

# Seasonal Updates to the 2011 Water Management Plan

Updated May 13, 2011

## ***Introduction***

The Annual Water Management Plan (WMP) is developed prior to the implementation of operational measures identified in the BiOp. 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 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 on November 1<sup>st</sup> of each year. The first update for the primary elements of Spring and Summer will be posted by March 1<sup>st</sup> of each year.

## ***Seasonal Update Elements***

The elements included in the Season Update are generally the same as have been previously presented in the Fall/Winter and Spring/Summer Updates to the WMP. The change to present in this manner has been implemented to present better continuity for tracking operations as they change throughout and across each season. The elements included in the Seasonal Update and the approximate schedule for updates and finalization are as present in the table below.

<b>Update Elements</b>	<b>Last Updated</b>	<b>Begins</b>	<b>Finalized</b>
Current Conditions (WSF, Streamflows, etc...)	May 3, 2011	October	July
Seasonal Flow Objectives		April	August
Flood Control	Feb 22, 2011	January	June
Storage Project Operations	Nov 1, 2010	September	September
Water Quality (spill priority lists)	Dec 2, 2010	April	August 31
Specific Operations			
Chum Operations	May 2, 2011	November	April 18
Burbot	Nov 1, 2010	November	December 30
Upper Snake Flow Augmentation		April	August 31
Lake Pend Oreille		September	December 30
Transportation	May 2, 2011		
Spill Operations	May 2, 2011		
Fish Passage Research	May 2, 2011	March	April 3
Snake River Zero Generation	Dec 2, 2010	December	February
Hanford Reach Fall Chinook Protection Operations	May 2, 2011	November	June

## 1.0 Current Conditions

### NOAA River Forecasts:

The Dalles January-July (Average = 107.3 maf)

Date Issued	Forecast	Volume (maf)	% Normal
Dec 16, 2010	December Mid Month	111.0	103%
Dec 30, 2010	January Early Bird	103.0	96%
Jan 7, 2011	January Final	104.0	97%
Jan 20, 2011	January Mid-Month	108.0	101%
Jan 27, 2011	February Early Bird	108.0	101%
Feb 9, 2011	February Final	110.0	103%
Feb 17, 2011	February Mid-Month	108.0	101%
Feb 24, 2011	March Early Bird	108.0	101%
Mar 7, 2011	March Final	109.0	102%
Mar 17, 2011	March Mid- Month	112.0	104%
Mar 31, 2011	April Early Bird	115.0	107%
Apr 7, 2011	April Final	117.0	109%
Apr 21, 2011	April Mid-Month	127.0	118%
Apr 27, 2011	May Early Bird	128.0	119%

The Dalles April-August (Average = 93.1 maf)

Date Issued	Forecast	Volume (maf)	% Normal
Dec 16, 2010	December Mid Month	98.9	103%
Dec 30, 2010	January Early Bird	89.0	96%
Jan 7, 2011	January Final	90.6	87%
Jan 20, 2011	January Mid-Month	91.5	98%
Jan 27, 2011	February Early Bird	90.9	99%
Feb 9, 2011	February Final	92.5	99%
Feb 17, 2011	February Mid-Month	91.2	98%
Feb 24, 2011	March Early Bird	91.4	98%
Mar 7, 2011	March Final	92.3	99%
Mar 17, 2011	March Mid- Month	97.3	105%
Mar 31, 2011	April Early Bird	99.9	107%
Apr 7, 2011	April Final	101.0	108%
Apr 21, 2011	April Mid-Month	112.0	120%
Apr 27, 2011	May Early Bird	113.0	121%

The Grand Coulee January-July (Average = 62.9 maf)

Date Issued	Forecast	Volume (maf)	% Normal
Dec 16, 2010	December Mid Month	64.1	102%
Dec 30, 2010	January Early Bird	58.9	94%
Jan 7, 2011	January Final	59.0	94%
Jan 20, 2011	January Mid-Month	61.7	98%
Jan 27, 2011	February Early Bird	61.9	98%
Feb 9, 2011	February Final	65.2	104%
Feb 17, 2011	February Mid-Month	65.5	104%
Feb 24, 2011	March Early Bird	65.3	104%
Mar 7, 2011	March Final	65.6	104%
Mar 17, 2011	March Mid- Month	67.6	107%
Mar 31, 2011	April Early Bird	68.5	109%
Apr 7, 2011	April Final	68.2	108%
Apr 21, 2011	April Mid-Month	74.1	118%
Apr 27, 2011	May Early Bird	74.7	119%

Lower Granite April-July (Average = 21.6 maf)

Date Issued	Forecast	Volume (maf)	% Normal
Dec 16, 2010	December Mid Month	23.5	109%
Dec 30, 2010	January Early Bird	22.7	105%
Jan 7, 2011	January Final	23.7	110%
Jan 20, 2011	January Mid-Month	23.5	109%
Jan 27, 2011	February Early Bird	23.0	107%
Feb 9, 2011	February Final	22.2	103%
Feb 17, 2011	February Mid-Month	21.0	97%
Feb 24, 2011	March Early Bird	21.6	100%
Mar 7, 2011	March Final	21.6	100%
Mar 17, 2011	March Mid- Month	22.5	104%
Mar 31, 2011	April Early Bird	24.5	114%
Apr 7, 2011	April Final	25.1	116%
Apr 21, 2011	April Mid-Month	27.7	129%
Apr 27, 2011	May Early Bird	27.9	129%

NOAA link to their water supply forecasts:

[http://www.nwrhc.noaa.gov/water\\_supply/ws\\_fcst.cgi](http://www.nwrhc.noaa.gov/water_supply/ws_fcst.cgi)

**Corps Forecasts:**

**Libby April-August** (new equation)

<b>Date Issued</b>	<b>Forecast</b>	<b>Volume (kaf)</b>	<b>% Normal</b>
November 5, 2010	November Pre-Season	5822	99%
December 3, 2010	December Final	6262	107%
January 7, 2011	January Final	5610	89%
February 4, 2011	February Final	6656	105%
March 4, 2011	March Final	7105	112%
April 5, 2011	April Final	7191	113%
May 3, 2011	May Final	8165	129%

Normal April-August 1928-1999 = 6337 kaf

**Dworshak April-July**

<b>Date Issued</b>	<b>Forecast</b>	<b>Volume (kaf)</b>	<b>% Normal</b>
Oct 15, 2010	October Pre-Season	3972	148%
November , 2010	November Pre-Season	3972	148%
December 7, 2010	December Final	3452	129%
January 5, 2011	January Final	3340	124%
February 4, 2011	February Final	3142	117%
March 4, 2011	March Final	3329	124%
April 7, 2011	April Final	3387	126%
May 3, 2011	May Final	3772	141%

Normal April-July 1928-1999 = 2683 kaf

**Reclamation Forecast:**

**Hungry Horse April-August**

<b>Date Issued</b>	<b>Forecast</b>	<b>Volume (maf)</b>	<b>% Normal</b>
January 6, 2011	Apr-Aug January Final	2.193	106%
February 4, 2011	Apr-Aug February Final	2.413	117%
March 3, 2011	Apr-Aug March Final	2.506	121%
April 5, 2011	Apr-Aug April Final	2.659	128%
May 3, 2011	Apr-Aug May Final	2.933	142%

Hungry Horse April-August (30 year average =2070 kaf)

**Hungry Horse January - July**

<b>Date Issued</b>	<b>Forecast</b>	<b>Volume (maf)</b>	<b>% Normal</b>
January 6, 2011	Jan-Jul January Final	2.356	106%
February 4, 2011	Jan-Jul February Final	2.654	119%
March 3, 2011	Jan-Jul March Final	2.741	123%

April 5, 2011	Jan-Jul April Final	2.862	129%
May 3, 2011	Jan-Jul May Final	3.118	140%

Hungry Horse January-July (30 year average = 2224 kaf)

**Hungry Horse May-September**

Date Issued	Forecast	Volume (maf)	% Normal
January 6, 2011	May-Sep January final	1.944	106%
February 4, 2011	May-Sep February Final	2.139	117%
March 3, 2011	May-Sep March Final	2.222	121%
April 5, 2011	May-Sep April Final	2.357	128%
May 3, 2011	May-Sep May Final	2.798	153%

Hungry Horse May-September (30 year average = 1835 kaf)

**Precipitation Summaries:**

**Precipitation (WY2011)**

	Oct	Nov	Dec	Jan	Feb	Mar	Apr*	M	J	J	A	S	WYTD
								a	u	u	u	e	
								y	n	l	g	p	
GCL	93%	105%	99%	144%	122%	138%	183%						121%
LWG	161%	106%	135%	94%	75%	165%	192%						129%
TDA	122%	100%	111%	120%	100%	167%	189%						123%

\* Thru April 26

**Streamflow (WY2011)**

	Oct	Nov	Dec	Jan	Feb	Mar	Apr*	May	Jun	Jul	Aug	Sep
GCL	92%	82%	90%	98%	96%	111%	107%					
LWG	86%	82%	83%	126%	79%	93%	129%					
TDA	105%	94%	98%	144%	92%	103%	109%					

Date	Operation/TMT Discussion
October 26, 2010	The stormy weather that occurred over the past weekend will continue this week. There will be some streamflow rises; however, temperatures are cool. So flows are tempered because precipitation falling at higher elevations is coming down as snow. The new water year snowpack is starting to build!
November 1, 2010	Remnants of the typhoon from Asia are bringing warm wet weather to the Pacific Northwest. The northern part of the basin, particularly British Columbia, will be receiving the heaviest of the precipitation. Snow levels in Canada will be about 6000 feet so some of the precipitation will be falling as rain. Expect precipitation, overall, for the week, to be average to above average. Moderate streamflow rises expected.
November 15, 2010	Precipitation this past weekend caused moderately small streamflow rises from BC to the lower Snake. Precipitation will continue this week although amounts expected are considered to be normal to below normal. With the cold front moving in, temperatures have dropped. This should temper streamflows rises, particularly at mid level and higher elevations, as the precipitation will be falling as snow.

November 22, 2010	This week streams should be quiet with the much colder weather shutting things down. Precipitation will fall mostly as snow. Overall, the precipitation will be average to below average this week.
November 29, 2010	The week of November 21-27 was perhaps the coldest November week since 1985 in the Columbia River Basin. A major winter storm moved off the Gulf of Alaska on the 21 <sup>st</sup> , which pulled Arctic air south from the Yukon Territory. Snow levels fell to the valley floors on the 22 <sup>nd</sup> with 2 to 3 feet of snow accompanied by hours of blizzard conditions in both middle and upper elevations. This was followed by record cold, particularly east of the Cascades. Temperatures began a slow recovery by Thanksgiving, but were still 5 to 7 degrees below long-term averages by week's end. The extreme cold slowed runoff into the river basin, with ice development noted at several headwater sites.
December 13, 2010	Unusually heavy precipitation, combined by a significant jump in snow levels, led to significant flows over the weekend, mostly west of the Cascades and especially over western Washington. Farther east where cold air remained entrenched until Sunday, most of the precipitation fell as snow or freezing rain before turning to rain. Reports are still coming in, but some stream response is already underway in some of the upper Columbia and Snake River tributaries. These increased flows will work downstream over the next few days. However a return to more seasonable precipitation and temperatures will slow runoff and reduce streamflows by midweek. The best news with this past weekend's storm is that significant precipitation fell over southern Canada, northeast Washington, and northern Idaho and Montana. These areas had generally missed out on previous storms this fall.
December 20, 2010	Below normal precipitation fell over the basin last week, which allowed streams to gradually recede throughout the week after significant jumps occurred in the wake of the December 7-9 heavy rain events. A storm system this weekend brought moderate amounts of precipitation to the southern two-thirds of the basin, but most of that fell as snow. Although still quite early in the season, snowpacks were above mid-December normals across Oregon and Southern Idaho and near normal in Northern Idaho and Montana. Snowpacks continued to lag behind normal in Washington and British Columbia.
December 27, 2010	Precipitation over the past four days was mostly a west side event. Snow conditions in Canada remain much below average in many spots. The rest of the basin is a mixed bag but pans out to an overall near average snowpack. Streamflows have been flat.  The forecast for the next several days is for below normal precipitation in BC region (again) and near normal precipitation in northern Idaho and northwestern Montana, with heavier amounts in central and south Idaho. Mostly snow is expected but there will be a rain/snow mix at lower elevations. Small rises may occur in the Clearwater and lower Spokane river basins. Small rises should occur in the Willamette.
January 3, 2011	After a wet Christmas, below normal precipitation and temperatures were the main story across the entire basin last week. Temperature departures bottomed out at -10F over the New Years' weekend, with many subzero low temperatures in the interior Pacific Northwest. This kept streamflows flat with some icing noted on many smaller river systems. While snowpack levels remain near or even slightly above normal on the U.S. side of the border, they remain well below normal in southwest Canada.
January 10, 2011	Most of the precipitation last week was focused where it is needed most: over Canadian portions of the Columbia Basin. Several feet of snow fell in the mountains of southwest Canada, but that merely put a dent into ongoing snowpack deficits. The U.S. portion of the basin received below average precipitation last week, although snowpacks remained near or above early January normals.
January 18, 2011	Both weather and streamflows were unusually active across the basin last week, even for a La Niña winter. The beginning of the week featured a brief cold snap and unusually low elevation snows. By the end of the week, the jet stream quickly shifted into a nearly classic pineapple express configuration it dipped into Hawaii and aimed at the Pacific Northwest. The result was a rapid warmup and record rainfall this past weekend. This precipitation, which ranged from 2 to 9 inches across the U.S. portion of the Basin, in addition to snow levels ranging from 4000ft in Canada to 8000ft in the Cascades, led to significant streamflows and some tributary flooding -- particularly in the streams flowing out of the Cascades, and in the Clearwater, Spokane, and Pend Oreille Basins. Even southern British Columbia got into the action with high flows and significant improvement in the snowpack. While the Canadian headwater snowpack continues to lag well behind the rest of the basin, snow water equivalents as of this morning had risen above their record lows near Mica, and were now above average in the Kootenay Basin.
January 24, 2011	After the active weather from last weekend and early in the week, this coming week looks to be fairly quiet here in the northwest with dry conditions and just above normal temperatures. Streamflow rises peaked both above Coulee and Lower Granite early in the week with slow recessions across the week. Heartening news is that although we lost low elevation snow,

	that the storms from these past two weeks have increased the upper elevation snow and especially increased the snow pack in Canada. Water supply saw a small increase in the mid-month forecast, with these dry conditions expected for the next week, we may see that drop down again.
January 31, 2011	The Columbia Basin continued dry weather is expected this week, with the exception of some spotty light rain or mountain snow over southern Canada and Washington. A piece of the Arctic air heading into the eastern U.S. has also spilled into the valleys east of the Cascades and will remain in place for much of the week. East winds through the Gorge and passes will help drop temperatures to near average levels for a few days this week in the I-5 corridor before turning milder again this weekend. The forecast for the second week of February looks on the cool side, with some indications of more seasonable, wetter weather returning to the basin.
February 7, 2011	The cool dry weather led to gradual streamflow decreases, with some river icing returning to headwater areas in Montana and Idaho. Snowpack averages actually decreased in the U.S. portion of the basin last week because of the fact that snowpack should be steadily increasing in early February, and it simply did not last week. The only location which built snowpack was over southern British Columbia where many locations are finally near average after lagging for much of the winter so far.
February 14, 2011	Much of the week was mild and dry across the basin with temperatures several degrees above early February averages. By the end of the week, though, the expected turn toward much wetter and cooler weather began, particularly over British Columbia and Washington where significant valley rain and mountain snow fell. Streamflows slowly receded through much of the week, although some snowmelt in the Snake basins helped maintain some elevated base flows.
February 22, 2011	A major weather pattern change occurred last week. During the first half of the month most of the precipitation was aimed at the northern half of the basin where snow water equivalents made significant gains – mainly over Canada. Since mid-month, though, the jet stream has shifted into the U.S. basins, with the main precipitation axis shifting with it. The shift also allowed cooler air to overspread the entire basin, with snow levels dropping unseasonably low – at times near sea level. As this shift took place and precipitation increased over the southeast half of the basin, minor stream rises were noted in the Spokane, Clearwater, and upper Snake basins as some of the initial precipitation fell as rain. By week's end, though, runoff dropped as temperatures fell near or below freezing, and subsequent precipitation fell as light to moderate snow.

February 28, 2011	Light precipitation gave way to a significant cold snap by week's end across the basin. As forecast about a week in advance, load center temperatures plummeted to 15 degrees below normal or colder from Thursday through the Saturday, which is "major cold snap" territory. Several cities hit new low record low temperatures as a result of the arctic front which brought the cold and accumulating snow to both Portland and Seattle.
March 7, 2011	Heavy rain and mountain snow fell over most of the basin last week with unusually low snow levels and temperatures hovering 2 to 6 degrees below average. In much of Oregon, Idaho and Montana, precipitation was over double what would normally fall during the first week of March, with a few locations in the Cascades picking up over 5 inches of water equivalent. This supported significant gains in snowpack over the Cascades, and above about 3500 feet over the rest of the U.S. portion of the basin. Even the Canadian portion of the basin saw snowpack gains – mainly near the U.S. border. Despite such heavy precipitation last week, streamflow responses were very modest due to the unusually low snow levels and cold temperatures.
March 14, 2011	Above normal precipitation continued across the Columbia basin last week with more rain in the valleys and snowfall in the mountains. Snowpack percentages continued to increase basinwide. Canada gained 2%, areas above Grand Coulee 3%, and the Snake was up 1% for the week. Temperatures started out as much as 5 degrees below normal, then warmed to near normal by weeks end. Despite the above normal precipitation last week, streamflow responses were very modest due to the low snow levels and cool temperatures.
March 21, 2011	For the third week in a row, precipitation was well above average across the Columbia basin last week. This led to another significant increase in mountain snowpack, particularly in the southern two-thirds of the basin. Some individual reporting stations in the basin, including Portland, received double their normal precipitation for the first 3 weeks of March. Temperatures remained a bit below normal last week as snow levels remained near or below pass levels. Thus streamflow responses were modest and generally limited to the Snake and John Day basins where average temperatures this time of year begin a noticeable, almost daily increase.
March 28, 2011	Although not as cold and wet as the first three weeks of the month, we once again had above average precipitation and below average temperatures last week, which led to another significant gain in snowpack, particularly in the U.S. basin. Streamflow responses were once again modest as most of the precipitation fell as snow above pass levels. The existing

	<p>snowpack grew less dense last week as rather steady, light, fluffy snow continued to accumulate in the mountains. This increased the water content of the snowpack, but also increased its ability to absorb any rain that may fall this week as snow levels rise to more typical late March levels, and made it even less likely for a sudden melt should unusually warm temperatures arrive by surprise.</p>
<p>April 4, 2011</p>	<p>Yet another wet week was experienced basin-wide. The month of March closed with several locations having their 3<sup>rd</sup>, 4<sup>th</sup> or 5<sup>th</sup> wettest March on record. The big difference last week was in our temperatures and snow levels, which rose well above pass levels and initiated our first melt of the season in the US part of the basin. The heaviest precipitation fell in northwest Washington, British Columbia, and northern Idaho/Montana Tuesday through Thursday, where some 3 days totals exceeded 3 inches in the mountains. Much of the precipitation fell as snow in the high mountains, but below 7000ft in the interior Columbia Basin, the precipitation changed to rain and melted the lowest portions of the snowpack. Streamflows responded quickly, particularly in the Clearwater, Spokane, Snake, Yakima, John Day, and Willamette basins. In the higher elevations, we continued to either build snowpack, or some of the rain was absorbed into the pack. As we entered the weekend, another system brought more moderate to heavy precipitation on Saturday, but much colder air coming in behind it brought snow levels back below pass levels and began to slow the runoff – at least temporarily.</p>
<p>April 11, 2011</p>	<p>Unlike the soggiessness of the past five weeks, precipitation was just slightly above average across the basin last week. Initially, snow levels were typical for early April which prolonged ongoing high flows on the Snake and Spokane basins. By Wednesday, though, snow levels fell to levels more typical of February, mountain temperatures fell into the teens, and even the lowest coastal valleys had morning freezes. Temperatures bottomed out well below average, with a few record low temperatures broken. This refroze the still-building snowpack, allowed new snow to accumulate at mid elevations, and slowed runoff. We had yet more gains in the snowpack compared to average, not only because of the additional snow, but also because we saw accumulations the southern Oregon and Idaho where we should already be melting.</p>
<p>April 18, 2011</p>	<p>Although temperatures briefly approached normal levels for a time, heavy precipitation and unusually low snow levels were again the rule last week. New daily precipitation records set both last Thursday and Friday in Portland, the mountains picked up anywhere from 1 to 3 inches of snow-water equivalent over the 7 day period, and significant snowpack gains were noted basin-wise, and at unusually low elevations for mid April. Despite the heavy precipitation, streamflows declined last week, although modest rises were being observed this morning in some of the lowest elevation streams.</p>
<p>April 25, 2011</p>	<p>For the first time since mid-February, basin-average precipitation was below average this week. However temperatures were even colder relative to average last week, with several morning lows below freezing all the way down to sea level. Where precipitation did fall (mostly in BC, ID and MT), it was the form of yet more mountain snow. Snowpack gains were noteworthy in Canada, and while less snow fell in the Snake Basin, we should be melting off snow this time of year – not gaining like we did. Streamflows generally receded last week, although base flows in the Snake and mid-Cs rose a bit due to low elevation precipitation and melting in the very lowest elevation snowpacks.</p>
<p>May 2, 2011</p>	<p>Once again, above average precipitation and much below average temperatures were observed last week, which closed out the wettest March-April period ever recorded at several locations in the Pacific Northwest, including Portland. Much of the precipitation fell as snow in the mountains which kept streamflows modest, however by the end of the week, snowmelt cycling was observed in some of the lowest elevation streams in the US basin and extreme southern BC. Despite some snowmelt in the lowest elevations over the weekend, another significant snowpack gain was noted basin-wide, with a couple of locations in Montana and southern BC near record levels.</p>

## 2.0 Seasonal Flow Objectives

Project	Average to date	BiOp Objective
Priest Rapids Spring ( 4/10-6/30)	148 kcfs	135 kcfs
McNary Spring (4/10-6/30)	260 kcfs	
McNary Summer (7/1-8/30)		200 kcfs
Lower Granite Spring (4/3-6/20)	100 kcfs	
Lower Granite Summer (6/21/8/30)		

## 3.0 Flood Control

[Flood Control Elevations](#) and April 10 Objective Elevations per each forecast period. Forecasted flood control elevations will be presented 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. *(The April 10 elevations noted below are the result of linear interpolation between the March 31 and April 15 forecasted flood control elevations.)*

Libby	Dec	Jan	Feb	Mar	Apr
Jan 31	2410.8	2424.5			
Feb 28	2409.2	2432.7	2392.7		
March 31	2408.4	2436.7	2388.6	2364.3	
April 10	2408.4	2436.7	2388.6	2364.3	2360.9
April 15	2408.4	2436.7	2388.6	2364.3	2359.2
April 30	2408.4	2436.7	2388.6	2364.3	2359.2

Hungry Horse	Dec	Jan	Feb	Mar	Apr
Jan 31	3543.6	3541.8			
Feb 28	3538.5	3534.9	3525.1		
March 31	3532.5	3527	3511.2	3503.4	
April 10	3530.6	3524.4	3506.5	3497.7	-
April 15	3529.6	3523.1	3504.1	3494.8	3480.7
April 30	3526.7	3519.0	3501.8	3493.7	3479.5

Grand Coulee	Dec	Jan	Feb	Mar	Apr
Jan 31	1290.0	1290.0			
Feb 28	1289.8	1289.7	1289.4		
March 31	1259.3	1267.4	1262.0	1270.2	
April 10	1246.3	1254.8	1248.9	1258.4	-
April 15	1239.8	1248.5	1242.3	1252.5	1232.2
April 30	1230.8	1238.5	1235.1	1237.0	1220.2

Brownlee	Dec	Jan	Feb	Mar	Apr
Jan 31	2077.0	2077.0			
Feb 28	2048.4	2044.5	2044.5		
March 31	2043.1	2036.8	2035.9	2038.7	-
April 15	2040.7	2031.7	2030.7	2034.6	2026.2
April 30	2038.4	2028.8	2026.8	2031.4	2017.4

Dworshak	Dec	Jan	Feb	Mar	Apr
Jan 31	1526.2	1526.2			
Feb 28	1491.5	1493.5	1501.4		
March 31	1469.6	1479.7	1495.6	1445.0	
April 10	1472.3	1483.6	1495.1	1445.0	1445.0
April 15	1474.2	1485.5	1494.8	1445.0	1462.7
April 30	1466.6	1475.2	1489.8	1476.1	1471.6

Grand Coulee and all Canadian projects will be operated for standard flood control in 2009-10. 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. For detailed flood control operations see: <http://www.nwd-wc.usace.army.mil/report/colsum>.

## **4.0 Storage Project Operations**

### **Libby Dam**

#### **Libby Dam - Bull Trout Flows**

Bull trout minimum flows are specified in the 2006 Libby Sturgeon Biological Opinion (2006 BiOp) and presented in Table 7 of the WMP.

#### **Libby Dam - Sturgeon Pulse**

Per the 2006 BiOp, the sturgeon pulse volume is determined from a tiered flow structure based upon the Corps' May Final WSF for the period of April-August.

#### **Libby Dam - April 10 and Refill Objectives**

Based on the April Libby water supply forecast the April 10 objective elevation was 2360.9 feet. The actual elevation on April 10 was 2361.5 feet. Due to a rising water supply and continued cool and wet conditions the Libby project was drafting aggressively in April and continues to do so in March, for purposes of system flood control. The project ended April at 2349.4 feet. . The May forecast sets the flood control elevation to 2287 ft as an input for the calculation of the VARQ refill flow once the start of refill is declared, although due to physical outlet considerations and water quality considerations the project is not expected to draft that deep prior to beginning of refill. There is a high potential of reaching flood stage at Bonners Ferry, Idaho and Nelson in British Columbia this year, as well as other points on the Pend Oreille and other rivers within the Seattle District. The project is expected to fill or be nearly full by late July.

### **Libby Dam – Summer draft Limit**

Experimental draft to 10 feet from full by the end of September, except in the lowest 20th percentile of water years (currently less than 71.8 MAF), as measured at The Dalles, when draft will increase to 20 feet from full by end of September. The RFC's May Final forecast for April-August is used to set the official draft limit. The limit will be 10 feet from full, or 2449.0 feet, based on the May water supply forecast.

## ***Hungry Horse Dam***

### **Water Supply Forecast and Minimum Flows**

The minimum flow requirements are measured at two locations 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. The Bureau of Reclamation's March Final WSF for April–August was 2506 kaf (121% of average). Minimum flow requirements from Hungry Horse and Columbia Falls are currently set at 900 cfs and 3,500 cfs, respectively. The March final forecast sets the minimum flow requirements from March through December.

### **Hungry Horse 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. Based on the 2011 March Final WSF, the April 10 elevation objective was 3497.7 ft. However due to the increasing WSF from March to April and lower flood control elevations, Hungry Horse increased discharges to 10.6 kcfs (included 2 kcfs spill) in order to draft down to the April 30 flood control elevation. The actual elevation on April 10 was 3492.98 ft. Hungry Horse Reservoir is expected to refill by approximately June 30. A late snowmelt runoff may delay refill to sometime after June 30 in order to avoid excessive spill at the project. Hungry Horse will most likely fill sometime after June 30 in 2011 due to the well above average WSF.

### **Hungry Horse Summer Draft Limit**

The experimental summer reservoir draft limit at Hungry Horse is 3,550 ft. (10 ft. from full) by September 30, except in the lowest 20th percentile of water years (The Dalles April-August <71.8 maf) when the draft limit is elevation 3,540 ft. (20 ft. from full) by September 30. The RFC's May Final April-August forecast is used to set the official draft limit. Based on the April Final WSF, the September 30 draft limit for 2011 is expected to be 3550 ft.

## ***Grand Coulee Dam***

### **Grand Coulee 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. Based on the 2011 March Final WSF, the April 10 elevation objective was 1258.4 ft. However due to the increasing WSF from March to April and lower flood control elevations, Grand Coulee began drafting in late March and continued drafting through April in order to draft down to the April 30 flood control elevation of 1220.2 ft. Grand Coulee drafted around 1ft/day during April and the actual elevation on April 10 was 1238.5 ft.

### **Grand Coulee 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. Based on the April Final WSF at The Dalles, the summer draft limit for Grand Coulee is expected to be 1,280 ft. This draft limit will most likely be modified to implement the Lake Roosevelt Incremental Storage Release component of Washington's Columbia River Water Management Program (CRWMP). The amount of additional draft in 2011 is still to be determined.

### **Drum Gate Maintenance**

Because maintenance was deferred in 2009 and 2010, drum gate maintenance will have to be performed in the spring of 2011 regardless of water supply conditions. Flood control drafts at Grand Coulee in 2011 provided significant time for the maintenance to be completed without consequence to downstream flow objectives.

## ***Dworshak Dam***

### **Summer Draft for Temperature Control and Flow Augmentation**

To be update in June

### ***Upper Snake River Flow Augmentation***

The Bureau of Reclamation is expecting that 487 kaf of Upper Snake River flow augmentation will be provided in 2011.

## ***4.0 Water Quality***

### **Current Spill Priority List**

1. This teletype provides guidance on project operations to provide fish passage spill, and lack of market spill.

2. Until further notice, during periods of lack of market, projects should spill in the following order: LWG, LGS, MCN, LMN, IHR, TDA, JDA, BON, MID-C, CHJ, GCL & DWR.

3. Current spill caps for the various TDG levels are shown below. These are changed based on real-time data.

**Spill Priority List  
May 3, 2011**

Project	TDG% 110	TDG% 115	TDG% 120	TDG% 125	TDG% 130	TDG% 135
LWG	20	30	41	90	125	200
LGS(NIGHT)	18	23	40	80	150	250
MCN	40	80	160	230	290	450
LMN	18	23	30	95	180	250
IHR	18	45	94	110	180	240
LGS(DAY)	18	23	40	80	150	250
TDA	45	60	125	250	360	600
JDA	15	60	125	240	450	600
BON	65	GC75	100	190	225	270
MID-C	GC	110GC	GC	GC	GC	GC
CHJ	20	1745	110	130	165	200
GCL(a)	7	3013	17	20	35	50
GCL(b)	0	15	30	75	120	130
DWR	37%	37%	37%	37%	37%	37%

4. Mid-C represent Grant; Douglas and Chelan PUDs as a block as measured at priest rapids tailwater. GC means gas cap of 110%; 115%; 120%; 125% & 130%.

5. LGS (night) is from 1800 to 0500; and LGS (day) is from 0500 to 1800.

6. Spill caps for DWR are listed in terms of percentage of total outflow.

7. When Grand Coulee forebay elevation is less than 1266 ft use GCL(a) spill caps associated with outlet tubes. When Grand Coulee forebay elevation is greater than 1265.5 ft, use GCL(b) spill caps associated with drum gates.

A new proposed spill priority list format is being routed to the FCRPS Action Agencies. Once the AA review process of the spill priority list is complete it will be provided for WMP update.

## **5.0 Specific Operations**

### **Lake Pend Oreille Kokanee Operation**

The state of Idaho (Idaho Department of Fish and Game (IDFG)) and the U.S. Fish and Wildlife Service (USFWS) submitted a System Operation Request (SOR) presented at the October 15, 2010 TMT meeting requesting that the Action Agencies: *“Draw Lake Pend Oreille down to a winter minimum control elevation (MCE) no lower than 2055' while minimizing or eliminating the need to spill at Albeni Falls Dam.”* The SOR further specified: *“We therefore request that the drawdown be completed by November 8 if reasonably possible. If this is not possible, the MCE should be reached no later than November 15 and should not be dropped below this elevation for the duration of the winter. This proposed operation is not anticipated to cause exceedence of the state maximum total dissolved gas standards at downstream projects barring unforeseen circumstances. The lake will then be held within 0.5' above the MCE to the end of kokanee spawning [monitored by Idaho Department of Fish and Game (IDFG)] or December 31, whichever comes first.”*

In response to this SOR the Corps implemented a drawdown plan on as agreed to by TMT on October 15. Additional information will be included in the final Fall/Winter update.

### **Burbot Spawning Flows (Non-BiOp Action)**

*EDIT PER any changes for this year.*

Under the terms of an MOU prepared in 2005 by the Kootenai Valley Resource Initiative (KVRI) and signed by the Corps, the selective withdrawal gate system at Libby Dam has been set to release cool water in November and December, before temperature stratification limits the temperature control capability. The purpose of this operation is to provide cooler river temperatures downstream Libby Dam (closer to normative thermal conditions). This operation will likely result in November and December temperatures being slightly cooler than the existing selective withdrawal temperature rule curve. Corps staff at Libby Dam removed selective withdrawal gates incrementally during late October to assure that daily temperature change remains within 2° F per day; gates were removed systematically to slowly lower river temperature by early November (a span of about 8° F). Temperature will not be minimized this fall until isothermal conditions develop due to constraints and precautions that will be observed related to selective withdrawal crane rehabilitation that will occur over the winter, necessitating a more conservative gate removal pattern. Rather than removing all gates (resulting in withdrawal elevation of 2,222 ft.), the Corps removed all but 3 rows of gates (resulting in withdrawal elevation of 2,253 ft.).

## **Chum Operations**

<b>Date</b>	<b>Operation/TMT Discussion</b>
October 26, 2010	TMT discussion – Lots of chum showing up in the commercial and tribal fisheries. We've had plenty of rain recently resulting in good streamflows in the Hamilton springs, and Hamilton Creek. The early arrival of chum and good hydrologic conditions lead to a decision plan the start the chum spawning operation for November 1 <sup>st</sup> . The typical daytime spawning tailwater range of 11.3-11.7 the planned operation.
Nov 1, 2010	Chum spawning operation begins as planned
November 19, 2010	Chum teletype modified to meet the desire of the salmon managers to move excess water at night around the midnight hour as much as possible.
December 13, 2010	High flows associated with a large amount of basin-wide precipitation resulted in the need to move excess water for several days at a tailwater elevation of 18.5'. Hoping to recover the daytime spawning operation by Monday the 20th.
December 22, 2010	TMT declares chum spawning completed. The chum operation transitions to the incubation phase with a minimum tailwater of 12.2 feet. TMT left the door open for a lower protection level if water becomes limited in the before emergence is completed in the spring.
March 9, 2011	TMT reviewed the chum emergence model developed by PNNL. The 2010-2011 pre-season estimate for 50% emergence was April 6 and 90% emergence was on April 18, 2011. The end of the chum spawning operation will be determined in the near future pending real time data and the outcome of modeling efforts.
April 20, 2011	During the April 20 TMT meeting NOAA announced emergence ended on April 18, 2011 in accordance with the model therefore the COE discontinued the Bonneville Dam tailwater restriction of 12.2 ft or greater on all hours.

### Ives/Pierce Survey Data

<b>Date</b>	<b>Lives</b>	<b>Dead*</b>	<b>Redds</b>
24-Sep	0	0	0
1-Oct	0	0	0
14-Oct	0	0	0
19-Oct	0	0	0
26-Oct	0	0	0
2-Nov	18	1	3
9-Nov	38	2	11
16-Nov	32	24	18

23-Nov	130	17	39
30-Nov	134	30	16
6-Dec	47	21	NC
14-Dec	5	7	NC
21-Dec	1	2	0
28-Dec	0	1	0

Most areas are mass redds.

### ***Vernita Bar spawning operation (Non-BiOp Action)***

<b>Date</b>	<b>Operation/TMT Discussion</b>
October 24, 2010	Based on survey counts and the Hanford Reach Fall Chinook Protection Program Agreement, the Initiation of Spawning has not occurred for either zone below or above the 50 kcfs elevation.
October 31, 2010	The Initiation of Spawning has been set to be October 27 for the 36 kcfs - 50 kcfs zone (the Wednesday before the weekend on which the Monitoring Team identifies five or more redds within the zone). The Initiation of Spawning has not been set for the zone above 50 kcfs since no redds were counted above the 50 kcfs flow elevation.
November 7, 2010	Based on the November 7 survey count and the Hanford Reach Fall Chinook Protection Program Agreement, the Initiation of Spawning has been set for the zone above 50 kcfs to be November 3 (the Wednesday before the weekend on which the Monitoring Team identifies five or more redds within the zone). The Initiation of Spawning for the 36-50 kcfs zone was set to be on October 27 during the October 31 redd survey.
November 21, 2010	Based on the November 21 survey count and the Hanford Reach Fall Chinook Protection Program Agreement, the 2010-2011 Critical Flow Elevation is set at the 65 kcfs elevation (the Agreement states in section C6b, "If there are fewer than 15 redds above the 65 kcfs elevation, then the Critical Elevation will be the first 5 kcfs elevation above the elevation containing the 16 <sup>th</sup> highest redd"). The Monitoring Team agreed that the fish spawning season had ended and that November 21, 2010 be identified as the End of Spawning date. The Team also agreed that since fish spawning has ended, there was no need for the November 28 supplemental ground redd count.
February 22, 2011	It is estimated that 1,000 temperature units (TU) from the initiation of spawning will be reached on Saturday 2/26/2011 marking Emergence and the start of the Emergence and Rearing periods.
March 23, 2011	Current projections show the end of emergence will be around June 19. Constraints were ranging 30-40 kcfs and there had been just one minor exceedance on 3/13 when flows dropped just below the band. Stranding and entrapment studies were in their 3 <sup>rd</sup> week. One Chinook had been observed entrapped and that number was likely to increase further into

	the migration season. Field crews were finding that the new web based modeling tool was helping them focus/streamline their work.
April 6, 2011	The operation has stayed within flow bands prescribed, with two exceptions: on 3/14, .2 kcfs exceedance occurred due to operator error (which was corrected), and on 4/2, a .6 kcfs exceedance occurred due to changing conditions – higher flows over the weekend – that had also been resolved. No strandings and few entrapments had been observed. This was likely due to higher flows and early emergence. Peak emergence was a few weeks out. A lower flow operation would go into effect to pull the egg tubes in the river to examine egg/fry survival.
April 20, 2011	The Hanford reach had accumulated about 772 temperature units from the end of spawning and emergence had occurred in all three zones indicating that more fish would be observed in the Hanford Reach very soon. Weekend minimums will begin this weekend and continue for four weekends through emergence. A 40 kcfs band width constraint is guiding operations; the mean flow was 154.8 kcfs. One exceedance occurred on 4/7 to support the egg-to-fry survival work that was reported during the 4/6 TMT meeting. The study was successful and results will be available soon. Russell will provide another update to TMT in two weeks.

### ***Spring Creek Hatchery Releases***

During the April 6 TMT meeting the US Fish and Wildlife Service indicated the Spring Creek and Little White Salmon Hatchery releases would occur on April 12. The Spring Creek National Fish Hatchery will release approximately 6.15 million juvenile Tule Fall Chinook and the Little White Salmon National Fish Hatchery will release approximately 1.8 million juvenile Fall Chinook. Consistent with previous years operations the USFWS had been working with BPA and the Corps on an operation that was designed to improve passage conditions of these juvenile hatchery fish through the gatewells of powerhouse 2 (PH2). The Corps initiated this operation on April 13 at 0600 hours. The operation included operating the units at PH2 at the mid to lower end of the 1% limit to improve passage of juveniles through the gatewells of PH2. In coordination with the USFWS the Corps ended this operation April 21 at 1131 hours.

During the April 27 TMT meeting the US Fish and Wildlife Service indicated the second Spring Creek Hatchery releases would occur on May 4. The Spring Creek National Fish Hatchery will release approximately 4.6 million juvenile Tule Fall Chinook. Consistent with previous operations the USFWS had been working with BPA and the Corps on an operation that was designed to improve passage conditions of these juvenile hatchery fish through the gatewells of PH2. The Corps initiated this operation on May 4 at 1800 hours. The operation included operating the units at PH2 at the lower 25% of the 1% limit to improve passage of juveniles through the gatewells of PH2. In coordination with the USFWS the Corps ended this operation May 12 at 1700 hours. **Snake River Zero Generation (Non-BiOp Action)**

According to the Lower Snake projects operating manuals, “From December to February, "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.”

In 2005, the Salmon Managers developed guidance criteria for dropping to zero generation. The status of the actively migrating fish in the Snake River will be evaluated in November and December to determine when the criteria have been met.

Paul Wagner, NOAA Fisheries and further clarified by David Benner, FPC reported at the December 1, 2010 TMT that the criteria this year for “few if any” fish is 65 combined and 20 wild. As of TMT on December 1<sup>st</sup>. the criteria had not been met but was only a few fish off the objective. Paul committed to TMT to coordinate with TMT when the criteria is met. On December 2<sup>nd</sup> the criteria was met.

## Minimum Operating Pool (MOP)

*(Edit for what we know now)*

To be updated spring 2011

Table 5.— Snake River MOP elevations.

<b>Project</b>	<b>Operation</b>	<b>Lower Range Elevation (ft)</b>	<b>Upper Range Elevation (ft)</b>
Ice Harbor	MOP	437.0	438.0
Lower Monumental	MOP	537.0	538.0
Little Goose <sup>A</sup>	MOP	633.0	634.0
Lower Granite	MOP	733.0	Variable*

A – To be adjusted as necessary to provide adequate depth over entrance sill at Lower Granite navlock.

At John Day, the forebay is being operated within a 1.5 ft range of the minimum level that provides irrigation pumping from April 10 to September 30. The initial range is 262.5 to 264.0 feet. The minimum level will be adjusted upward as necessary to facilitate irrigation pumping.

<b>Date</b>	<b>MOP Operation Discussion</b>
April 3, 2011	Planned start of MOP operations on the Lower Snake River
March 28, 2011	Corps received System Operations Request (SOR) 2011-01 SOR on March 28, 2011, submitted by the Columbia River Towboaters Association (SOR 2011-01) requesting Lower Granite be operated at MOP+2 (e.g. 735.0 - 736.0 ft.) April through August 2011.
March 30, 2011	Pacific Northwest Waterways Association (PNWA) presented SOR 2011-01 during the TMT meeting and requested the implementation of the SOR beginning 1 April.
*March 31, 2011	*Via email in an Official TMT Coordination Request the Corps provided TMT with an alternative to the operation identified in SOR 2011-01 that would provide navigation safety as requested and minimize impacts to fish protection measures (eg. minimize the frequency of operating Lower Granite in excess of MOP - 733.0 to 734.0 ft.). The Corps proposed alternative was based on the relationship between the pool elevation at Lewiston due to the backwater effects of Lower Granite Dam. The Corps alternative was to operate the Lower Granite forebay in variable 1-foot ranges between MOP (733.0 – 734.0 ft.) and MOP+2 (735.0 to 736.0ft.) as a function of inflow measured at Lower Granite Dam forebay (as opposed to the proposed MOP+2 operation in the SOR). Specifically, when daily average inflow is greater than or equal to 120 kcfs, Lower Granite would be operated at MOP (733.0-734.0 ft.) and for flood control.

	<p>When day average inflow is less than 120 kcfs but greater than or equal to 80 kcfs, Lower Granite would be operated at MOP+1 (734.0-735.0 ft.).</p> <p>When day average inflow is less than 80 kcfs but greater than or equal to 50 kcfs, Lower Granite would be operated at MOP+1.5 (734.5-735.5 ft.).</p> <p>When day average inflow is less than 50 kcfs, Lower Granite will be operated at MOP+2 (735.0-736.0 ft.).</p> <p>The Corps' proposal would provide safe conditions with respect to depth in the area near Lewiston while operating as close to MOP as possible at Lower Granite. Tidewater and PNWA agreed that the Corps' alternative would address their concerns, and the Corps proposed the alternative operation to TMT on Thursday morning, March 31.</p>
April 1, 2011,	<p>A TMT Conference Call was convened to clarify the proposed operation and conduct an official poll for those members who had not already responded. TMT members did not object to this operation; however there were concerns about this situation continuing into the next migration season and potential mitigation actions. TMT members that were polled were: Idaho, Washington, Oregon, Montana, USFWS, NOAA, BPA, Nez Perce. Receiving no objection to the Corps proposed revised operation as specified in the March 31 Official TMT Coordination request the Corps implemented the operation. The Corps will implement this modified MOP operation through August 31, 2011.</p>

## **6.0 2011 Spill and Transportation Operations**

Spring spill operations will be implemented consistent with the 2011 Spring Fish Operations Plan (Table 2 below).

Table 2.— Summary of 2011 spring spill levels at lower Snake and Columbia River projects.<sup>4</sup>

<b>Project</b>	<b>Planned 2011 Spring Spill Operations (Day/Night)</b>	<b>Comments</b>
Lower Granite	20 kcfs/20 kcfs	Same as 2010
Little Goose	30%/30%	Same as 2010
Lower Monumental	Gas Cap/Gas Cap (approximate Gas Cap range: 20-29 kcfs)	Same as 2010
Ice Harbor	<b>April 3-April 28:</b> 45 kcfs/Gas Cap <b>April 28-June 20:</b> 30%/30% vs. 45 kcfs/Gas Cap (approximate Gas Cap range: 75-95 kcfs)	Same as 2010
McNary	40%/40%	Same as 2010
John Day	<b>Pre-test:</b> 30%/30% <b>Testing:</b> 30%/30% and 40%/40%	Same as 2010
The Dalles	40%/40%	Same as 2010
Bonneville	100 kcfs/100 kcfs	Same as 2010

The discussion associated with the initiation of transportation from the 2011 Spring Fish Operation Plan (FOP) is included below.

Transportation will be initiated at Lower Granite Dam no earlier than April 20 and no later than May 1. Transportation will start up to 4 days and up to 7 days after the Lower Granite Dam start date at Little Goose and Lower Monumental dams, respectively. The actual start date for Lower Granite, Little Goose, and Lower Monumental dams will be determined through coordination with TMT as informed by the in-season river condition (e.g. river flow and temperature) and the status of the juvenile Chinook and steelhead runs (e.g. percentage of runs having passed the project).

In accordance with the FOP, TMT discussed the initiation of juvenile transportation during the April 27 meeting. The Corps reported that, with no objections from the salmon managers, the COE planned to begin the transportation operation on May 1. Specifically, Lower Granite would initiate collection at 0700 hours on May 1, with transportation beginning on May 2; collection would begin at Little Goose on May 5 with transport on May 6; and collection at Lower Monumental will begin on May 8 with transport on May 9. Hearing no objection the proposed operation the Corps initiated this operation on May 1.

## **7.0 2011 Fish Passage Research**

A brief summary of 2011 fish passage research is included below. More details regarding 2011 fish passage research is located in Appendix A of the 2011 Fish Passage Plan available on the following website:

<http://www.nwd-wc.usace.army.mil/tmt/documents/fpp/2011/>

### **Bonneville**

- BiOp Performance Standard Compliance Test
- Adult Kelt Passage Test at B1 Sluiceway and B2CC
- Lamprey Passage Evaluations

### **The Dalles**

- Adult Lamprey Studies
- Steelhead Ice Trash Sluiceway Passage Study
- BiOp Performance Standard Testing

### **John Day**

- Adult Lamprey Studies
- BiOp Performance Standard Compliance Test

### **McNary**

- McNary adult steelhead fallback study
- Monitoring fish passage at McNary OR shore ladder
- Identify potential for adverse impact of aquatic invertebrates growing within the juvenile collection and bypass systems at McNary
- Evaluation of Adult Pacific Lamprey Passage Success at McNary and Lower Snake River Dams
- Underwater Video Monitoring of Adult Fish Ladder Modifications to Improve Pacific Lamprey Passage at McNary and Ice Harbor Dams
- Determining the feasibility of detecting JSAT Transmitters in the Tailrace Environment at McNary Dam

### **Ice Harbor**

- Evaluation of Adult Pacific Lamprey Passage Success at McNary and Lower Snake River Dams
- Underwater Video Monitoring of Adult Fish Ladder Modifications to Improve Pacific Lamprey Passage at McNary and Ice Harbor Dams
- Evaluation of Fish Counting Accuracy Issues at FCRPS Dams, at Ice Harbor and Lower Monumental Dams

#### Lower Monumental

- Bull Trout PIT Tag Study
- Developing Half-Duplex PIT Tag Antennas at Fishway Entrances and Exits at Ice Harbor Dam
- Evaluation of Fish Counting Accuracy Issues at FCRPS Dams, at Ice Harbor and Lower Monumental Dams

#### Little Goose

- Bull Trout PIT Tag Study

#### Lower Granite

- A study to compare seasonal SARs of early in-river migrating versus transported Snake River yearling anadromous salmonids
- A study to compare SARs of Snake River fall Chinook salmon under alternative transportation and dam operational strategies
- Kelt reconditioning / transportation
- A Study to Evaluate Hydropower System-related Latent Mortality Associated with Passage of Yearling Chinook Salmon Smolts through Snake River Dams
- A study to evaluate straying behavior in steelhead
- A study to identify overwintering behavior of Fall Chinook salmon
- Developing Half-Duplex PIT Tag Antennas at Fishway Entrances and Exits at Lower Granite Dam