 hrs/day)	2020 SUMMER SPILL^A (August 15 – August 31) (24 hrs/day)
Lower Granite ^B	18 kcfs	SW flow or ~7 kcfs spill
Little Goose ^B	30%	SW flow or ~7 kcfs spill
Lower Monumental ^B	17 kcfs	SW flow or ~7 kcfs spill
Ice Harbor ^B	30%	SW flow or ~8.5 kcfs spill
McNary	57%	20 kcfs
John Day	35%	20 kcfs
The Dalles	40%	30%
Bonneville	95 kcfs	50 kcfs

A. Spill may be temporarily reduced below the FOP target summer spill level at any project if necessary to ensure navigation safety or transmission reliability, or to avoid exceeding State TDG standards.

B. Summer spill from August 15-August 31 may be through the SW or through conventional spillbays using the appropriate FPP spill pattern for each project. The SWs will be operated consistent with the SW operational criteria in the FPP.

2.15. Juvenile Transportation

As described in the 2020 FOP, transportation will be initiated at Lower Granite, Little Goose, and Lower Monumental dams on April 24 (collection starting on April 23) or as coordinated through the TMT and the RIOG, but begin no later than May 1. Barging of fish begins the following day after fish collection and collected juvenile fish will be transported from each facility on a daily or every-other-day basis (depending on the number of fish) throughout the migration season. Transportation of spring migrants ends on June 20. Truck transportation of summer migrants resumes on August 15 with allowance for TMT adaptive management adjustments and continues through September 30 at Lower Monumental and October 31 at Little Goose and Lower Granite.

2.16. Fish Passage Research in 2020

2.16.1. Bonneville Dam

2.16.1.1. There are no studies planned at Bonneville Dam in 2020.

2.16.2. The Dalles Dam

2.16.2.1. There are no studies planned at Bonneville Dam in 2020.

2.16.3. John Day Dam

2.16.3.1. There are no studies planned at John Day Dam in 2020.

2.16.4. McNary Dam

2.16.4.1. **Study of Adult Steelhead Fallback (Overshoots) through the Spillway Weir.**

Dates: Spring 2020 and Fall 2020.

Description:

In spring 2020, the objectives of this study are to:

- Estimate the seasonal duration of spring spill for steelhead overshoots;
- Estimate weekly timing and duration of spring spill for steelhead overshoots;
- Determine if spring spill at McNary Dam has unintended consequences for overwintering upstream stocks of steelhead.

In fall 2020, from September 15 until November 15, surface spill will occur via the spillway weir three times each week on non-consecutive days for four hours in the morning (between 05:00 and 11:00). The spill schedule will be designed to achieve the objectives of the steelhead overshoot study. This operation is pursuant to terms and conditions in the 2020 NOAA CRS BiOp.

Impacts to FPP Criteria: To be determined. Any modification to or deviation from FPP criteria will be coordinated with FPOM.

2.16.5. *Ice Harbor Dam*

2.16.5.1. There are no studies planned for Ice Harbor Dam in 2020.

2.16.6. *Lower Monumental Dam*

2.16.6.1. There are no studies planned for Lower Monumental Dam in 2020.

2.16.7. *Little Goose Dam*

2.16.7.1. No studies are planned at Little Goose Dam in 2020.

2.16.8. *Lower Granite Dam*

2.16.8.1. No studies are planned at Lower Granite Dam in 2020.