Appendix C

2012 Fish Operations Plan

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2012 Fish Operations Plan

INTRODUCTION

The 2012 Fish Operations Plan (FOP) describes the U.S. Army Corps of Engineers' (Corps) planned operations for fish passage at its mainstem Federal Columbia River Power System (FCRPS) dams during the 2012 fish migration season; generally April through August. The 2012 FOP is consistent with the 2011 Court ordered spring and summer spill operations, and the adaptive management provisions in the 2010 NOAA Fisheries FCRPS Supplemental Biological Opinion (2010 Supplemental BiOp)[1] and the Corps' Record of Consultation and Statement of Decision (ROCASOD) adopting the project operations contained in the 2010 Supplemental BiOp and the Columbia Basin Fish Accords (Accords).

As in 2011, the 2012 FOP incorporates planned project operational adjustments necessary to conduct essential research to evaluate fish passage features during the 2012 migration season. Other FCRPS water management actions and project operations not specifically addressed in this document shall be consistent with the 2010 Supplemental BiOp and other guiding operative documents, including the 2012 Water Management Plan (WMP), seasonal WMP updates, and the 2012 Fish Passage Plan (FPP). Operations described herein are consistent with the 2011 Court Order, including adjustments to address in-season developments through discussion and coordination with the regional sovereigns as provided for in the 2010 Supplemental BiOp.

The following sections describe factors that influence management of fish operations during various runoff conditions, including: management of spill for fish passage, spillway operations, minimum generation requirements, operations under low flow conditions, navigation safety, juvenile fish transportation operations, specified spring operations for fish at each mainstem project, protocols for fish protection measures related to operational emergencies, coordination with regional entities, and monthly reporting.

GENERAL CONSIDERATIONS FOR FISH OPERATIONS

For planning purposes, the Corps' 2012 FOP assumes average runoff conditions. As actual runoff conditions vary in timing and shape and may be higher or lower than average in any given year, adjustments in fish transportation and/or spill operations (spill levels, spill percentages, or spill caps) will be adaptively managed in-season. These in-season changes will be coordinated through the Technical Management Team (TMT) and

[1] The 2010 Supplemental BiOp incorporates the 2008 NOAA BiOp.

other appropriate regional forums, to avoid or minimize adverse impacts to juvenile and/or adult fish passage conditions, navigation safety concerns, or to accommodate powerhouse and/or transmission system constraints. Actual spill levels may be adaptively managed to accommodate fish research or other conditions and will be coordinated through the TMT and other appropriate regional forums.

Management of Spill for Fish Passage

The Corps will manage spill levels for fish passage to avoid exceeding 120% total dissolved gas (TDG) in project tailraces, and 115% TDG in the forebay of the next project downstream consistent with the current State of Washington percent TDG limits.[2] These limits are referred to as gas caps. The maximum project spill level that meets, but does not exceed, the gas cap is referred to as the spill cap. Gas caps are constant, whereas spill caps may vary daily depending on flow, spill operation, spill pattern, temperature, and other environmental conditions.

As noted above, the spill levels presented below in Tables 2 and 3 are planned spill operations and assume average runoff conditions; however, adjustments to these spill rates may be necessary. Reasons for these adjustments may include:

1. Low runoff conditions that may require adjustments in spill level while still meeting project minimum generation requirements.
2. High runoff conditions where flows exceed the powerhouse hydraulic capacity with the specified spill rates.
3. Navigation safety concerns.
4. Generation unit outages that reduce the powerhouse hydraulic capacity.
5. Power system or other emergencies that reduces powerhouse outflow.
6. Lack of power demand resulting in an increase in spill levels.

The Corps' Reservoir Control Center (RCC) is responsible for daily management of spill operations responsive to changing TDG conditions. In order to manage gas cap spill levels consistent with the states' TDG saturation limits, the RCC establishes the TDG spill caps for the lower Columbia and Snake River projects on a daily basis throughout the fish passage season. The resultant TDG spill caps are set to provide percent TDG saturation levels that are not expected to exceed the 120%/115% TDG limits, which are measured as the average of the highest 12 hourly readings for each day.

Within any given day, some hours of measured TDG levels may be higher or lower than the gas caps due to changing environmental conditions (wind, air temperature, etc.). The process of establishing daily spill caps entails reviewing existing hourly data at each dam

[2] The 2010 Supplemental BiOp provides: "Specific spill levels will be provided for juvenile fish passage at each project, not to exceed established TDG levels (either 110 percent TDG standard, or as modified by State water quality waivers, currently up to 115 percent TDG in the dam forebay and up to 120 percent TDG in the project tailwater…". In February 2009, the State of Oregon modified its 5-year waiver to remove the 115% forebay TDG limit. However, the Corps will continue to manage to 120% and 115% (the Washington TDG standard) consistent with the 2011 Court Order in 2012.

(including flow, spill, temperature, and TDG levels) and taking into consideration a number of forecast conditions (including total river flow, powerhouse flow, wind and temperature forecast, etc.). These data are used as input variables into the System TDG (SYSTDG) model. The SYSTDG model estimates TDG levels expected several days into the future and is a tool integral to daily decision-making when establishing spill caps at individual dams. Spill caps set by RCC and contained in the daily spill priority list will be met at the projects using the individual project spill pattern(s) contained in the FPP Sections 2 through 9, that most closely corresponds to the specified spill level (i.e. may be slightly over or under the specified spill level or percent value). During the spring freshet, when river flow may be greater than project powerhouse hydraulic capacity given the specified FOP spill level, or a lack of power load results in an increase in the spill level, the Corps will attempt to minimize TDG on a system-wide basis. In this case, spill caps are also developed for 122%, 125%, 127%, 130%, or 135% TDG as a means of minimizing TDG throughout the system.

The Corps will initiate spill at 0001 hours, or shortly after midnight, at each of the projects on the start dates specified in the project sections below. Spill caps will be established at the specified FOP levels and will continue unless conditions require changing to maintain TDG within the upper limits of 120% in the tailwater of a dam and 115% in the forebay of the next project downstream (and at Camas/Washougal[3] - except during summer testing). Unless otherwise specified, spill will transition to summer levels at 0001 hours, or shortly after midnight, at each project on the day after spring spill ends, (specified in the project sections below). Operations to manage TDG will continue to be coordinated through the TMT.

Spillway Operations

The Action Agencies will meet the specified spill levels to the extent feasible; however, actual hourly spill levels at each dam may be slightly more or less than those specified in Tables 2 and 3 below. Actual spill levels vary depending on the precision of spill gate settings, flow variations in real time, varying project head (the elevation difference between a project's forebay and tailwater), automatic load following, and other factors.

Operational Considerations:

- Spill levels: Project spill levels listed in Tables 2 and 3 coincide with specific gate settings in the FPP project spill pattern tables. Due to limits in the precision of spill gates and control devices, short term flow variations, and head changes, it is not always possible to meet the exact spill levels identified in Tables 2 and 3 or in RCC spill requests (teletypes) to specific projects. Therefore, spillway gates are opened to the gate settings identified in the FPP project spill pattern tables to provide spill levels that are the closest to the prescribed FOP spill levels.

3 The Camas/Washougal TDG fixed monitoring site is located approximately 24 miles downstream of Bonneville Dam and is used to simulate a forebay gauge for Bonneville Dam.

- Spill percentages: Spill percentages are considered target spill levels. The project control room operator and BPA duty scheduler calculate spill levels to attempt to be within ±1% of the target percentage for the following hour (or more than ±1% at The Dalles and Little Goose dams as specified in FPP Sections 3 and 8 spill pattern tables). Prescribed or specified spill percentages in Tables 2 and 3 may not always be attained due to low flow conditions and minimum generation requirements (Table 1), TDG gas cap limitations, temporary spill curtailment for navigation safety, and other unavoidable circumstances. Operators and schedulers review the percentages achieved during the day and adjust spill levels in later hours, with the objective of ending the day with a daily average spill percentage that achieves the specified spill percentage.

Minimum Generation

Both Snake and Columbia River dams have a minimum generation requirement that has been established to maintain power system stability and reliability. The Corps has identified minimum generation powerhouse outflow values derived from actual generation records when turbines were operating within ±1% of best efficiency (Table 1). Values stated in Table 1 are approximations that account for varying head or other small adjustments in turbine unit operation that may result in variations from the reported minimum generation flow and spill amount. Conditions that may result in minor variations include:

1. Varying pool elevation: as reservoirs fluctuate within the operating range, flow rates through the generating unit change.
2. Generating unit governor "dead band": the governor controls the number of megawatts the unit should generate, but cannot precisely control a unit flow; variations may be 1-2% of unit flow.
3. System disturbances: once a generator is online and connected to the grid, it responds to changes in system voltage and frequency. These changes may cause the unit to increase or decrease flow and generation slightly within an hour. Individual units operate differently from each other and often have unit specific constraints.
4. Generation control systems regulate megawatt (MW) generation only; not flow through individual turbine units.

All of the lower Snake River powerhouses may be required to keep one generating unit on line at all times for power system reliability under low river flow conditions, which may result in a reduction of spill at that project. These projects have two “families” of turbines with slightly different capacities – small and large. In most cases during low flow conditions, one of the smaller turbine units (with reduced generation and flow capabilities) will be online. The smaller turbine units are generally numbered 1–3 and are the first priority for operation during the fish passage season. If smaller turbine units are unavailable, larger units may be used.

During low river flow events, the operating unit generally runs at the lower end of the ±1% of best efficiency range. At Lower Monumental Dam, however, turbine unit 1 (the first priority unit during fish passage) cannot operate at the low end of the design range because it has welded blades. Ice Harbor turbine units cannot be operated at the lower end of the ±1% of best efficiency range because these units experience cavitation, which damages the turbine runner and can be detrimental to fish. Therefore, Ice Harbor turbine units will operate at their lower cavitation limits. Minimum generation flow ranges at McNary, John Day, and The Dalles dams are 50-60 kcfs and 30-40 kcfs at Bonneville, as shown in Table 1.

Table 1.— Minimum generation ranges for turbine units at the four lower Snake and four lower Columbia River dams.

Project	**Turbine Units**	**Minimum Generation (kcfs)**
Lower Granite	1-3	11.3-13.1
	4-6	13.5-14.5
Little Goose	1-3	11.3-13.1
	4-6	13.5-14.5
Lower Monumental	1	16.5-19.5
	2-3	11.3-13.1
	4-6	13.5-14.5
Ice Harbor	1, 3-6	8.5-10.3
	2	11.3-13.1
McNary	N/A	50-60
John Day	N/A	50-60
The Dalles	N/A	50-60
Bonneville	N/A	30-40

Low Flow Operations

Low flow operations at lower Snake and Columbia River projects are triggered when inflow is not sufficient to meet both minimum generation requirements and planned FOP spill levels listed in Tables 2 and 3. In these situations, Snake River projects will operate one turbine unit at the minimum generation outflow and spill the remainder of inflow at the project. Columbia River projects will also operate at minimum generation and pass the remaining inflow as spill down to minimum spill levels. As river flow transitions from higher flow to low flow, there may be situations when maintaining minimum generation and the target spill identified in Tables 2 and 3 may not be possible every hour, since these projects have limited flexibility. During the transition phase, flow may recede at a higher rate than forecasted and inflow provided by non-Federal projects upstream is often variable and uncertain. The combination of these factors may result in instances where unanticipated changes to inflow cause forebay elevations to go outside of the normal minimum operating pool (MOP) ranges for Snake River projects as provided for in the 2010 Supplemental BiOp.

During low flow conditions when the navigation lock is being emptied at some projects, the total spill volume remains constant, but the spill reported as a percent of total flow may be temporarily reduced below the target spill percentage. This occurs because the volume of water needed to empty the navigation lock during periods of low flow is a greater percentage of the total flow than when river flow is higher.
At Little Goose Dam, when daily average flow in the lower Snake River is ≤32 kcfs, achieving 30% spill would require switching powerhouse operations between operating two units at the low end of the ±1% of best efficiency range to operating one unit at the high end of the ±1% of best efficiency range. This operation, in combination with constant inflow from Lower Granite Dam, often makes it difficult to achieve the FOP prescribed spill level downstream at Lower Monumental Dam and to also maintain MOP operations. In years past, through coordination with TMT during low flow periods, Little Goose spill operations changed from 30% to a constant spill level of approximately 7-11 kcfs to smooth out Little Goose outflow, meet Lower Monumental FOP specified spill levels, and maintain the MOP elevation at Little Goose. A similar operation will be implemented in 2012, if necessary, depending on river flow.

Operations during Rapid Load Changes

Project operations during hours when power system load and/or intermittent generation changes rapidly, may result in not meeting FOP specified hourly spill levels because projects must be available to respond to within-hour load variability to satisfy North American Electric Reliability Council (NERC) reserve requirements ("on response"). This usually occurs at McNary, John Day, and The Dalles dams. In addition to within-hour load variability, projects on response must be able to respond to within hour changes that result from intermittent generation (such as wind generation). During periods of rapidly changing loads and intermittent generation, projects on response may have significant changes in turbine flow within the hour, while the spill quantity remains the same within the hour. Under normal conditions, within-hour load changes occur mostly on hours immediately preceding and after the peak load hours; however, within-hour changes in intermittent generation can occur at any hour of the day. Due to the high variability of within-hour load and intermittent generation, these load swing hours may have a greater instance of reporting actual spill percentages that vary more than the ±1% requirement in other hours.

Turbine Unit Testing around Maintenance Outages

Turbine units may be operationally tested for up to 30 minutes by running the unit at speed no load and various loads within the 1% of best efficiency range to allow for pre-maintenance measurements and testing, and to allow all fish to move through the unit. Units may be operationally tested after maintenance or repair, but before a unit comes out of a maintenance or forced outage status. This testing may consist of running the unit for up to 30 minutes before it is returned to operational status. Testing of a unit under maintenance is in addition to a unit operating at minimum generation required for power system reliability. Testing may deviate from unit operating priorities specified in FPP sections 2-9 and may use water that would otherwise be used for spill if the running unit

for reliability is at the bottom of the ±1% of best efficiency range. Water will be used from the powerhouse outflow allocation if possible, and water diverted from spill for operational testing will be minimized. Consistent with the 2011 Court Order and previous years, the Corps will coordinate this testing with the region through the Fish Passage Operations and Maintenance (FPOM) group.

Navigation Safety

Short-term adjustments in spill may be required for navigation safety, primarily at the lower Snake projects, but may also be necessary at the lower Columbia projects. This may include changes in spill patterns, reductions in spill, or short-term spill curtailment. In addition, unsteady flow at Little Goose and Ice Harbor dams during low flow conditions may impact reservoir elevations at those projects and cause inadequate navigation depths at the downstream entrances to the Lower Granite and Lower Monumental navigation locks. Therefore, adjustments to pool elevation in the Little Goose pool and Ice Harbor pool, of up to 1.0 ft. above the MOP operating range may be necessary to accommodate safe entrance to the navigation locks at Lower Granite and Lower Monumental dams during periods of low flow (approximately 50 kcfs or less) and will be coordinated in TMT. These adjustments may be necessary for both commercial tows and fish barges. Additionally, to accommodate safe navigation, the Lower Granite pool will be operated up to MOP+2 ft. depending on river flow, consistent with operations coordinated in 2011[4].

JUVENILE FISH TRANSPORTATION PROGRAM OPERATIONS

As noted above, the Corps' planned spill operations assume average runoff conditions. In previous years, the FOP provided that spill for fish passage would occur under all flow conditions.[5] To improve survival of juvenile migrants, the 2010 Supplemental BiOp calls for an annual review of the previous year's fish survival information and discussion with the Regional Implementation Oversight Group (RIOG) to inform transport/spill operations for the subsequent year. After considering the best available information and taking into account input from regional sovereigns, the Corps will continue implementation of the 2011 juvenile fish transportation program operations at the Snake River collector projects in 2012. These operations will continue spill levels specified in Tables 2 and 3 independent of flow conditions. River flow and fish condition will be monitored, and if regional sovereigns recommend adjustments in spill and/or transportation operations that differ from those stated herein, the Corps will use the regional coordination process to make a determination on recommended operational changes.

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[4] Flow specific criteria under the variable-MOP operation are as follows: If inflow is ≥120 kcfs, then operate at 733.0-734.0 ft. (MOP); if inflow is 80-119 kcfs, then operate at 734.0-735.0 ft. (MOP+1); if inflow 50-79 kcfs, then operate at 734.5-735.5 ft. (MOP+1.5); if inflow is ≤49 kcfs, then operate at 735.0-736.0 ft. (MOP+2).

[5] The 2009 FOP provided: "In exceptionally low water years, when the projected seasonal average flow is less than 70 kcfs, the Corps will begin transportation on April 20 at all three Snake collector projects. Spill for fish passage will occur under all flow conditions."

The following describes the proposed transportation operations for the lower Snake River projects. Detailed descriptions of project and transport facility operations to implement the juvenile fish transportation program are contained in the FPP Appendix B.

Lower Snake River Dams - Operation and Timing

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).

The collection of fish at lower Snake River projects for transportation will commence at 0700 hours on the agreed to start dates. Barging of fish will begin the following day 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 operations will be carried out at each project in accordance with all relevant FPP operating criteria.

Transportation and spill operations may be adjusted due to research, conditions at fish collection facilities such as overcrowding or temperature extremes, through the adaptive management process with FPOM and/or TMT to better match juvenile outmigration timing or achieve/maintain performance standards.

McNary Dam - Operation and Timing

Transportation will be initiated at McNary Dam between July 15–30 per the 2010 Supplemental BiOp (RPA 30, Table 4) and in coordination with NOAA Fisheries and the TMT. Fish will be transported from McNary Dam by barge through August 16, then transported by truck every other day. All fish collected will be transported except those marked for in-river studies. Fish are expected to be transported through September 30. The presence of factors such as excess shad, algae or bryozoans that can clog screens and flumes may result in discontinuing transport operations at McNary Dam before September 30. Detailed criteria for McNary transport are contained in the FPP, Appendix B.

Transportation operations may be adjusted for research purposes, due to conditions at the collection facilities, or as a result of the adaptive management process (to better match juvenile outmigration timing and/or to achieve or maintain performance standards). If new information indicates that modifying (or eliminating) transportation operations at McNary Dam is warranted, adaptive management will be used to make appropriate adjustments through coordination with the FPOM/TMT.

SPRING SPILL OPERATIONS

Lower Snake River Projects

Spring spill will begin on April 3 at Lower Granite, Little Goose, Lower Monumental, and Ice Harbor dams. Spring spill operations will continue through June 20. However, fish run timing and research schedules may require an earlier transition date to summer operations to assure that research occurs during the bulk of the migration. Such changes will be coordinated through TMT. Spring spill levels for Snake River dams are shown in Table 2.

Lower Columbia River Projects

Spring spill will begin April 10 at McNary, John Day, The Dalles, and Bonneville dams. Spring spill operations will continue through June 30 at John Day, and The Dalles dams, through June 19 at McNary Dam, and through June 15 at Bonneville Dam. However, fish run timing and research schedules may require earlier transition dates to summer spill operations to assure that research occurs during the bulk of the migration. Such changes if necessary will be coordinated through the TMT. Spring spill operations are shown in Table 2.

SUMMER SPILL OPERATIONS

Lower Snake River Projects

Summer spill will begin on June 21 at Lower Granite, Little Goose, Lower Monumental and Ice Harbor dams and continue through August 31 at all four Snake River projects. Summer spill levels are shown in Table 3.

Lower Columbia River Projects

Summer spill will begin June 16 at Bonneville Dam, June 20 at McNary Dam, and July 1 at John Day and The Dalles dams and continue through August 31 at all four Columbia River projects. Summer spill levels are shown in Table 3.

PROJECT BY PROJECT OPERATIONS

The following sections describe 2012 spill operations for each project. Included in the descriptions are planned research activities identified in the 2010 Supplemental BiOp. The Corps, regional fishery agencies, and Tribes are interested in the continuation of project research studies under the Corps' Anadromous Fish Evaluation Program (AFEP). These studies have been evaluated through the annual AFEP review process with the regional fishery agencies and Tribes, with the study designs being finalized prior to initiation in 2012. The studies are intended to provide further information on project survival that will help inform the region in making decisions on future operation and

configuration actions to improve fish passage and survival and meet BiOp performance standards at the lower Snake and Columbia River dams.

Table 2.— Summary of 2012 spring spill levels at lower Snake and Columbia River projects.[6]

Project	**Planned 2012 Spring Spill Operations (Day/Night)**	**Comments**
Lower Granite	20 kcfs/20 kcfs	Same as 2011
Little Goose	30%/30%	Same as 2011
Lower Monumental	Gas Cap/Gas Cap (approximate Gas Cap range: 20-29 kcfs)	Same as 2011
Ice Harbor	**April 3-April 28:** 45 kcfs/Gas Cap **April 28-June 20:** 30%/30% vs. 45 kcfs/Gas Cap (approximate Gas Cap range: 75-95 kcfs)	Same as 2011
McNary	40%/40%	Same as 2011
John Day	**Pre-test:** 30%/30% **Testing:** 30%/30% and 40%/40%	Same as 2011
The Dalles	40%/40%	Same as 2011
Bonneville	100 kcfs/100 kcfs	Same as 2011

[6] Table 2 summarizes the planned spring spill operations. More specific detail governing project operations is included in project specific sections.

Table 3.— Summary of 2012 summer spill levels at lower Snake and Columbia River projects.[7]

Project	Planned 2012 Summer Spill Operations (Day/Night)	Comments
Lower Granite	18 kcfs/18 kcfs	Same as 2011
Little Goose	30%/30%	Same as 2011
Lower Monumental	17 kcfs/17 kcfs	Same as 2011
Ice Harbor	**June 21-July 13:** 30%/30% vs. 45 kcfs/Gas Cap **July 13-August 31:** 45 kcfs/Gas Cap (approximate Gas Cap range: 75-95 kcfs)	Same as 2011
McNary	50%/50%	Same as 2011
John Day	**July 1-July 20:** 30%/30% and 40%/40% **July 20-August 31:** 30%/30%	Same as 2011
The Dalles	40%/40%	Same as 2011
Bonneville	**June 16-July 20:** 85 kcfs/121 kcfs and 95 kcfs/95 kcfs **July 21-August 31:** 75 kcfs/Gas Cap	Same as 2011

Lower Granite

Spring Spill Operations April 3 through June 20: 20 kcfs 24 hours per day.

Summer Spill Operations June 21 through August 31: 18 kcfs 24 hours per day.

Changes in Operations for Research Purposes:

- Research operations: There are no special spill operations for research planned in 2012. Established spill patterns as described in FPP Section 9 will be used.

Operational Considerations:

- Lack of power load or unexpected unit outages could cause involuntary spill at higher total river flow that could result in exceeding the gas cap limits.
- During periods of high spring runoff when involuntary spill occurs, there may be periods where spill levels create unsafe hydraulic conditions for commercial, non-commercial, and fish transportation barges entering and exiting the tailrace and/or while moored at the fish loading facility. If such runoff conditions occur, spill may be reduced temporarily when fish transport barges approach or leave the barge

[7] Table 3 summarizes the planned summer spill operations. More specific detail governing project operations is included in project specific sections.

docking area or are moored at loading facilities. If conditions warrant a spill reduction for any navigational passage, Lower Granite pool MOP elevation restrictions may be temporarily exceeded until the barge/vessel exits the tailrace safely and spill resumes.

- Unit outages may occur for required or emergency unscheduled maintenance activities described in FPP Appendix A. Maintenance dates are subject to change.

Little Goose

Spring Spill Operations April 3 through June 20: 30% spill 24 hours per day. The spillway weir closure gate will be raised as soon after 0630 hours on April 3 as weather permits.

Summer Spill Operations June 21 through August 31: 30% spill 24 hours per day.

Changes in Operations for Research Purposes:

- Research operations: Performance standard testing at 30% spill will occur in spring and summer 2012 at Little Goose Dam. Testing will begin in late April and continue through mid-July. The dates of testing will be dependent on the size and availability of fish for tagging. Final dates for testing will be coordinated through the Studies Review Workgroup (SRWG). Established spill patterns as described in FPP Section 8 will be used.
- Objectives of the biological test: The objectives of the test are to assess passage distribution and efficiency metrics, forebay retention and tailrace egress times, and dam survival for yearling Chinook, juvenile steelhead, and subyearling Chinook to determine if juvenile dam survival at 30% spill under the current project configuration meets or exceeds the juvenile dam survival performance standard for spring (96%) and summer (93%) migrants specified in the 2010 Supplemental BiOp.

Operational Considerations:

- Daily average flows in the lower Snake River of ≤32 kcfs can result in incompatible operations with Lower Monumental Dam and cause spill quantity fluctuations. Alternative Little Goose operations to resolve this issue are described in the Low Flow Operations section above and will be coordinated through the FPOM/TMT.
- Unit outages may occur for required or emergency unscheduled maintenance activities described in FPP Appendix A. Maintenance dates are subject to change.
- Turbine Unit 1 Operation: Operating range will be set within the GDACS program for Little Goose Dam to restrict Turbine Unit 1 operation to approximately the upper 25% of the 1% of best efficiency range (about 16-17.5 kcfs). This will ensure a strong current along the south shore to counter the strong eddy that forms in the tailrace during certain spill conditions. A strong south shore current in the tailrace is important for both adult fish passage and juvenile fish egress. If low flow conditions occur in the spring, the full ±1% of best efficiency range will be restored to minimize impacts on spill levels.

Lower Monumental

Spring Spill Operations April 3 through approximately June 20: Spill to the 115/120% TDG gas cap 24 hours per day.

Summer Spill Operations Approximately June 21 through August 31: 17 kcfs 24 hours per day.

Changes in Operations for Research Purposes:

- Research operations: Performance standard testing at the TDG Gas Cap (spring) and at 17 kcfs (summer) spill will occur in 2012 at Lower Monumental Dam. Testing will begin in late April and continue through mid-July. The dates of testing will be dependent on the size and availability of fish for tagging. Final dates for testing will be coordinated through the SRWG. The "bulk" spill pattern as described in FPP Section 7 will be used. Based on a previous year's study results, dam survival is higher using the "bulk" spill pattern compared to the "uniform" spill pattern.
- Objectives of the biological test: The objectives of the test are to assess passage distribution and efficiency metrics, forebay retention and tailrace egress times, and dam survival for yearling Chinook, juvenile steelhead, and subyearling Chinook to determine if juvenile dam survival at Gas Cap (spring) and 17 kcfs (summer) spill under the current project configuration meets or exceeds the juvenile dam survival performance standard for spring (96%) and summer (93%) migrants specified in the 2010 Supplemental BiOp.

Operational Considerations:

- Consistent with adjustments made in 2011 spring operations through regional coordination, when total river flow is likely to exceed turbine capacity and spill over the 120% TDG gas cap (occurs at a total river flow of ~140 kcfs) for three or more days, the project will use the uniform spill pattern. This may also occur if spill over the 120% TDG gas cap is required due to "lack of demand" spill at any river flow level.
- Daily average flows of ≤32 kcfs can result in incompatible operations with Little Goose Dam and may cause spill quantity fluctuations.
- Transit of the juvenile fish barge across the Lower Monumental tailrace, then docking at and departing from the fish collection facility, may require spill level to be reduced due to safety concerns. The towboat captain may request that spill level be reduced or eliminated during transit. During juvenile fish loading operations, spill is typically reduced to 15 kcfs, but can be reduced further if necessary for safety reasons. Barge loading duration can be up to 3.5 hours. Because of the time needed to complete loading at Lower Monumental, the Little Goose Project personnel will notify the Lower Monumental personnel when the fish barge departs from Little Goose. This ensures that BPA scheduling is provided advance notice for spill control at Lower Monumental Dam. Reducing spill may cause the Lower Monumental pool to briefly operate outside of MOP elevations.

- Operating units within the 1% of best efficiency range translates to as much as 19 kcfs discharge for each of the 6 turbine units, for a maximum hydraulic capacity of approximately 114 kcfs. The expected spill cap is roughly 27 kcfs (but varies depending on total river flow). Therefore, if total river flow is greater than 141 kcfs the gas cap will be exceeded. Either lack of power load or unit outages can also cause forced spill above spill cap limits at higher total river flow.
- Unit outages may occur for required or emergency unscheduled maintenance activities described in FPP Appendix A. Maintenance dates are subject to change.

Ice Harbor

Spring Spill Operations April 3 through June 20: Spill will begin at 45 kcfs day/spill cap night on April 3 and continue until April 28. On April 28, spill will alternate between 45 kcfs day/spill cap night and 30% /30% with the SW operating and continue through the spring season. Nighttime spill hours are 1800–0500.

Summer Spill Operations June 21 through August 31: Spill operations will continue from spring at 30% 24 hours per day vs. 45 kcfs day/Gas Cap night until July 13 at 0500 hours, then 45 kcfs day/Gas Cap night through August 31.

Changes in Operations for Research Purposes:

- Research operations: There are no special spill operations for research planned in 2012. Spill patterns as described in FPP Section 6 will be used.

Operational Considerations:

- Spill operation treatments may be rearranged within a week throughout the season. If rearrangement of treatments occurs, the total number of each spill level treatment for the spring season will not change. The flexibility to rearrange treatments during periods of higher power demand may alleviate the need to declare a power emergency.
- Powerhouse capacity at Ice Harbor is approximately 94 kcfs with all 6 units operating within the 1% of best efficiency range, while spill cap rates are about 100 kcfs. If total river flow exceeds about 194 kcfs, TDG levels may exceed the water quality standards set by the States of Oregon and Washington.
- Unit outages may occur for required or emergency unscheduled maintenance activities described in FPP Appendix A. Dates are subject to change.
- Submersible Traveling Screens (STSs) will be installed by April 1. The normal juvenile bypass operation will be to route fish through the full flow bypass pipe, which has interrogation capability to monitor for PIT tags. From April 1 through July 31, juvenile fish will be sampled every 3 to 5 days to monitor fish condition and then bypassed to the river. Sampling activity may be terminated early should juvenile bypass fish numbers drop to the point where valid sampling is no longer feasible (100 fish of the most dominant species present are needed to properly assess fish

condition). Sampling may also cease if the cumulative number of fish sampled for the season reach the permitted maximum.

McNary

Spring Spill Operations April 10 through approximately June 19: 40% spill 24 hours per day with the two spillway weirs operating. A spillway weir will be operated in both spillbay 19 and spillbay 20 for the period April 10 through June 6. As in past years, both spillbay weirs will be removed from service by June 8 (or next business day as coordinated through the FPOM) for the benefit of subyearling Chinook. This operational change will be coordinated through the Fish Facility Design Review Workgroup (FFDRWG), FPOM, the Tribes, and NOAA. Temporary spill pattern changes to allow removal of the spillway weirs will occur, however spill will continue at 40% during the spillway weir removal process. Following removal of the spillway weirs, the spill pattern contained in Table MCN-10 in FPP section 5 will be used for the remainder of the spring.

Summer Spill Operations June 20 through August 31: 50% spill 24 hours per day without spillway weirs.

Changes in Operations for Research Purposes:

- Research operations: Performance standard testing at 40% spill the spring and 50% during the summer will occur in 2012 at McNary Dam. Testing will begin in late April and continue through mid-July. The dates of testing will be dependent on the size and availability of fish for tagging. Final dates for testing will be coordinated through the SRWG. Spill patterns as described in FPP Section 5 will be used.
- Objectives of the biological test: The objectives of the test are to assess passage distribution and efficiency metrics, forebay retention and tailrace egress times, and dam survival for yearling Chinook, juvenile steelhead, and subyearling Chinook to determine if juvenile dam survival at 40% (spring) and 50% (summer) spill under the current project configuration meets or exceeds the juvenile dam survival performance standard for spring (96%) and summer (93%) migrants specified in the 2010 Supplemental BiOp.

Operational Considerations:

- Juvenile fish collected at McNary during the spring FOP implementation period will be bypassed to the river. The normal operation will be to bypass fish through the full flow bypass pipe, which has interrogation capability to monitor for PIT tags. Every other day, however, in order to sample fish for the Smolt Monitoring Program, fish will be routed through the separator, interrogated for PIT tags, and then bypassed to the river.
- All extended-length submersible bar screens (ESBSs) at McNary will be installed by April 15 as agreed to in consultation with FPOM, the Tribes, and NOAA. This is part of the Corps' consideration of lifting (or waiting to install) some turbine intake screens during periods of significant juvenile lamprey passage. Effects to both

salmon and lamprey have been considered. Although there are some adverse impacts to migrating salmon from this delay in screen installation, regional sovereigns have considered this acceptable in balancing the needs of multiple species.

- Spill will be curtailed as needed to allow safe operation of fish transportation barges near collection facilities downstream of the project.
- During the periods when total river flow exceeds approximately 320 kcfs, involuntary spill in excess of the States' TDG limits for fish passage may occur.
- In addition, low power demand may also necessitate involuntary spill at total river flow of less than 320 kcfs.
- Unit outages may occur for required or emergency unscheduled maintenance activities described in FPP Appendix A. Dates are subject to change.

John Day

Spring Spill Operations April 10 through June 30: 30% spill 24 hours per day will begin on April 10 and continue until testing begins on approximately April 27. During the test, spill 30% and 40% 24 hours per day for the remainder of spring. Spill levels will alternate between 30% and 40% spill in 4-day blocks with two-day treatments. Spill level changes will occur at 0600 hours.

Summer Spill Operations July 1 through August 31: Spill operations will continue from spring at 30% and 40% spill 24 hours per day and continue through approximately July 20. Spill levels will alternate in a four-day block with two-day treatments (30% or 40% spill). Spill treatment changes will occur at 0600 hours. Once performance standard testing concludes, 30% spill 24 hours per day will begin approximately July 20 and continue through August 31.

Changes in Operations for Research Purposes:

- Research operations: Performance standard testing at 30% and 40% spill will occur in spring and summer 2012 at John Day Dam. Testing will begin in late April and continue through mid-July. The dates of testing will be dependent on the size of fish, fish availability, and the number of treatments needed for testing. Final dates for testing will be coordinated through the SRWG. Spill patterns contained in FPP section 4 will be used.
  Objectives of the biological test: The objectives of the test are to assess passage distribution and efficiency metrics, forebay retention and tailrace egress times, and dam survival for yearling Chinook, juvenile steelhead, and subyearling Chinook to determine if juvenile dam survival at 30% and/or 40% spill under the current project configuration meets or exceeds the juvenile dam survival performance standard for spring (96%) and summer (93%) migrants specified in the 2010 Supplemental BiOp.

Operational Considerations:

- Spill operation treatments may be rearranged within a week throughout the season. If rearrangement of treatment occurs, the total number of each spill level treatment for

the spring season will not change. The flexibility to rearrange treatments during periods of higher power demand may alleviate the need to declare a power emergency.

- Unit outages may occur for required or emergency unscheduled maintenance activities described in FPP Appendix A. Maintenance dates are subject to change.
- Unit outages and spillway outages may also be required to repair hydrophones and other research equipment. These will be coordinated through FPOM and TMT as needed.

The Dalles

Spring Spill Operations April 10 through June 30: 40% spill 24 hours per day.

Summer Spill Operations July 1 through August 31: 40% spill 24 hours per day.

Changes in Operations for Research Purposes:

- Research operations: Performance standard testing at 40% spill will occur in summer 2012 at The Dalles Dam. Testing will begin in June and continue through mid-July. The dates of testing will be dependent on the size and availability of fish for tagging. Final dates for testing will be coordinated through the SRWG. Spill patterns developed for use with the spillwall and included in FPP section 3 will be used.
- Objectives of the biological test: The objectives of the test are to assess passage distribution and efficiency metrics, forebay retention and tailrace egress times, and dam survival for subyearling Chinook to determine if juvenile dam survival at 40% spill under the current project configuration meets the juvenile dam survival performance standard for summer migrants (93%) specified in the 2010 Supplemental BiOp.

Operational Considerations:

- If total river flow is between 90 and 150 kcfs, the spill percentage could range from 38.6 to 41.4 percent; if the total river flow is between 150 and 300 kcfs, the spill percentage could range from 38.9 to 41.2 percent; if the total river flow is between 300 and 420 kcfs, the spill percentage could range from 38.4 to 41.0 percent.
- At no time is spill recommended on the south side of the spillway (Bays 9-23) as this creates a poor tailrace egress condition for spillway-passed fish.
- Spill bays 10, 11, 13, 16, 18, 19, and 23 are not operational due to wire rope, structural, and concrete erosion concerns.
- The spill pattern in the FPP is based on a nominal Bonneville forebay elevation of 74 feet.
- Unit outages may occur for required or emergency unscheduled maintenance activities described in FPP Appendix A. Maintenance dates are subject to change.

Bonneville

Spring Spill Operations April 10 through June 15: 100 kcfs spill 24 hours per day.

Summer Spill Operations June 16 through August 31: Summer spill operations will alternate every two days between 85 kcfs/121 kcfs and 95 kcfs 24 hours per day. The alternating operation will begin at 0430 hours approximately June 16 and continue through July 20. Spill changes will occur according the daytime spill schedule contained in Table BON-5 in FPP section 2. Spill at 85 kcfs/121 kcfs and/or 95kcfs/95 kcfs will be unconstrained by the Camas/Washougal fixed monitoring TDG station. Following the alternating spill operation, a 75 kcfs/Gas Cap operation (managed using the Camas/Washougal fixed monitoring TDG station) will begin on July 21 and continue through August 31.

Changes in Operations for Research Purposes:

- Research operations: Performance standard testing at 85 kcfs/121 kcfs and 95 kcfs spill 24 hours per day will occur in summer 2012 at Bonneville Dam. Testing will begin in June and continue through mid-July. The dates of testing will be dependent on the size and availability of fish for tagging. Final dates for testing will be coordinated through the SRWG. Spill patterns as described in FPP section 2 will be used.
- Objectives of the biological test: The objectives of the test are to assess passage distribution and efficiency metrics, forebay retention and tailrace egress times, and dam survival for subyearling Chinook to determine if juvenile dam survival at either 85 kcfs/121 kcfs and/or 95 kcfs 24 hours per day spill under the current project configuration meets the juvenile dam survival performance standard for summer migrants (93%) specified in the 2010 Supplemental BiOp.

Operational Considerations:

- High flow conditions in 2011 moved rock and large boulders into the Bonneville spillway stilling basin. If left in place, the rock and boulders would cause significant erosion and damage to the stilling basin due to ball milling during spill. For dam safety, before spill for juvenile fish passage occurs in April 2012, this material will be removed from the stilling basin. The schedule is to complete removal of material from the stilling basin by April 1, 2012. This has been coordinated through FPOM and any schedule delays impacting the initiation of spill will be coordinated through the FPOM and TMT.
- Minimum spill level is 50 kcfs; however, as in past years, under extreme low flow conditions lower spill levels may be considered and coordinated through the TMT. This is to provide acceptable juvenile fish egress conditions in the tailrace.
- During spring, at a total river flow of less than about 135 kcfs, spill will be less than 100 kcfs to maintain minimum powerhouse generation of 30 kcfs plus fish ladder and facility spill (e.g. second powerhouse corner collector, first powerhouse sluiceway).

- The TMT will consider the possible effects of TDG on emerging chum salmon downstream of Bonneville Dam. The TMT may request special operations such as flow increases or spill reductions to protect ESA-listed fish.
- Unit outages may occur for required or emergency unscheduled maintenance activities described in FPP Appendix A. Maintenance dates are subject to change.
- Actual spill levels at Bonneville Dam may range from up to 3 kcfs lower or higher than specified in Table 2. A number of factors influence this including hydraulic efficiency, exact gate opening calibration, spillway gate hoist cable stretch due to temperature changes, and forebay elevation (a higher forebay results in a greater volume of spill since more water can pass under the spill gate).
- The second powerhouse Corner Collector (5 kcfs flow) will operate from the morning of April 10 through the remainder of the spill season as coordinated through the FPOM.
- High river flow and excessive debris load at the second powerhouse may require removal of submersible traveling screens (STSs) and vertical barrier screens (VBSs) according to criteria described in FPP Section 2 in coordination with the FPOM.

TRANSPORT AND LATENT MORTALITY RESEARCH

Seasonal Effects of Transport

A study will be conducted to determine seasonal effects of transporting fish from the Snake River to optimize a transportation strategy. At Lower Granite, fish will be collected for this study starting on April 4, with marking beginning on April 5. Depending on the number of fish available, fish will be collected 1-2 days with tagging occurring on the day following collection. A barge will leave each Thursday morning with all fish collected during the previous 1-3 days. By barging all fish (minus the in-river group) during 1 to 3 days of collection, barge densities will be maintained at a level similar to what would occur under normal transport operations that time of year. This pattern will occur in the weeks preceding general transportation and will be incorporated into general transportation once that operation begins. The desired transported sample size is 6,000 wild Chinook and 4,000 - 6,000 wild steelhead weekly for approximately eight weeks.

Latent Mortality

A study will be conducted to evaluate latent mortality associated with passage through Snake River dams. The goal of this study is to determine whether migration through Snake River dams and reservoirs causes extra mortality in Snake River yearling (spring/summer) Chinook salmon smolts. Specifically, the study will determine if life-cycle survival downstream from McNary Dam is significantly higher for yearling hatchery Chinook salmon released into the Ice Harbor Dam tailrace than for counterparts which must pass three additional dams and reservoirs after release into the Lower Granite Dam tailrace. Fish will be collected at Lower Granite Dam beginning approximately April 20, with the goal of tagging approximately 74,000 smolts of which 45,000 will be

released into the tailrace of Lower Granite Dam, and 29,000 transported by truck and released in the tailrace of Ice Harbor Dam.

EMERGENCY PROTOCOLS

The Corps and the Bureau of Reclamation will operate the projects in emergency situations in accordance with the WMP Emergency Protocol (WMP Appendix 1). This protocol identifies the process the Action Agencies will use in the event of an emergency concerning the operation of FCRPS that impacts planned fish protection measures. The most recent version of the Emergency Protocols is located at: http://www.nwd-wc.usace.army.mil/tmt/documents/wmp/2010/final/emerproto

COORDINATION

To make adjustments in response to changes in conditions, the Corps will utilize the existing regional coordination committees. Changes in spill levels when flow conditions are higher or lower than anticipated will be coordinated through the TMT. This could include potential issues and adjustments to the juvenile fish transportation program. Spill patterns and biological testing protocols that have not been coordinated to date will be finalized through the Corps' AFEP subcommittees, which include the SRWG, FFDRWG, and FPOM.

REPORTING

The Corps will provide periodic in-season updates to TMT members on the implementation of 2012 fish passage operations. The updates will include the following information:

- the hourly flow through the powerhouse;
- the hourly flow over the spillway compared to the spill target for that hour; and,
- the resultant 12-hour average TDG for the tailwater at each project and for the next project's forebay downstream.

The updates will also provide information on substantial issues that arise as a result of the spill program (e.g. Little Goose adult passage issues in 2005 and 2007), and will address any emergency situations that arise.

The Corps will continue to provide the following data to the public regarding project flow, spill rate, TDG level, and water temperature.

- Flow and spill quantity data for the lower Snake and Columbia River dams are posted to the following website every hour: http://www.nwd-wc.usace.army.mil/report/projdata.htm
- Water Quality: TDG and water temperature data are posted to the following website every hour: http://www.nwd-wc.usace.army.mil/report/total.html. These data are received via satellite from fixed monitoring sites in the Columbia and Snake rivers

every hour, and placed on a Corps public website upon receipt. Using the hourly TDG readings for each station in the lower Snake and Columbia rivers, the Corps will calculate both the highest and highest consecutive 12-hour average TDG levels daily for each station. These averages are reported at:

http://www.nwd-wc.usace.army.mil/ftppub/water_quality/12hr/wa/