Draft 2007/2008 Water Management Plan

1. Introduction

The Corps of Engineers (COE), Bureau of Reclamation (Reclamation), and Bonneville Power Administration (BPA), collectively referred to as the Action Agencies (AA), consult on the effects of the operation of the dam and reservoir projects in the Federal Columbia River Power System (FCRPS) on listed species with NOAA Fisheries (also National Marine Fisheries Service or NMFS) and the U.S. Fish and Wildlife Service (USFWS).

The purpose of the Water Management Plan (WMP) is to layout how the Action Agencies plan to operate the FCRPS projects (Bonneville Dam and above - not including the Willamette Projects or Upper Snake River) during the current water year (October – September)

1.1. 2004 Remand of the National Marine Fisheries Service Biological Opinion for the Federal Columbia River Power System

The current WMP revisions reflect provisions contained in the NOAA Fisheries Biological Opinion (BiOp), issued November 30, 2004, and titled "Consultation on Remand for Operation of the Columbia River Power System and 19 Bureau of Reclamation Projects in the Columbia Basin," Updated Proposed Action (UPA) prepared by the Corps, BPA, and the Bureau of Reclamation (Action Agencies)and released November 24, 2004, and USFWS BiOp, issued December 20, 2000, and titled "Effects to Listed Species from Operations of the Federal Columbia River Power System." The Corps prepared a Record of Consultation and Statement of Decision (ROCASOD) relative to the NOAA Fisheries BiOp in January 2005 and also prepared a ROCASOD relative to the USFWS BiOp in May 2001. The two ROCASODs state how the Corps plans to meet its ESA responsibilities to protect multiple ESA-listed fish species.

The 2004 UPA can be found at
http://www.salmonrecovery.gov/Biological_Opinions/FCRPS/biop_remand_2004/docs/upa_final/FinalUPANov242004.pdf.
The NOAA Fisheries 2004 FCRPS BiOp can be found at
http://www.salmonrecovery.gov/biological_Opinions/FCRPS/biop_remand_2004/index.cfm.
The 2004 Final UPA and NOAA Fisheries BiOp were prepared in response to the court ordered remand of the 2000 NMFS FCRPS BiOp in National Wildlife Federation v. NMFS.
In May 2005, the District Court of Oregon invalidated the 2004 NOAA Fisheries FCRPS BiOp. In October 2005, the Court remanded the BiOp to NOAA Fisheries to produce a BiOp consistent with the Court's order by October 2006. The Court has granted extensions with the current deadline for completing a final BiOp is May 5, 2008. The Court also ordered NOAA Fisheries and the Action Agencies to collaborate with sovereign states and tribes on the development of a new proposed action and a jeopardy framework. During the remand, the Court left the 2004 NOAA Fisheries BiOp in effect. Remand discussions are now occurring, both to determine annual river operations and longer range actions to protect ESA-listed anadromous fish species.

Also during the ongoing remand, the Action Agencies have reached agreement on interim operations with some interested parties, on a seasonal basis. A new draft Biological Opinion was issued on October 31, 2007. At the current time while new BiOp is being worked on the plan is to operate the project for fisheries purposes according to the 2008 Fish Operations Plan (see below)

1.2. 2008 Fish Operations Plan

For 2008, the Corps will operate for fish passage in accordance with the 2008 Fish Operations Plan (FOP) as directed by the court order issued by the U. S. District Court of Oregon on February 25, 2008. The 2008 FOP is included as Appendix E of the FPP.

The 2008 FOP describes actions by the Corps to implement project operations for fish passage at its Federal Columbia River Power System (FCRPS) dams during the April – August 2008 fish migration season. The 2008 FOP was prepared by repeating the 2007 operations, with modifications limited only to those needed to account for new structures that were not in place in 2007 and for continuation or initiation of planned essential research. Consistent with the 2004 Biological Opinion adaptive management strategy, water management and project operations for fish passage not addressed in this FOP will be consistent with the operations considered in the 2004 Biological Opinion and in particular, the 2008 Water Management Plan and 2008 FPP. Additionally, this plan incorporates operational adjustments necessary to perform essential research and to accommodate the installation or adjustment of surface bypass structures subsequent to the 2007 migration season. The structural modifications necessitating changes in operations are: (1) installation of a removable spillway weir (RSW) at Lower Monumental Dam; (2) installation of two prototype temporary spillway weirs (TSWs) at John Day Dam; and, (3) moving one of the two TSWs at McNary Dam to a different spill bay. In addition, the FOP describes operations during low flow periods and load swing hours which occurred in 2007 and were reported to the court.

Actions that are specified in the 2008 FOP will be referenced in the WMP to avoid duplication.

1.3. U.S. Fish and Wildlife 2000 FCRPS Biological Opinion and 2006 Libby Dam Biological Opinion

The 2000 USFWS FCRPS Biological Opinion, "Effects to Listed Species from Operation of the Federal Columbia River Power System," is operative for all the FCRPS projects except for Libby Dam and can be found at: http://www.fws.gov/pacific/finalbiop/BiOp.html
That Biological Opinion is also the subject of litigation pending in the District of Montana, Center for Biological Diversity and State of Montana et al. v. U.S. Fish and Wildlife Service. The USFWS released the “Fish and Wildlife Service Biological Opinion Regarding the Effects of Libby Dam Operations on the Kootenai River White Sturgeon, Bull Trout and Kootenai Sturgeon Critical Habitat” on February 18, 2006. The Libby Dam BiOp can be found at: http://www.fws.gov/easternwashington/documents/Final%20Libby%20Dam%20BiOp%202-18-06lr3.pdf.

The Corps of Engineers prepared a Determination and Finding of Columbia River Flood Control Operation at Libby Dam for the 2008 Operating Year. This document (located http://www.nws.usace.army.mil/PublicMenu/documents/LIBBY_BIOP/Libby_2008_Ops_Determination&FindingSigned.pdf) describes the implementation of flood control procedures that can be expected at Libby Dam in 2008.

1.4. Upper Snake Biological Assessment and Biological Opinion,

In November 2004, the U.S. Department of the Interior, Bureau of Reclamation (Reclamation) initiated formal consultation under Section 7 of the Endangered Species Act (ESA) by submitting a biological assessment (BA) to the U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service (NMFS). The *Biological Assessment for Bureau of Reclamation Operations and Maintenance in the Snake River Basin above Brownlee Reservoir* (2004 Upper Snake BA) (USBR 2004a) described 12 separate actions involving operations and routine maintenance at 12 Federal projects located upstream of Brownlee Reservoir and evaluated the potential effects of those actions on ESA-listed endangered or threatened species and their designated critical habitat. The 2004 Upper Snake BA can be found at: http://internet.pn.usbr.gov/programs/UpperSnake/2004ba/index.html.

Reclamation received a Biological Opinion from NMFS in March 2005 (2005 Upper Snake BiOp) (NMFS 2005a) concluding that Reclamation's proposed actions were not likely to jeopardize the continued existence of 13 species of Columbia River basin salmon and steelhead or to adversely modify or destroy designated critical habitat. The 2005 Upper Snake BiOp can be found at: http://seahorse.nmfs.noaa.gov/pls/pcts-pub/sxn7.pcts_upload.summary_list_biop?p_id=22363.

In 2005, American Rivers and others filed a suit alleging Administrative Procedures Act (APA) and ESA violations (*American Rivers v. NOAA Fisheries*). On May 23, 2006, Oregon U.S. District Judge James Redden held that NMFS' March 2005 Upper Snake BiOp contained flawed analysis and did not comply with the ESA or APA. On September 26, 2006, Judge Redden issued an Opinion and Order of Remand providing details on how Federal defendants must revise the consultation to correct these deficiencies.

In response to this Order of Remand, Reclamation has prepared a biological assessment (2007 Upper Snake BA) to analyze its proposed actions consistent with the Court's findings and assist NMFS with the preparation of a BiOp that will comply with ESA and satisfy the direction given by the Court in its Orders. This 2007 Upper Snake BA builds upon and updates as appropriate information contained in the 2004 Upper Snake BA, incorporating by reference factual information and replacing the analyses in accordance with the Court's opinion. The 2007 Upper Snake BA can be found at: http://internet.pn.usbr.gov/programs/UpperSnake/index.html.

Judge Redden also ordered that the upper Snake remand be integrated with the FCRPS remand to ensure a comprehensive analysis. In order to integrate the upper Snake and FCRPS analyses, the action agencies incorporated information from both river basins into a biological analysis for each species so that a collective or comprehensive conclusion can be made as to the status of each species. These biological analyses are contained in a separate document entitled Comprehensive Analysis of the Federal Columbia River Power System and Mainstem Effects of Upper Snake and Other Tributary Actions (Comprehensive Analysis) (USACE et al. 2007). The

Comprehensive Analysis can be found at:
http://www.salmonrecovery.gov/biological_opinions/fcrps/ba-ca/index.cfm.
NOAA Fisheries will use the Comprehensive Analysis and both BA documents to develop the new Biological Opinions for operation of the FCRPS and the Upper Snake projects. The current date for completing both final biological opinions is May 5, 2008

1.5. Preparation of Plans

The Action Agencies have prepared this WMP for 2008 as part of the implementation planning process outlined in the 2004 UPA concerning the operation of FCRPS dams. This plan describes how the FCRPS dams and reservoirs (not including the Willamette projects or Upper Snake River) will be operated for the 2008 water year (October 1, 2007 through September 30, 2008) to implement water management measures in a manner consistent with the actions proposed in 2008 FOP, the UPA, and called for in the USFWS BiOp, and to make progress towards meeting the biological performance standards specified in the NOAA 2004 FCRPS BiOp while also meeting non-BiOp related requirements and purposes such as flood control, hydropower, irrigation, navigation, and recreation. For a detailed description of flood control see http://www.nwd-wc.usace.army.mil/report/colriverflood.htm. Each fall, the Action Agencies will prepare an annual WMP. Seasonal updates that describe planned hydro system fish operations for the upcoming fall and winter and for the spring, and summer passage seasons will be prepared as water supply forecast become available. The annual plans cover a 1-year period and will be completed by the end of September. It covers FCRPS hydro operations for the upcoming water year which begins on October 1 and ends on September 30 the following year. This 1-year plan is written when very little information is available about the future year's water supply; therefore, will provide only a general description of how the FCRPS will be operated during the year. It will also include any special operations (such as any special tests, flood control procedures planned for the year, etc.) that are known at the time the plan is developed.
The Action Agencies will develop more detailed in-season action plans for the proposed FCRPS project operations as the water supply forecasts become available. The first action plan will be prepared in the fall to address the fall/winter operation. A spring update will be drafted in January and finalized in the March/April time period to address the spring and summer operation. These action plans will take into account changes in the operations due to water supply or other factors
The Corps of Engineers also prepares a FPP each year that provides detailed operating criteria for project fish passage facilities, powerhouses, and spillways to allow for the efficient passage of migratory fish. The FPP is one of the three (FPP, WMP and FOP) describing of the FCRPS will be operated. The FPP contains appendices that describe special operations for studies, the juvenile fish transportation program, operation of units within 1% of best efficiency, spill for fish passage, total dissolved gas monitoring, and dewatering procedures. The plan is coordinated through the Fish Passage Operations and Maintenance Coordination Team (FPOM) and is available on the web at http://www.nwd-wc.usace.army.mil/tmt/documents/fpp/.

1.6. UPA, ESA, and Implementation Plan Strategies

This WMP addresses strategies to enhance juvenile and adult fish survival through a coordinated set of hydro project management actions to achieve performance standards, and to provide benefits to resident fish. The plan is structured to address water management actions associated with the following strategies and substrategies, as defined for anadromous fish in the UPA and for resident fish in the ESA 2004/2004-2008 Implementation Plan for the FCRPS.

1.6.1. 2004 UPA Hydro Strategies for Listed Species of Anadromous Fish

Hydro Strategy 2 – Manage water to improve juvenile and adult fish survival

Substrategy 2.1 – Reservoir operations to enhance fish survival: Actions under this substrategy are project operations that benefit fish at or near the project or its reservoir.

Substrategy 2.2 – System flow management to improve fish survival: This substrategy includes coordinated system operations for mainstem flow management and redd protection.

Substrategy 2.3 – Spill operations for project passage: This substrategy includes spill operations at individual projects to provide a better project passage for juvenile fish while avoiding high dissolved gas levels or adult fallback problems.

Substrategy 2.5 – Operate to achieve maximum fish benefits in a cost effective manner: This substrategy highlights the Action Agencies' objective to meet biological performance standards in a cost effective manner.

Hydro Strategy 3 – Operate and maintain fish passage facilities to improve fish survival

Substrategy 3.3 – Juvenile fish transport actions to enhance fish survival: This substrategy includes the transportation of juvenile fish around FCRPS dams.

1.6.2. ESA and Implementation Plan Strategies for Listed Species of Resident Fish

Strategy 1 – Promote the reproduction and recruitment of Kootenai River white sturgeon (KWS).

Substrategy 1.1 – Create conditions below Libby Dam that facilitate KWS natural reproduction and juvenile survival: This substrategy includes operations at and below Libby Dam that aid in KWS recovery.

Strategy 2 – Determine the impacts of the FCRPS on bull trout and mitigate for those impacts.

Substrategy 2.2 – Operate and modify FCRPS dams to protect, provide, and reconnect bull trout habitats: This substrategy includes actions to improve conditions for bull trout.

1.7. Non-BiOp Operations

Each year the Action Agencies implement water management actions that are not part of our ESA obligations, but are aimed at meeting other project requirements and purposes such as flood control, power generation, irrigation, navigation, recreation, and fish and wildlife not listed under the ESA. The table below includes fish and wildlife related non-ESA water management actions that may be implemented and the time of year such actions typically occur. These actions are further described below.

Action	**Time of Year**
Keenleyside Dam (Arrow) mountain whitefish actions	December - January
Keenleyside Dam (Arrow) rainbow trout actions	April - June
Libby - burbot actions	December - February
Dworshak – flow increase for hatchery release	March
Grand Coulee – kokanee	September – Mid November
Hanford Reach Protection Flows	March – June
Vernita Bar Protection Flows	November – April
McNary - waterfowl nesting	March – May
McNary - waterfowl hunting enhancement	October – January
John Day - goose nesting	March – May
John Day - waterfowl hunting enhancement	October – January
Bonneville - Tribal fishing	April – September
Bonneville - Spring Creek Hatchery release	March

1.8. Changes from Last Year's Plan

This plan is very similar to last years plan with the exception that it has been reorganized on a project basis as opposed to a strategy and sub- strategy basis as were previous Water Management Plan. This change was made to make the plan easier to use and has been approved by the Technical Management Team (TMT)

2. Hydro System Operation

2.1. Priorities

The 2008 FOP, 2004 UPA, 2004 NOAA Fisheries BiOp, and USFWS BiOp list the following strategies for flow management:

- Limit the winter/spring drawdown of storage reservoirs to increase spring flows and the probability of reservoir refill.

- Draft from storage reservoirs in the summer to increase summer flows.

- Provide minimum flows in the fall and winter to support mainstem chum spawning and incubation flow below Bonneville Dam.

- Provide minimum project flows in the fall and winter to support fisheries below the projects (e.g. Hungry Horse, Dworshak, Libby)

The Action Agencies have reviewed these strategies and other actions called for in the 2008 FOP, UPA and BiOps and developed the following priorities (in order) for flow management and individual reservoir operations after ensuring adequate flood damage reduction is provided:

1. Operate storage reservoirs (Hungry Horse and Libby) to meet minimum flow and ramp rate criteria for resident fish.

2. Refill the storage projects to provide summer flow augmentation. The timing and shape of the spring runoff may result in reservoir refill a few days before or after the target refill date. For example, a late snowmelt runoff may delay refill in order to avoid excessive spill.

    - Hungry Horse refill by about June 30 to provide summer flow augmentation.

    - Dworshak refill by about June 30 to provide summer flow augmentation.

    - Grand Coulee refill by about June 30 to provide summer flow augmentation.

- Libby reservoir refill in 2008 may be less likely than recent years as the result of operating in strict accordance with the VARQ Operating Procedures at Libby Dam as described in the Determination and Finding Document with the tiered sturgeon volume as recommended in the 2006 USFWS BiOp. These operating assumptions provide probability of Libby refill to within one foot of full by July 31 of about 12%. This is further described in the Corps' 2006 UCEIS.

3. Operate storage projects to be at their April 10 target flood control elevations if possible to increase available flows for spring flow management.

4. Provide fall and winter flows for chum salmon spawning and incubation.

In addition to operations for anadromous fish, the Action Agencies operate the FCRPS projects to benefit listed fish at or near each project or in its reservoir. Reservoirs operate to meet project minimum outflows, to reduce outflow fluctuations to avoid stranding fish and degrading fish habitat and productivity, to reduce cross sectional area to speed juvenile passage, and to make specific temperature releases to improve water temperatures for fish. These operations are generally the highest priority because of the direct linkage between a particular operation and impacts on fish near the dam.

As the operating year begins on October 1, the flow objectives are not encountered in the same order as the BiOp flow priorities (e.g. decisions need to be made on chum spawning flows first despite the fact that they have a lower priority than spring or summer migration flows). However, the Action Agencies will operate chronologically during the year while attempting to meet the flow priorities as they are outlined in the NOAA-F BiOp. Objectives include:

- Operate the storage reservoirs (Dworshak, Hungry Horse, Libby, and Grand Coulee) to be on their respective flood control upper rule curve by early April. This level varies by runoff forecast. The ability to reach early April flood control levels is affected by how much water was released for flood control, power generation, and fishery flows to support both lower Columbia chum and Hanford reach fall Chinook spawning, as well as minimum flow requirements below the projects. If projects are maintained through the winter and spring near their flood control elevations (within the constraints of Vernita Bar, chum, and minimum flows), there is an increased likelihood of refilling projects by June 30th with a minimal impact on spring flows.

- Refill the storage reservoirs by about June 30[1] while minimizing spill (except as needed to maintain flood control), in order to maximize available storage of water for the benefit of summer migrants. Although the June 30 refill objective generally has priority over spring flow (April, May, June) objectives, the Action Agencies attempt to refill as well as meet the spring flow objectives and other fish needs.

- Manage the available storage to augment summer (July and August) flows in an attempt to meet flow objectives and to moderate water temperature. Except for Dworshak, the other storage reservoirs will be drafted to their specified draft limits by August 31 to augment summer flows and/or moderate river temperatures. Dworshak will reach its summer draft limit in September. Draft limits are a higher priority than the summer flow objectives in order to meet other project uses and reserve water in storage for the following year.

These objectives are intended as general guidelines. The 2008 FOP, 2004 UPA, the 2004 NOAA-F BiOp and the 2000 and 2006 USFWS BiOps embrace the concept of adaptive management. Adaptive management is the concept that the operation of the system should be adjusted based on acquired knowledge about current conditions in the system and effects due management actions, as opposed to following a rigid set of rules. Conditions that are continually changing include information on fish migration, stock status, biological requirements, biological effectiveness, and hydrologic and environmental conditions.

[1] Libby Dam refill probability is likely to be later into July as defined in the VARQ Flood Control Operating Procedures and supporting effects analysis.

System managers recognize that there is often insufficient water to meet all the actions specified in the 2008 FOP,2004 UPA and the 2004 NOAA-F and 2000 and 2006 USFWS BiOps while operating for other authorized purposes such as flood protection, power system reliability, irrigation, recreation, and navigation needs. The use of water for any one fish species or project purpose will most likely affect the amount of water available for other fish species or project purposes. The Action Agencies, in coordination with regional parties through the TMT, consider the multiple uses of the system, while placing a high priority on measures to benefit listed species.

2.2. Conflicts

As stated above, water availability may not be sufficient in the Columbia River basin to meet every action item stated in the 2008 FOP, 2004 UPA and 2004 NOAA-F and the 2000 and 2006 USFWS BiOps while providing for other project purposes. Below are some of the main conflicts that may occur.

2.2.1. Flood control draft versus project refill

One way to maximize flood control is to provide abundant storage space in the event a large flood occurs. Conversely, the 2008 FOP ,2004 UPA and 2004 NOAA-F BiOp and 2000 and 2006 USFWS BiOps specify that the storage projects be as full as possible to increase the likelihood of refill and provide flows for spring flow management and summer flow augmentation.

Flood control procedures specify the amount of storage needed to provide flood damage reduction. In furtherance of the flood damage reduction objective, storage space is provided to reduce the risk of forecast and runoff uncertainty. In an effort to reduce forecast error and to better anticipate the runoff timing or water supply for a given year, the 2004 BiOp calls for the Action Agencies to study system flood control requirements and forecast procedures to determine if they can be improved.

2.2.2. The provision of spring flows versus project refill and summer flow augmentation

Because water supply and runoff forecasts are not 100 percent accurate, it is difficult to estimate how much water is available for spring flows and still assure refill at the storage projects by June 30 (or in July for Libby Dam). If too much water is allowed to flow through the storage reservoirs in the spring, there is an increased risk of not refilling the projects. This will reduce the water supply available for summer flow augmentation. On the other hand, if the reservoirs fill too early in the spring, late season rain or snowmelt may cause flood damage downstream, or cause excessive spill and produce higher dissolved gas levels.

2.2.3. Chum tailwater elevations versus refill/spring flows

Setting the Bonneville tailwater elevation level for chum spawning and incubation in the Ives Island complex is difficult as the decision needs to be made when there is little reliable flow forecast information available. Project refill in the summer and spring flows have priority over chum tailwater elevations which have to be set in October/November. Although there is an early season Southern Oscillation Index (SOI) that provides an indication of the upcoming year's

water supply, the more reliable water supply forecasts don't start until January. If the tailwater elevation level selected during the spawning season is too high (causing higher flows), there is a risk of refill failure if the higher flows are maintained throughout the incubation period. On the other hand if the flows are reduced during the incubation period in order to refill, then there is the risk of dewatering chum redds.

2.2.4. Sturgeon pulse versus summer flow augmentation

Water released from Libby Dam for spring sturgeon flows (pulse) during April through July may reduce the water available for summer flow augmentation from Libby.

2.2.5. Fish operations versus other project uses

In addition to flood control operation, there are other project purposes that may conflict with operations for enhancing fish survival. For example; (1) steady flows below a project to benefit resident and anadromous fish conflicts with the ability for load following or peaking power operations, (2) spilling water for juvenile fish passage reduces the amount of power that can be generated to meet demand; and, (3) Timing of releases for flow augmentation during fish migration periods may conflict with the shape or timing of power demand. In addition to power generation, operations for irrigation and reservoir recreation may conflict with releases of water for flow augmentation

2.2.6. Conflicts and priorities

The conflicts described above pose many challenges to the Action Agencies in meeting the multiple uses of the hydrosystem. The priorities for flow management and individual reservoir operations outlined in section 2.1 will assist the Action Agencies in their operational decision-making. Discussion of conflicts between operational requirements and alternatives for addressing such conflicts will occur in TMT.

2.3. Emergencies

The Water Management Plan, the 2008 FOP ,2004 NOAA-F BiOp and the 2008 FPP acknowledge that emergencies and other unexpected events occur and may cause deviations from fish operations. Such deviations may be short in duration, such as a response to an unexpected unit outage or power line failure, or longer in duration, such as what was experienced in 2001 in response to the low water conditions and unprecedented power market conditions. Emergency operations will be managed in accordance with TMT Emergency Protocol, the Fish Passage Plan and other appropriate Action Agencies emergency procedures. The TMT Emergency Protocols can be found Appendix 1: Emergency Protocols or see TMT homepage at http://www.nwd-wc.usace.army.mil/tmt/documents/wmp.

2.4. Research

Research studies sometimes require special operations that differ from routine operations otherwise described in the 2008 FOP, 2004 UPA , 2004 NOAA-F BiOp and 2008 FPP. These studies are generally developed through technical workgroups of the Regional Forum [e.g., System Configuration Team (SCT)) and the Corps' Anadromous Fish Evaluation Program Fish Facilities Design Review Work Group (FFDRWG) and Studies Review Work Group (SRWG)].

They are further described in the Corps of Engineers' Fish Passage Plan and the Action Agencies' seasonal updates to the WMP. In most cases, operations associated with research entail relatively minor changes from routine operations and are coordinated in technical forums (e.g., TMT and FPOM). In some cases, the nature or magnitude of operational changes for research may require further coordination and review in policy forums [e.g., Implementation Team (IT)]. Generally, research planning and coordination occurs throughout the late fall and winter, with final research plans established by late winter/early spring. In extraordinary events such as extreme low runoff conditions or an emergency, planned research may be modified prior to implementation to accommodate anticipated unique circumstances and/or to reallocate resources to obtain the greatest value given the circumstances.

3. Decision Points and Water Supply Forecasts

Table 1 below lists the key water management decisions/actions and when they need to be made. Some decision points, such as setting flow objectives, are clearly articulated in the 2008 FOP, 2004 UPA and 2004 NOAA-F BiOp and the USFWS BiOps. Other decision points, such as setting weekly flow augmentation levels, require thorough discussion and coordination. The decision points given below are spelled out in the UPA or BiOps, or are based on experience. These decisions are made by the Action Agencies in consideration of actions called for in the UPA and BiOps, and input received through the Regional Forum (TMT, IT, Regional Executives).

Table 1. Water Management Decision Points/Actions

	Early October	November	Winter (December – March)	Early April	Early May	June	Early July
Operations	• Assess potential tailwater elevations / flow levels to support chum spawning below Bonneville Dam • Preliminary discussions of flood control/ project refill strategy • Albeni Falls fall/winter drawdown strategy discussion • Hanford Reach /Vernita Bar flows set *(Non-BiOp Action)*	• Early season forecast using SOI • Evaluate likely tier for sturgeon water volume • Consider Kootenai burbot operation	• Determine winter/spring chum flow levels below Bonneville Dam • Determine flood control and refill strategies, including any available flood control shifts • Minimum flows from Hungry Horse Dam and minimum Columbia Falls flows are set by April-August forecast • Begin discussing spring operations • Spring Creek Hatchery release – March *(Non-BiOp Action)* • Begin spring transport discussions • Hanford Reach operations *(non-BiOp action)* discussed, beginning in January. • Perform analysis to determine	• Spring flow objectives are set by the April final volume forecasts • Determine spring flow management strategy including priority for refill • Determine start dates and levels by project for spring spill • Determine start date for MOP at Lower Snake River projects • Determine John Day forebay elevations • Determine refill start date based on streamflow forecast to exceed Initial Control Flow at The Dalles • If required, use April	• Use May final forecast to calculate the appropriate volume of the sturgeon tiered flow release from Libby • Determine required outflow from Libby for bull trout. • Use May forecast to determine VARQ refill flows for Libby and Hungry Horse • Determine refill start date based on streamflow forecast to exceed Initial Control Flow at The Dalles (if this does not occur in April	• Summer flow objective at Lower Granite determined by June final volume forecast • Determine summer flow augmentation strategy (early June) • Complete Dworshak temperature modeling and determine release strategy • Decision on McNary juvenile fish transportation (late June) • Switch to 30% spill 24 hours a day at John Day. • Use June forecast to determine VARQ refill flows for Libby and Hungry Horse	• Grand Coulee summer reservoir draft limit determined by July Final April – August volume forecast at The Dalles • Salmon Draft at Libby and Hungry Horse?

	Early October	November	Winter (December – March)	Early April	Early May	June	Early July
			amount of flexibility Dworshak has to operate above minimum flow and still reach spring refill targets. • Prepare outlook for meeting flow objectives. • Determine end of December flood control elevation at Libby, using December SOI –based forecast	forecast to determine VARQ refill flows for Libby and Hungry Horse			
Plans	Develop fall/winter update to the annual WMP		Preliminary work on spring/summer update to the annual WMP	Start operational plans for Libby and Hungry Horse Dams	Libby and Hungry Horse operational plans due		
Forecasts			January, February, and March volume forecasts released by the RFC	April final forecast released by RFC	May final forecast released by RFC	June final forecast released by RFC	

3.1. Water Supply Forecasts

Water supply forecasts serve as a guide to how much water is available for fish and other operations. Flow projections are provided to the TMT regularly during the flow management season (April 3 – August 31).

The National Weather Service's Northwest River Forecast Center (NWRFC), USACE Northwestern Division Hydrologic Engineering Branch, Reclamation, and others prepare water supply forecasts to manage the Columbia River. Table 2 below lists the forecasts used to implement actions referenced in the UPA and BiOps. Table 3 summarizes the major fish-related reservoir and flow operations by project. More detailed descriptions of each of these operations follow.

Table 2. Water Supply Forecasts Used to Implement UPA and BiOp Actions

Forecast Point	Forecast period	Forecast	UPA actions determined
Hungry Horse	April – August	January, February, and March Final provided by USBR	Columbia Falls and Hungry Horse minimum flows
The Dalles	April – August	April Final July Final Provided by NWS RFC	Spring flow objective at McNary Dam Summer draft elevation for Grand Coulee (August 31 elevation of 1280 feet or 1278 feet)
Lower Granite	April – July	April Final Provided by NWS RFC	Spring flow objective at Lower Granite
Lower Granite	April – July	June Final Provided by NWS RFC	Summer flow objective at Lower Granite
The Dalles	April – August	July Final Provided by NWS RFC	Grand Coulee summer draft limit
Libby	April – August	May Final Provided by COE	Volume of water to provide for sturgeon and minimum bull trout flows to begin May 15
Libby, Hungry Horse	April – August	April, May, June Final Libby Forecast provided by COE, Hungry Horse provided by USBR	VARQ Refill Flows

Table 3. Major Reservoir and Flow Operations for ESA-listed fish species.

Project	Flood Control & Refill	Sturgeon	Bull Trout	Spring Anadromous	Summer Anadromous	Chum
Libby	Winter: Operate to VARQ flood control rule curve and achieve appropriate elevation by April 10 if possible Spring: Adhere to VARQ Operating Procedures at Libby Dam and supply the appropriate tiered volume for sturgeon.	April – July Provide USFWS Sturgeon Volume to Augment flows at Bonners Ferry.	Year Round: Operate to minimum flows and project ramping rates to minimize adverse affects of flow fluctuations	Operate to meet flow objectives and refill if possible without jeopardizing flood control.	July/August: Draft for summer flow augmentation, not to exceed reservoir draft limit of 2,439 feet by August 31st	Fall/winter storage may be used to support chum flows
Hungry Horse	Winter: Operate to VARQ flood control rule curves with a 75% confidence of meeting the April 10 target elevation. Spring: Refill by about June 30 if possible without excessive spill and operate to help meet flow objectives		Year Round: Operate to Columbia Falls minimum flows and project ramping rates to minimize adverse affects of flow fluctuations	Operate to meet flow objectives and June 30 refill if possible without exceeding TDG limits	July/August: Draft for summer flow augmentation, not to exceed reservoir draft limit of 3540 feet	
Albeni Falls	Winter: Operate to flood control rule curve Spring: Refill by June 30 and operate to help meet flow objectives		Fall/Winter: Reach 2051-2055 feet msl by November 20 and maintain this elevation until kokanee fry emergence. Recommendation will be made by TMT			Fall/winter storage may be used to support chum flows

Project	Flood Control & Refill	Sturgeon	Bull Trout	Spring Anadromous	Summer Anadromous	Chum
Grand Coulee	Winter: Operate to 85% confidence of meeting April 10 flood control elevation Spring: Refill by about June 30 and operate to meet flow objectives			Operate to 85% confidence of meeting April 10 URC to increase spring flows in the Lower Columbia river. Operate to help meet the Spring flow objective at Priest Rapids Dam.	July-August: Draft for summer flow augmentation, not to exceed reservoir draft limit of 1,280 feet (>/= 92 maf forecast at The Dalles) or 1,278 feet (< 92 maf forecast at The Dalles)	Fall/winter storage may be used to support chum flows
Grand Coulee (continued)					July/August: Operate Banks Lake to draft to elevation 1565 feet by August 31 to provide more water for summer flow augmentation	
Dworshak	Winter: Operate to flood control rule curve by April 10 Spring: Refill by about June 30 and operate to help meet flow objectives				Draft for summer flow augmentation and water temperature reduction, not to exceed reservoir draft limit of 1,520 feet in September	Fall/winter storage may be used to support chum flows
Lower Granite				Flow objective of 85-100 kcfs Operate within 1 foot of MOP to reduce juvenile travel time Apr 1 – Oct 31 Operate within 1% of best efficiency	Flow objective of 50-55 kcfs Operate within 1 foot of MOP to reduce juvenile travel time Apr 1 – Oct 31 Operate within 1% of best efficiency	
Little Goose				Operate within 1 foot of MOP to reduce juvenile travel time Apr 1 – Oct 31 Operate within 1% of best efficiency	Operate within 1 foot of MOP to reduce juvenile travel time Apr 1 – Oct 31 Operate within 1% of best efficiency	

Project	Flood Control & Refill	Sturgeon	Bull Trout	Spring Anadromous	Summer Anadromous	Chum
Lower Monumental				Operate within 1 foot of MOP to reduce juvenile travel time Apr 1 – Oct 31 Operate within 1% of best efficiency	Operate within 1 foot of MOP to reduce juvenile travel time Apr 1 – Oct 31 Operate within 1% of best efficiency	
Ice Harbor				Operate within 1 foot of MOP to reduce juvenile travel time Apr 1 – Oct 31 Operate within 1% of best efficiency	Operate within 1 foot of MOP to reduce juvenile travel time Apr 1 – Oct 31 Operate within 1% of best efficiency	
McNary				Flow objective of 220-260 kcfs Apr 1 – Oct 31 Operate within 1% of best efficiency	Flow objective of 200 kcfs Apr 1 – Oct 31 Operate within 1% of best efficiency	
John Day				Apr 10-Sep 30 Operate within 1.5 feet of minimum level that provides irrigation pumping to reduce juvenile travel time Apr 1 – Oct 31 Operate within 1% of best efficiency	Apr 1 – Oct 31 Operate within 1% of best efficiency	
The Dalles				Apr 1 – Oct 31 Operate within 1% of best efficiency	Apr 1 – Oct 31 Operate within 1% of best efficiency	

Project	Flood Control & Refill	Sturgeon	Bull Trout	Spring Anadromous	Summer Anadromous	Chum
Bonneville				Apr 1 – Oct 31 Operate within 1% of best efficiency	Apr 1 – Oct 31 Operate within 1% of best efficiency	Provide support to chum if hydrologic conditions indicate system can likely maintain minimum project tailwater elevation (on Oregon side 0.9 miles downstream of first powerhouse and 50 feet upstream of Tanner Creek) during spawning and incubation ,. .

4. Project Operations

Below the Water Management Plan describes project operations for each of the major FCRPS projects.

4.1. Hugh Keenlyside Dam (Arrow Canadian Project)

4.1.1. Mountain Whitefish

Spawning flow levels are set between 45 and 55 kcfs beginning the third week in December and continuing through mid-January. Egg protection flows are set 5 to 15 kcfs lower than the spawning flow from mid-January through the end of March.

4.1.2. Rainbow Trout

Rainbow trout spawning begins in April. Protection levels begin somewhere between 15 and 25 kcfs. The goal is to have stable flows or ever-increasing flows through June

4.2. Hungry Horse Dam

Hungry Horse Dam is operated for multiple purposes including fish and wildlife, flood control, irrigation, power, and recreation. Specific operations for flow management to aid anadromous and resident fish are listed in the following sections.

4.2.1. Winter/Spring Operations

Hungry Horse will be operated during the winter and early spring to achieve a 75% probability of reaching the April 10 Upper Rule Curve (URC) elevation in order to provide more water for spring flows. However in many years, typically dry years, the previous year's summer draft for flow augmentation and year-round required minimum discharges for resident fisheries will prevent Hungry Horse from reaching the April 10 elevation objective. Reclamation computes Hungry Horse Dam's April 10 elevation objective by linear interpolation between the March 31

and April 15 forecasted flood control elevations based on the Reclamation March Final April-August Water Supply Forecast (WSF).

Hungry Horse will be operated for flood control from January through April using the Storage Reservation Diagram (SRD) developed for VARQ flood control. Hungry Horse began operating using VARQ Flood Control rule curves on an interim basis starting January 1, 2001 based on an EA FONSI. Reclamation in coordination with the Corps of Engineers completed the Upper Columbia Alternative Flood Control and Fish Operations Final Environmental Impact Statement (VARQ FEIS) in 2006. A ROD will be prepared in 2008. The purpose of this action is to provide more water for spring flow augmentation.

During the spring, the Action Agencies will operate the FCRPS to meet the flow and refill objectives at Hungry Horse. If both these objectives cannot be achieved, the TMT will make an in-season recommendation, weighing considerations unique to each particular year and project. Because research results indicate that increased flows typically have more direct survival benefits for summer migrants than for spring migrants, depending upon the actual base spring flow being provided, modest reductions in spring flows to facilitate reservoir refill would generally be preferable to refill failure.

Often during the spring, changes in flood control, transmission limitations and generation unit availability will require adaptive management actions for real-time operations in order to control refill and to avoid spill.

4.2.2. Summer Operations

Hungry Horse will operate to refill by about June 30 to provide summer flow augmentation, except as specifically provided by the TMT. Refill at Hungry Horse usually begins approximately ten days prior to when streamflow forecasts of unregulated flow is projected to exceed the Initial Control Flow (ICF) at The Dalles, Oregon. During refill, discharges from Hungry Horse are guided by the VARQ Operating Procedures and the Action Agencies will operate the project to help meet the spring flow objectives. During the latter part of the flood control season (April) and the refill season (typically May through June), Hungry Horse discharges may be reduced for local flood control operations in the Flathead Valley. The official flood stage for the Flathead River at Columbia Falls, Montana is 14 feet (an approximate flow of 51,000 cfs). In order to prevent or minimize flooding on the Flathead River above Flathead Lake, Reclamation will adjust outflows from Hungry Horse Dam as necessary (to a minimum discharge of Table 5 300 cfs) in order to maintain the Flathead River at Columbia Falls below 14 feet if possible (flood control operations generally start at around 13.0 feet or approximately 44,000 cfs). Reservoir refill normally occurs by approximately June 30. However, the timing and shape of the spring runoff may result in reservoir refill a few days before or after the June 30 target date. For example, a late snowmelt runoff may delay refill to sometime after June 30 in order to avoid excessive spill.

During the summer, the Action Agencies draft Hungry Horse within the NOAA Fisheries BiOp's specified draft limits based on flow recommendations provided by TMT. TMT considers a number of factors when developing its flow recommendations, such as: the status of the

migration, attainment of flow objectives, water quality, and the effects that reservoir operations will have on other listed and resident fish populations. The summer reservoir draft limit at Hungry Horse is elevation 3,540 feet by August 31. The 2003 NWPCC Mainstem Amendments call for an evaluation of the relative risks posed to downstream resident fish versus the benefits provided to anadromous fish by drafting the reservoir to elevation 3540 feet by September 30 in the lowest 20% of volume runoff years as measured at The Dalles Dam and to elevation 3550 feet by September 30 in all other years. The TMT will consider implementation of this plan prior to the summer flow augmentation period.

4.2.3. Reporting

Reclamation will fulfill the USFWS RPM (Reasonable and Prudent Measure) from the 2000 USFWS BiOp for annual and monthly reporting by contributing to the annual WMP and presenting weekly and biweekly reports of Hungry Horse operations through the TMT process. Reclamation will also fulfill the USFWS RPM recommendation for reporting actual operations by making available pertinent historic elevations and flows as related to Hungry Horse Dam through its current website at http://www.usbr.gov/pn/hydromet/esatea.html

4.2.4. Minimum Flows and Ramp Rates

The following ramp rates will guide project operations to meet various purposes, including power production.

Table 4. Ramp rates were prescribed in the 2000 USFWS BiOp for Hungry Horse Dam to protect resident fish and their food organisms in the Flathead River.

Daily and Hourly Maximum Ramp Up Rates for Hungry Horse Dam (as measured by daily flows, not daily averages, restricted by hourly rates).		
Flow Range (measured at Columbia Falls)	**Ramp Up Unit (Daily Max)**	**Ramp Up Unit (Hourly max)**
3,200 - 6,000 cfs	Limit ramp up 1,800 cfs per day	1,000 cfs/hour
> 6,000 - 8,000 cfs	Limit ramp up 1,800 cfs per day	1,000 cfs/hour
> 8,000 - 10,000 cfs	Limit ramp up 3,600 cfs per day	1,800 cfs/hour
> 10,000 cfs	No limit	1,800 cfs/hour

Daily and Hourly Maximum Ramp Down Rates for Hungry Horse Dam (as measured by daily flows, not daily averages, restricted by hourly rates)		
Flow Range (measured at Columbia Falls)	**Ramp Down Unit (Daily max)**	**Ramp Down Unit (Hourly max)**
3,200 - 6,000 cfs	Limit ramp down to 600 cfs per day	600 cfs/hour
> 6,000 - 8,000 cfs	Limit ramp down to 1,000 cfs per day	600 cfs/hour
> 8,000 - 12,000 cfs	Limit ramp down to 2,000 cfs per day	1,000 cfs/hour
> 12,000 cfs	Limit ramp down to 5,000 cfs per day	1,800 cfs/hour

Daily and hourly ramping rates may be exceeded during flood emergencies to protect health and public safety and in association with power or transmission emergencies.
Variances can occur due to unexpected transmission outages or flood control emergencies.
Variances to ramping rates during years where runoff forecasting or storage shortfalls occur, or variances are necessary to provide augmentation water for other listed species, will be coordinated through the TMT process. This is expected in only the lowest 20th percentile water years.
Note: The ramp rates will be followed except when they would cause a unit(s) to operate in a zone that could result in premature wear or failure of the units. In this case the project will utilize a ramp rate, which allows all units to operate outside the rough zone. The Action Agencies will provide additional information to the USFWS describing operations outside the "rough zone."
There are two minimum flow requirements for Hungry Horse Dam. One is for Columbia Falls on the mainstem Flathead River located just downstream from the confluence of the South Fork with the mainstem. This flow requirement generally governs Hungry Horse outflows during the fall and winter. The second minimum flow requirement is for the South Fork Flathead River just below Hungry Horse Dam. This minimum flow typically only comes into play during refill of the project in spring when the minimum flows at Columbia Falls are met by the North and Middle Fork flows. The minimum outflow for Hungry Horse Dam and the minimum flow for Columbia Falls will be determined monthly based on the Reclamation WSF for the inflows into Hungry Horse for the period April 1 to August 31. Both minimum flows are set monthly starting with the January forecast, and then set for the remainder of the year based on the March final runoff forecast. Table 5 shows how the minimum flows are calculated[2]. Reclamation Water Supply Forecasts will be provided to the TMT

Table 5. Minimum Flows at Hungry Horse and Columbia Falls

April – August inflow forecast (kaf)	Hungry Horse min flow[3] (cfs)	Columbia Falls min flow (cfs)
< 1190	400	3200
1790 > forecast > 1190	Interpolate between 400 and 900	Interpolate between 3200 and 3500
> 1790	900	3500

4.2.5. Spill

Hungry Horse will be operated to avoid spill if practicable. Spill at Hungry Horse is defined as any release through the dam that does not pass through the power plant. Large amounts of spill can cause TDG in the South Fork of the Flathead River to exceed the state of Montana's standard of 110%.

[2] USFWS BiOp at Section 3.A.1 Page 6
[3] To prevent or minimize flooding on the Flathead River above Flathead Lake, Hungry Horse discharges can be reduced to a minimum flow of 300 cfs when the stage at Columbia Falls exceeds 13 feet

4.3. Albeni Falls Dam

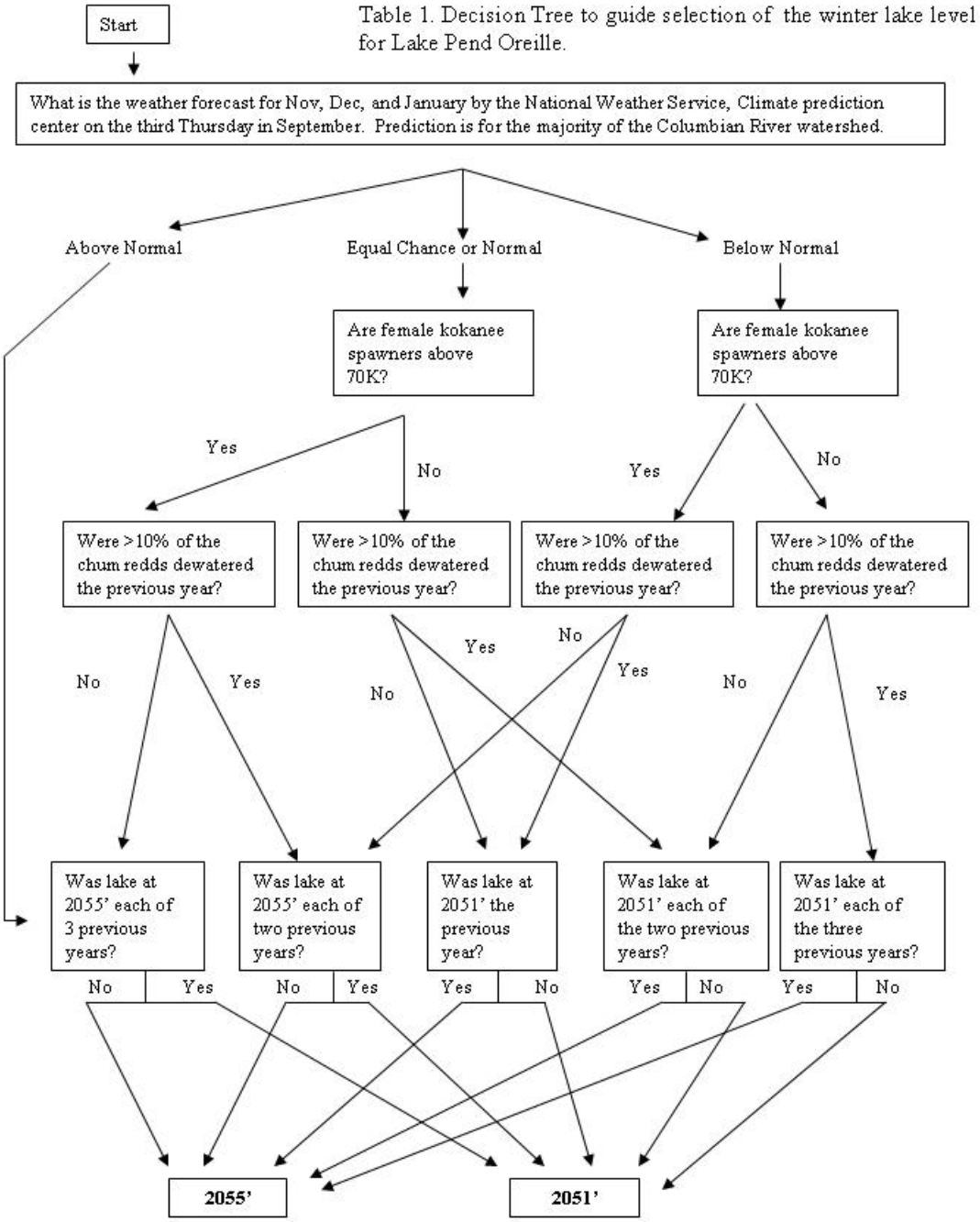
4.3.1. Fall and Winter Lake elevation

The reservoir will be drafted by November 20th to an elevation [2055 to 2051] for kokanee spawning. This elevation will be maintained as a minimum until kokanee emergence ends. The elevation and date will be determined annually by looking at current conditions and needs and a recommendation will be provided by TMT.

IDFG and USFWS have developed a draft decision tree that can be used annually as guidance to develop a recommendation for winter elevations of Lake Pend Oreille. An SOR was submitted in September 2007 by USFWS, IDFG, and the Pend Oreille/Priest Lakes Commission, recommending a winter lake level of 2055, based on the current working draft of the decision tree (which had the same result as the older version). The TMT discussed the SOR, and the Corps accepted the recommendation to use 2055 as the 2007-2008 winter lake level on September 24.

Albeni Falls Dam will operate to hold the lake winter elevation decided upon in TMT unless a change is necessary to meet flood damage reduction objectives.

Table 1. Decision Tree to guide selection of the winter lake level for Lake Pend Oreille.



4.3.2. Spring Operations

The purpose of the following actions is to refill Albeni Falls as much as possible in order to achieve a high probability of reaching flood control upper rule curve elevation by April 10, for spring flows.

During the spring, the Action Agencies will operate the FCRPS to meet the flow and refill objectives at Albeni Falls. If both these objectives cannot be achieved, the TMT will make an in-season recommendation, weighing considerations unique to each particular year and project. Because research results indicate that increased flows have more direct survival benefits for summer migrants than for spring migrants, depending upon the actual base spring flow being provided, modest reductions in spring flows to facilitate reservoir refill would generally be preferable to refill failure.

4.3.3. Flood Control Draft

Albeni Falls will be operated during the winter season using standard flood control criteria.

4.3.4. Refill

During the spring, Albeni Falls will be refilled in accordance with standard flood control criteria. The Action Agencies will operate Albeni Falls to meet the flow objectives and refill by approximately June 30.

4.3.5. Albeni Falls Coordination

Per the 2000 USFWS BiOp, the Action Agencies, the USFWS, NMFS, BPA, and Idaho Department of Fish & Game will meet annually to evaluate Lake Pend Oreille female kokanee spawner numbers, the winter climate (precipitation) forecast, spawning and incubation success for threatened lower Columbia River chum salmon the previous winter, and recent history of winter elevations for Lake Pend Oreille. The purpose of this action is to ensure winter lake operation protocol is addressing the needs of kokanee spawning and hence, threatened bull trout, which feed on kokanee.

4.4. Libby Dam

4.4.1. Spring Operations

The purpose of the following actions is to refill Libby in order to provide the agreed upon amount of anadromous fish augmentation water in the summer. Libby will provide flows for sturgeon and bull trout during spring and salmon and bull trout during summer, while attempting to minimize a double-peak in the June –August period. After adhering to the VARQ refill flood control guidance and providing the sturgeon flow operation, Libby Dam refill may occur by July 31. During the spring, the Action Agencies will operate the FCRPS to meet the flow and refill objectives at Libby. If both these objectives cannot be achieved, the TMT will make an in-season recommendation, weighing considerations unique to each particular year and project.

4.4.2. Summer operations

During the summer, the Action Agencies draft Libby within the NOAA BiOp's specified draft limits based on flow recommendations provided by TMT. TMT considers a number of factors when developing its flow recommendations, such as: the status of the migration, attainment of flow objectives, water quality, and the effects that reservoir operations will have on other listed and resident fish populations.

During the summer migration season (July and August), the Action Agencies will operate Libby to help meet the flow objectives for juvenile salmon out-migration in the Columbia River. The

summer reservoir draft limit is 2,439 feet, which determines the maximum draft available for summer flow augmentation from Libby. Arrangements for retention of July/August water in Lake Koocanusa is possible under a Libby-Canadian storage water exchange under the current Libby Coordination Agreement, which was signed February 16, 2000. However, this operation cannot be guaranteed in any given year because it must be mutually beneficial to the Canadian Entity and the U.S. Entity. To make such a determination, needed information, such as the volume of the water year, is not available until well into the migration season. This operation, if any, for a given water year is generally not finalized until June or July of that year. A benefit of this exchange agreement is to reduce or eliminate the second flow peak in the Kootenai River created by July/August salmon flow augmentation thus protecting bull trout and sturgeon by enhancing river productivity. Additionally, the exchange agreement reduces the draft of Lake Koocanusa and increases upstream benefits

The NWPCC 2003 Mainstem Amendments call for an evaluation of the relative risks posed to resident fish versus the benefits provided to anadromous fish by drafting the reservoir to 2439' by September 30 in the lowest 20% of volume runoff years and to elevation 2449' by September 30 in all other years.

4.4.3. Flood Control

The Corps will continue to use the new SOI forecast procedure in December to determine the December 31 flood control elevation. In water years where the forecast is less than 95% of average based on the SOI forecast procedures, the end of December draft elevation may be higher than 2411 feet. If the early forecast for the water year is 88% of average or less, the end of December target elevation would be 2426 feet. The end of December elevation is a straight line sliding scale between elevation 2426 feet and 2411 feet when the forecast is between 88% and 95%.

Libby will be operated during January through March to the Storage Reservation Diagram (SRD) developed for VARQ flood control. During the refill period from about April through July, Libby Dam will release flow in accordance with the refill guidance developed using the VARQ Operating Procedures at Libby Dam. Refill at Libby Dam will begin 10 days prior to when the unregulated forecast for The Dalles is expected to exceed the Initial Controlled Flow (ICF), and Libby outflow will be no lower than the computed VARQ refill outflow, unless otherwise allowed by the VARQ Operating Procedures. For example, changes to reduce the VARQ outflow can occur to protect human life and safety, during the final stages of refill, or through a deviation request.

The VARQ refill outflow will be recalculated with each new Corps water supply forecast and outflows will be adjusted in accordingly. If the VARQ refill guidance requires discharges above powerhouse capacity, spill from Libby Dam may occur. The intent is to adjust Libby Dam discharge to maximize reservoir refill probability and minimize the potential for spill.

Libby Dam will provide the tiered volume for sturgeon flows as described in the 2006 USFWS BiOp. The outflow during sturgeon augmentation period will be equal to or greater than the VARQ refill outflow. An accounting method will be developed prior to commencement of the sturgeon tiered flow release.

4.4.4. Sturgeon Operation

The purpose of the actions below is to provide water for sturgeon spawning.
Water temperature profiles will be monitored near the dam during May and June to provide information necessary for timing of sturgeon spawning/rearing flow augmentation. Also, water temperature profiles in the forebay are used to determine whether warmer temperatures may be provided to assist sturgeon spawning
Water will be stored in Libby reservoir and used to supply water volume during May and June for sturgeon flows, following the "tiered" approach as defined in the 2004 Supplemental Biological Assessment (BA supplement) and 2006 USFWS Biological Opinion, and as summarized in the table below. This water will be in addition to storage needs for listed bull trout, salmon, and will be measured above the 4,000 cfs minimum releases from Libby. Accounting on these total tiered volumes will begin when the USFWS determines benefits to conservation of sturgeon are most likely to occur. Sturgeon flows will generally be initiated between mid-May and the end of June to augment lower basin runoff entering the Kootenai River below Libby Dam, consistent with the BA supplement, The latest version of the Kootenai River Ecosystem Function Restoration Flow Plan Implementation Protocol and 2006 USFWS BiOp.

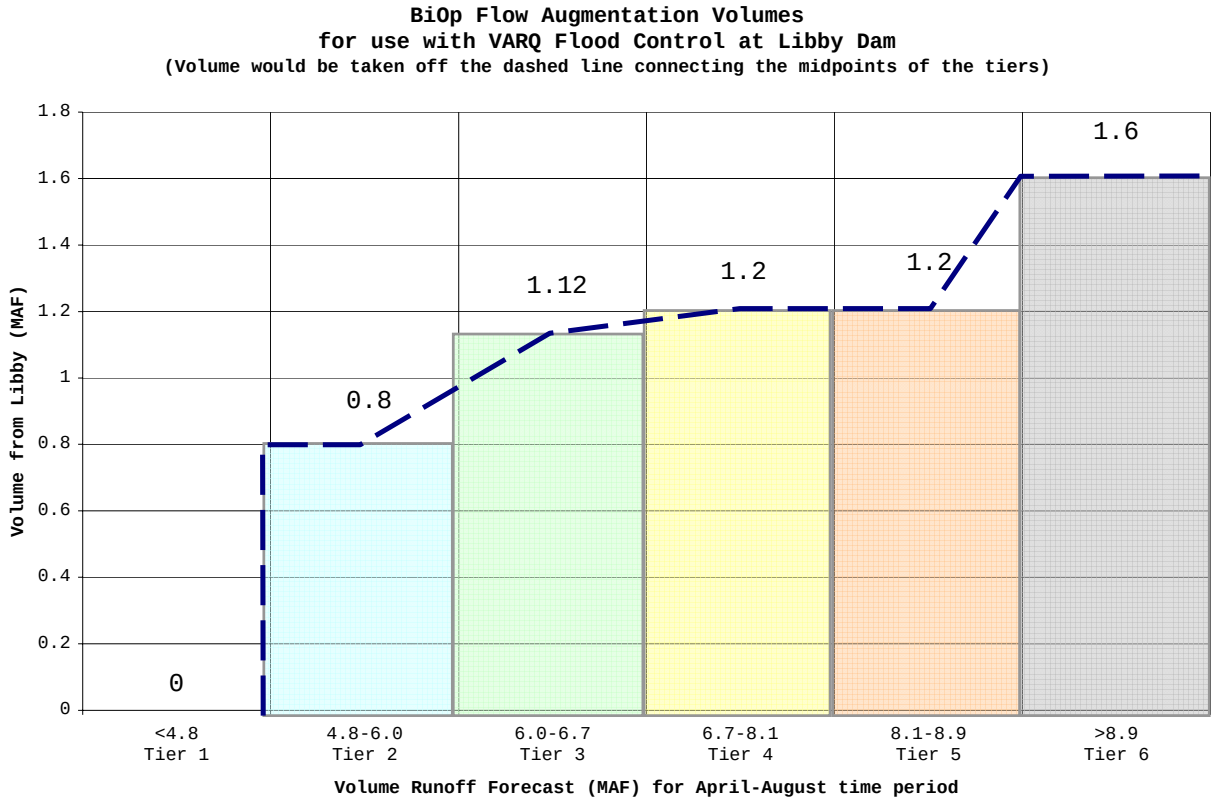


Table 5. "Tiered" volumes of water for sturgeon flow enhancement to be released from Libby Dam according to the Libby May final forecast of April - August volume. Actual flow releases would be shaped according to seasonal requests from the USFWS and in-season management of water actually available.

The tiered sturgeon volume and the release operations for that volume in 2008 have not been determined at this time (see 7.1.2). TMT will coordinate with USFWS for the 2008 sturgeon operations.

Efforts will be coordinated to attempt to limit sturgeon-spawning flows so they do not exceed a river stage elevation of 1,764 feet at Bonners Ferry. (Note: This may not always be possible during periods of unusual local runoff that may be beyond the control of Libby Dam.)

During sturgeon recruitment flow periods, local inflow will be allowed to supplement Libby Dam releases to the maximum extent feasible, while assuring public safety by monitoring water levels throughout relevant areas of the Kootenai River basin.

4.4.5. Coordination

The Action Agencies will continue to coordinate Libby BiOp operations at TMT.

4.4.6. IJC

Libby Dam flows will be regulated consistent with existing treaties, Libby Project authorization for public safety, other laws, and the 1938 International Joint Commission order 1938 Order on Kootenay Lake to achieve water volumes, water velocities, water depths, and water temperature

at a time to maximize the probability of allowing significant sturgeon recruitment, while also meeting flood damage reduction objectives.

4.4.7. Burbot

During the winter months from November through January, the water temperature in the Libby reservoir and downstream at Bonners Ferry will be monitored and enhanced for burbot needs near Bonners Ferry. During the periods when burbot move upstream (typically December and January) Libby reservoir may release cold water.

4.4.8. Bull Trout

Per the 2006 USFWS BiOp, the sliding scale bull trout minimum flow will be provided from 15 May through 31 August. The bull trout minimum flow may be from 6,000 cfs to 9,000 cfs. Table 6 shows how to determine the bull trout minimum flow during this period.

During the month of September, a minimum flow of 6,000 cfs will be provided and minimum flows of 4,000 cfs will be provided for the rest of the year.

Table 6. Minimum bull trout releases from Libby Dam 15 May through 31 August.

Forecast runoff Volume (maf*) at Libby	Min bull trout flows between sturgeon and salmon flows
0.00 < forecast < 4.80	6 kcfs
4.80 < forecast < 6.00	7 kcfs
6.00 < forecast < 6.70	8 kcfs
6.70 < forecast < 8.10	9 kcfs
8.10 < forecast < 8.90	9 kcfs
8.90 < forecast	9 kcfs

**maf = million acre-feet*

4.4.9. Ramp Rates and Daily Shaping

The purpose of the following actions is to provide better conditions for resident fish by limiting the flow fluctuations and setting minimum flow levels. These new ramp rates were proposed in the BA supplement to minimize impacts to bull trout and are included in the 2006 USFWS BiOp. The following ramp rates will guide project operations to meet various purposes, including power production.

Table 7. Prescribed ramp rates to protect resident fish and their food organisms, and to minimize levee erosion, in the Kootenai River.

		Summer (05/01 - 09/31)	
		Hourly	Daily
Ramp Up	4-6 kcfs	2500 cfs	1 unit
	6-9 kcfs	2500 cfs	1 unit
	9-16 kcfs	2500 cfs	2 units
	16-QPHC	5000 cfs	2 units
Ramp Down	4-6 kcfs	500 cfs	500 cfs
	6-9 kcfs	500 cfs	1000 cfs
	9-16 kcfs	1000 cfs	2000 cfs
	16-QPHC	3500 cfs	1 unit

		Winter (10/01 - 04/30)	
		Hourly	Daily
Ramp Up	4-6 kcfs	2000 cfs	1 unit
	6-9 kcfs	2000 cfs	1 unit
	9-16 kcfs	3500 cfs	2 units
	16-QPHC	7000 cfs	2 units
Ramp Down	4-6 kcfs	500 cfs	1000 cfs
	6-9 kcfs	500 cfs	2500 cfs
	9-16 kcfs	1000 cfs	1 unit
	16-QPHC	3500 cfs	1 unit

(USFWS 2006 BiOp at Description of the proposed action, page 7, Table 1.

Daily and hourly ramping rates may be exceeded during flood emergencies to protect health and public safety and in association with power or transmission emergencies. Variances to these ramping rates during years when water supply forecasting errors overestimate actual runoff, or variances are necessary to provide augmentation water for other listed species or other purposes, will be coordinated through the TMT process. This is expected in only the lowest 20th percentile water years.

Note: At the project, the ramp rates will be followed except when they would cause a unit(s) to operate in the rough zone, a zone of chaotic flow in which all parts of a unit are subject to increased vibration and cavitation that could result in premature wear or failure of the units. In this case the project will utilize a ramp rate, which allows all units to operate outside the rough zone.

4.4.10. Burbot

Providing low temperatures, if possible, from Libby Dam to aid upstream migration of burbot to spawning areas above Kootenay Lake on the Kootenai River in Idaho is considered each winter. These low temperatures may be called for over an extended period from December through February. The details of this operation for 2008 -2009 are being developed and may be included in the fall/winter update. An interagency Memorandum of Agreement for this species was completed in June 2005. Use of VARQ and implementation of the variable end of December flood control target elevation may aid this operation in years with below average runoff forecasts

4.4.11. Spill

4.5. Grand Coulee Dam

Grand Coulee Dam is operated for multiple purposes including fish and wildlife, flood control, irrigation, power, and recreation. Specific operations for flow management to aid anadromous fish are listed in the following sections.

4.5.1. Winter/Spring Operations

Grand Coulee will be operated during the winter and early spring to achieve an 85% probability of reaching the April 10 Upper Rule Curve (URC) elevation in order to provide more water for spring flows. Reclamation computes Grand Coulee Dam's April 10 elevation objective by linear interpolation between the March 31 and April 15 forecasted flood control elevations based on the Northwest River Forecast Center (NWRFC) March Final April-August WSF at The Dalles.

Grand Coulee will be operated for flood control from January through April using the NWRFC's forecast for unregulated runoff at The Dalles (adjusted for available storage capacity upstream of The Dalles other than at Grand Coulee Dam) and Grand Coulee's Flood Control SRD. During this time period Grand Coulee is also being operated to support the chum operation (described in detail in Section 5.3) and to achieve an 85% probability of reaching the April 10 elevation objective. Opportunities to shift system flood control requirements from Brownlee and Dworshak to Grand Coulee will be considered. These shifts may be implemented after coordination with TMT. The purpose

of this action is to provide more water for flow augmentation in the lower Snake River. This will occur when the shifts will not compromise flood control and they have been coordinated. Real-time operations during the months of April and May must also account for the flow objectives at Priest Rapids Dam, changes in the amount of flood control shift from Dworshak and/or Brownlee, changes in flood control and draft rate limitations. The deepest reservoir draft typically occurs around April 30.

During the spring, the Action Agencies will operate the FCRPS to help meet the flow objectives and to refill the projects. If both of these objectives cannot be achieved, the TMT will make an in-season recommendation, weighing considerations unique to each particular year and project.

4.5.2. Summer Operations

Grand Coulee will operate to refill by about June 30 to provide summer flow augmentation, except as specifically provided by the TMT. Refill at Grand Coulee normally begins approximately one day prior to when streamflow forecasts of unregulated flow is projected to exceed the ICF at The Dalles, Oregon. The Action Agencies will operate Grand Coulee during the summer (July and August) to help meet the flow objectives for juvenile salmon out-migration. Grand Coulee will be drafted to a minimum elevation of either 1280 feet or 1278 feet by the end of August depending on the July Final forecast for April through August runoff produced by the NWRFC. If the July Final April through August forecast for The Dalles is equal to or greater than 92 MAF then Lake Roosevelt's draft limit will be 1280 feet. If the forecast is less than 92 MAF, the draft limit will be 1278 feet.

4.5.3. Banks Lake Summer Operation

Banks Lake will be allowed to draft to elevation 1565 feet by the end of August to provide more water for summer flow augmentation. Pumping to Banks Lake will be reduced and irrigation for the Columbia Basin Project will be met by drafting the reservoir up to 5 feet from full (elevation 1565 feet)by the end of August.

4.5.4. Project Maintenance

Drum gate maintenance is planned to occur during April and May annually. The reservoir must be at or below elevation 1255 feet to accomplish this work. Typically the flood control elevations during this time of year provide the required elevations and sufficient time to accomplish this work. However, during dry years flood control operations will not draft Lake Roosevelt low enough for a long enough period of time to perform necessary maintenance on the drum gates. The drum gates are extremely important dam safety features and must be maintained at a satisfactory level. There will be some years when the project must be drafted below flood control rule curves to accomplish this work. Reclamation will coordinate such an operation with TMT.

4.5.5. Kokanee

Every attempt is made to refill Lake Roosevelt to 1283 feet by September 30 and maintain an elevation 1283 to 1285 feet or greater through the middle of November to aide in kokanee brood stock collection, improve spawning access to tributaries, and to increase retention time during a critical period for zooplankton production.

4.6. Priest Rapids Dam

4.6.1. Spring operations

The spring flow objective at Priest Rapids Dam is for 135 kcfs flow from April 10 to June 30. There is no summer flow objective for Priest Rapids Dam.

4.6.2. Hanford Reach Protection Flows

Grant County PUD shapes outflow from Priest Rapids Dam to minimize juvenile fish stranding.

4.6.3. Vernita Bar Protection Flows

Outflows from Priest Rapids Dam are managed in the fall to ensure that fall chinook salmon establish redds (spawn) at a low enough elevation that allows for a high likelihood that they would not be dewatered prior to emergence of fry. Daytime flows are regulated to a range between 50 and 70 kcfs during October and November when redds are being established. Flow fluctuations are limited from the time of fish emergence in early April through early June. (Note: This is included pursuant to the Vernita Bar Settlement Agreement and the annual Hanford reach stranding agreement.)

4.7. Dworshak Dam

4.7.1. Spring Operations

The purpose of the following actions is to refill Dworshak as much as possible in order to achieve a high probability of reaching flood control upper rule curve elevation by April 10, for spring flows.
During the spring, the Action Agencies will operate the FCRPS to meet the flow and refill objectives at Dworshak. If both these objectives cannot be achieved, the TMT will make an in-season recommendation, weighing considerations unique to each particular year and project. .

4.7.2. Flow increase for Dworshak National Fish Hatchery release.

Release 4 – 6 kcfs from Dworshak, if necessary, in order to move juvenile fish into the mainstem Clearwater River during the spring hatchery releases.

4.7.3. Summer Operations

Summer flow augmentation provided from Dworshak may cool water temperatures in the lower Snake River.

During the summer, releases will be made from Dworshak to attempt to maintain water temperatures at the Lower Granite tailrace fixed monitoring site at or below 68 F. Although a previous FCRPS BiOp stated the goal was to maintain the forebay at this temperature, modeling and experience have demonstrated that the tailrace temperature is more representative of river conditions and temperature exposure of migrating salmonids. The purpose of this action is to improve water quality (by lowering water temperature) in the lower Snake River.
During the summer, the Action Agencies draft Dworshak within the NOAA BiOp's specified draft limits based on flow recommendations provided by TMT. TMT considers a number of factors when developing its flow recommendations, such as: the status of the migration, attainment of flow objectives, water quality, and the effects that reservoir operations will have on other listed and resident fish populations.
During the summer (July and August) the Action Agencies will operate Dworshak to help meet the flow objectives. The summer reservoir draft limit is 1,520 feet. This limit determines the maximum draft available for summer flow augmentation from Dworshak. The Action Agencies plan to draft Dworshak to 1520 feet in September. The extension of the draft limit into September reflects assumed releases of about 200 KAF consistent with the agreement with the Nez Perce Tribe and the Snake River Basin Adjudication process.

4.7.4. Flood Control

Opportunities to shift system flood control requirements from Brownlee and Dworshak to Grand Coulee will be considered. These shifts may be implemented after coordination with TMT. The purpose of this action is to provide more water for flow augmentation in the lower Snake River. This will occur when the shifts will not compromise flood control and they have been coordinated.

4.7.5. Fall Operations

After summer fish operations are completed, flows from Dworshak will be limited to minimum one turbine operation (approximately 1,500 cfs) unless higher flows are required for flood control, emergencies, chum flows below Bonneville Dam, or other project uses. The purpose of these actions is to manage the filling of Dworshak reservoir while operating the project for multiple uses. Flows from Dworshak also may be maintained above minimum flow if Corps analysis determines there is flexibility to release a volume of water above minimum flow and still maintain a high reliability of meeting spring refill objectives.

4.8. Brownlee

Opportunities to shift system flood control requirements from Brownlee and Dworshak to Grand Coulee will be considered. The shifts would occur between January and March. All three reservoirs need to be back to their specific URC by April 30. The purpose of this shift is to improve the probability that Brownlee and Dworshak will be at their URC to allow for increased spring flows in the Snake River. These shifts may be implemented after coordination with TMT. The shifts typically occur in drier years when they will not compromise flood control.

4.9. Lower Granite Dam

4.9.1. Reservoir Operations

Lower Granite will operate within 1 foot of Minimum Operating Pool (MOP) from approximately April 3 until small numbers of juvenile migrants are present. This normally occurs in late August. Lower Granite Dam will not return to normal operating pool until enough natural cooling has occurred in the fall, generally after October 1. TMT will provide a recommendation. The purpose of this action is to provide a smaller reservoir cross section to reduce juvenile salmon travel time and reduce flow fluctuations. Elevations may be modified to maintain the minimum navigation channel requirements.

4.9.2. Turbine Operations

To enhance juvenile passage survival, turbines at Lower Granite will be operated within 1% of peak efficiency during the juvenile and adult migration seasons (April 1 through October 31). (See appendix C, Corps of Engineers 2008 Fish Passage Plan)

4.9.3. Spring flow objectives

The April final runoff volume forecast at Lower Granite Dam for April to July determines the spring flow objective at Lower Granite Dam. When the forecast is less than 16 million acre-feet (MAF) the flow objective will be 85 kcfs. If the forecast is between 16 MAF and 20 MAF the flow objective will be linearly interpolated between 85 kcfs and 100 kcfs. If the forecast is greater than 20 MAF the flow objective will be 100 kcfs. The planning dates for the spring flow objective are from April 3 to June 20. These flow objectives are provided as a biological guideline but they are not physically possible in some water years because they depend on actual water supplies provided by winter/spring snow pack and precipitation.

4.9.4. Summer flow objectives

The June final runoff volume forecast at Lower Granite Dam for April to July determines the summer flow objective at Lower Granite Dam. When the forecast is less than 16 MAF the flow objective will be 50 kcfs. If the forecast is between 16 MAF and 28 MAF the flow objective will be linearly interpolated between 50 kcfs and 55 kcfs. If the forecast is greater than 28 MAF the flow objective will be 55 kcfs. The planning dates for the summer flow objective are from June 21 to August 31. Summer flow objectives are provided as a biological guideline but they are not physically possible in most water years because they depend on actual water supplies provided primarily by precipitation.

4.9.5. Spill Operations

See 2008 Fish Operation Plan

4.10. Little Goose Dam

4.10.1. Reservoir Operations

Little Goose will operate within 1 foot of Minimum Operating Pool (MOP) from approximately April 3 until small numbers of juvenile migrants are present. This normally occurs in late August. The purpose of this action is to provide a smaller reservoir cross section to reduce juvenile salmon travel time and reduce flow fluctuations. Elevations may be modified to maintain the minimum navigation channel requirements.

4.10.2. Turbine Operations

To enhance juvenile passage survival, turbines at Little Goose will be operated within 1% of peak efficiency during the juvenile and adult migration seasons (April 1 through October 31). (See appendix C, Corps of Engineers 2008 Fish Passage Plan)

4.10.3. Spill Operations

See 2008 Fish Operation Plan

4.11. Lower Monumental Dam

4.11.1. Reservoir Operations

Lower Monumental will operate within 1 foot of Minimum Operating Pool (MOP) from approximately April 3 until small numbers of juvenile migrants are present. This normally occurs in late August. The purpose of this action is to provide a smaller reservoir cross section to reduce juvenile salmon travel time and reduce flow fluctuations. Elevations may be modified to maintain the minimum navigation channel requirements.

4.11.2. Turbine Operations

To enhance juvenile passage survival, turbines at Lower Monumental will be operated within 1% of peak efficiency during the juvenile and adult migration seasons (April 1 through October 31). (See appendix C, Corps of Engineers 2008 Fish Passage Plan)

4.11.3. Spill Operations

See 2008 Fish Operation Plan.

4.12. Ice Harbor Dam

4.12.1. Reservoir Operations

Ice Harbor will operate within 1 foot of Minimum Operating Pool (MOP) from approximately April 3 until small numbers of juvenile migrants are present. This normally occurs in late August. The purpose of this action is to provide a smaller reservoir cross section to reduce juvenile salmon travel time and reduce flow fluctuations. Elevations may be modified to maintain the minimum navigation channel requirements.

4.12.2. Turbine Operations

To enhance juvenile passage survival, turbines Ice Harbor will be operated within 1% of peak efficiency during the juvenile and adult migration seasons (April 1 through October 31). (See appendix C, Corps of Engineers 2007 Fish Passage Plan)

4.12.3. Spill Operations

See 2008 Fish Operations Plan

4.13. McNary Dam

4.13.1. Turbine Operations

To enhance juvenile passage survival, turbines at McNary projects will be operated within 1% of peak efficiency during the juvenile and adult migration seasons (April 1 through October 31). (See appendix C, Corps of Engineers 2008 Fish Passage Plan) .

4.13.2. Spring flow objectives

The spring flow objective at McNary Dam is set according to the April final runoff volume forecast at The Dalles Dam for April to August. When the forecast is less than 80 MAF the flow objective will be 220 kcfs. If the forecast is between 80 MAF and 92 MAF the flow objective will be linearly interpolated between 220 kcfs and 260 kcfs. If the forecast is greater than 92 MAF the flow objective will be 260 kcfs. The planning dates for the spring flow objective will be from April 10 to June 30.

4.13.3. Summer flow objectives

The summer flow objective at McNary Dam is 200 kcfs. The planning dates for the summer flow objective will be from July 1 to August 31.

4.13.4. Weekend flows

Weekend flows are often lower than weekday flows due to less electrical demand in the region. During the spring and summer migration period (April through August), the Action Agencies will strive to maintain MCN flows during the weekend at a level which is at least 80% of the previous weekday average.

4.13.5. Spill Operations

See 2008 Fish Operation Plan.

4.13.6. Waterfowl nesting

To improve waterfowl nesting conditions in the McNary pool between March and May each year, the pool is operated in the top 1 foot of the pool range for several hours every 4 days.

4.13.7. Waterfowl hunting enhancement

In order to enhance Waterfowl hunting, the McNary pool is held constant several times a week from October to January.

4.14. John Day Dam

4.14.1. Reservoir Operations

John Day pool will operate within a 1½-foot range of the minimum level that provides irrigation pumping from April 10 to September 30. The purpose of this action is to provide a smaller reservoir cross section to reduce juvenile salmon travel time.

4.14.2. Turbine Operations

To enhance juvenile passage survival, turbines at all the Lower Columbia projects will be operated within 1% of peak efficiency during the juvenile and adult migration seasons (April 1 through October 31). (See appendix C, Corps of Engineers 2008 Fish Passage Plan)

4.14.3. Spill Operations

See 2008 Fish Operation Plan.

4.14.4. Goose nesting

To encourage geese to nest in areas that are not typically inundated by frequent fluctuations in the John Day pool between March and May each year, the pool the reservoir is operated in the top 1 foot of the range for several hours every 4 days.

4.14.5. Waterfowl hunting enhancement

In order to enhance Waterfowl hunting, the John Day pool is held constant several times a week from October to January.

4.14.6. Tribal Fishing

To accommodate tribal fishing, the John Day pool may operate within a 1.5 foot operation range during tribal fishing seasons.

4.15. The Dalles Dam

4.15.1. Turbine Operations

To enhance juvenile passage survival, turbines at all the Lower Columbia projects will be operated within 1% of peak efficiency during the juvenile and adult migration seasons (April 1 through October 31). (See appendix C, Corps of Engineers 2008 Fish Passage Plan) .

4.15.2. Spill Operations

See 2008 Fish Operations Plan.

4.16. Bonneville Dam

4.16.1. Turbine Operations

To enhance juvenile passage survival, turbines at all the Lower Columbia projects will be operated within 1% of peak efficiency during the juvenile and adult migration seasons (April 1 through October 31). (See appendix C, Corps of Engineers 2008 Fish Passage Plan)

4.16.2. Spill Operations

See 2008 Fish Operations Plan.

4.16.3. Tribal Fishing

To accommodate tribal fishing, the Bonneville pool is normally held between elevation 75.0 and 76.5 feet during tribal fishing seasons.

4.16.4. Spring Creek Hatchery Release

The U.S. Fish and Wildlife Service typically releases between 7 and 8 million tule fall chinook fry from the Spring Creek National Fish Hatchery upstream of Bonneville Dam in March. The WY 2008 operation, which could include spill and/or corner collector operations, will be coordinated and included in the 2008 Spring Summer Update to the WMP.

5. Specific Operations

5.1. Canadian Storage for Flow Augmentation

The purpose of the actions below is to see if more water from Canadian storage projects can be obtained for flow augmentation.
One (1) MAF of Treaty storage will be requested and negotiated when available with BC Hydro to be provided and released during the migration season.
BPA will continue to work with BC Hydro to negotiate a non-Treaty storage agreement to provide for storage during the spring with subsequent release in July and August, for flow enhancement as long as operations forecasts indicate that water stored in the spring can be released in July and August.
A study regarding the shaping and release of water behind Canadian Treaty storage projects in July and August was completed in 2001.

5.2. Upper Snake River Reservoir Operation for Flow Augmentation

Reclamation will attempt to provide 487 KAF annually of flow augmentation from the Reclamation projects in the Upper Snake River basin consistent with its Proposed Action as described in the November 2004 Biological Assessment for O&M of its projects in the Snake River basin above Brownlee Reservoir. Reclamation's flow augmentation program is dependent on willing sellers and must be consistent with Idaho State law.

5.3. Bonneville Chum operations

The Action Agencies plan to operate the FCRPS to provide flows to support chum salmon spawning, incubation and egress in the Ives/Pierce Islands Complex, Hamilton Creek and Hardy Creek below Bonneville Dam.

The Ives/Pierce Islands Complex below Bonneville Dam represents about 10% of the natural spawning area for the ESA listed Columbia River chum. Non-listed lower Columbia River bright fall Chinook also spawn in the area. The 2004 NOAA Fisheries BiOp recognizes that access to spawning habitat in the Ives/Pierce area is primarily a function of the water surface elevations greater than 11.5 feet above mean sea level (msl). Managing the water surface elevation with the operation of Bonneville Dam has proven to be an effective means of protecting this spawning area.

Providing spawning access to Hamilton Creek and Hardy Creek is similarly a function of sufficient tailwater elevation but must be coupled with sufficient rainfall events to get the creeks flowing sufficiently.

As addressed in the 2004 UPA and NOAA-F BiOp, chum salmon spawning operations have lower priority than spring flow objectives or summer refill. If all of the UPA and BiOp objectives cannot be met, the Action Agencies will work with NOAA Fisheries and the regional salmon managers to identify operations that would best benefit salmon while maintaining other fish protection measures.

There are two phases of Chum operations; spawning which generally runs from late October through late December, and incubation and egress which runs from late December to early April.

5.3.1.1. Spawning Phase

During the spawning phase of the Bonneville/Ives Island chum salmon life cycle, the tailwater elevation will be held at minimum of 11.3 – 11.7 feet during the daylight hours. During night time hours the day time tailwater limits may be exceeded if needed to past additional water. This operation is generally requested (per the 2004 UPA and BiOp) to begin by TMT when a significant number of chum salmon present are spawning. Normally this occurs in the first week of November but can occur from late October through mid-November. The flow associated with providing an 11.5 foot msl tailwater is generally assumed to be between 110 kcfs and 125 kcfs. This is a conservative approach to managing chum spawning which is intended to discourage redd development at higher elevations that cannot be maintained throughout the incubation period. If higher flows materialize, the protection level may be increased or a decision may be made whether or not to protect the redds that were placed at higher elevations.

In order to maintain a stable tailwater elevation of 11.3 to 11.7 feet during day-light hours, water often needs to be held over at upstream reservoirs. The volume of water held over during the day must generally be released at night. As the distance between Grand Coulee (the nearest storage reservoir) and Bonneville dams is nearly three hundred miles, it can be difficult to maintain a tailwater elevation of 11.5 at all times due to the influence of significant rain events that could occur below Grand Coulee.

Research performed in 2005 to asses the impacts of higher flows (day and night) on chum salmon redd development by Tiffen (cite Tiffen, USGS if published) indicates that

increases in flows above 175 kcfs delayed spawning until flows dropped back to base levels (125 kcfs) but did not force fish to abandon their redds and search for new locations.

5.3.1.2. Incubation and Egress

WDFW will determine when chum spawning is completed, this usually occurs by the end of December. Then the operation is shifted to provide a tailwater elevation (to be determined by TMT) equal to or greater than the elevation of the highest established redds . This elevation is typically around 11.3 or 11.5 feet msl during normal water years. This operation continues until the completion of emergence and egress which usually extends to the start of the spring flow management season around April 10. At that time spring flow augmentation volumes generally provide sufficient flows to maintain the protection elevations necessary. If the emergence period extends beyond April 10th and the decision is made to maintain the tailwater, TMT will need to discuss the impacts of TDG associated with spill for fish in the gravel. Bonneville typically starts its spring spill around April 10, but a delay in the start of spill may be needed.

5.3.1.3. Typical Operation Specifications

During an average year, the following operation should begin in the first week of November or when fish arrive in sufficient numbers:
Bonneville project tailwater is held to the elevation range 11.3' - 11.7' between 0700 - 1900 hours. A project tailwater elevation of 11.7' must not be exceeded in any hour. Tailwater will be measured 0.9 miles downstream from the first powerhouse, 50 feet upstream from Tanner Creek and at R.M. 144.5. This is the “project tailwater” as opposed to the powerhouse tailwater.
After spawning is declared complete, the TMT establishes a recommended protection level considering the number of redds above the protection level provided during the operation to date. The protection elevation is then held as a minimum not to be exceeded in any hour until the end of emergence and egress.
After emergence and egress is declared complete by TMT, chum operations end.

5.3.1.4. General Chum Operation Considerations

Determine if operating Bonneville Dam to meet the minimum effective tailwater elevation of 11.5 feet or greater can be sustained over the needed duration of November through April exclusively from water stored in upstream reservoirs.
Consider implications of augmenting flows for chum on storage water available for spring and summer migrants. Augmenting flows for chum can significantly diminish the stored water available for migration of salmon in the spring.
Evaluate early season forecast to help inform establishment of tailbay elevations below Bonneville. A tailwater elevation of 11.5’ is possible in most years.
Minimize the impact to the upstream storage reservoirs by taking advantage of tides, precipitation, increases in incremental flows below Grand Coulee, the flow in the Willamette River and the operation of Bonneville Dam to maintain the tailbay elevation. It takes a few days for water from Grand Coulee Dam to arrive at Bonneville Dam. Requests to start the chum operation or change the current protection level should take into account the travel time. If managers expect the start of or a change in chum

operations to occur over a weekend the request must come by at least Wednesday of that week.
It is difficult to forecast increase in "local" inflows downstream of Grand Coulee which can raise the daytime tailwater elevation above the planned elevation. High night time spikes in temperature of short duration can be used to discourage redd development in low velocity areas at night. High flows from the Willamette River can raise the tailwater at Bonneville Dam significantly providing low velocity access to some areas in the Ives/Pierce complex. If spawning occurs in these areas, the redds may be difficult to protect once the Willamette recedes.
It is not possible to operate the system to provide desired tailwater elevations at spawning areas downstream of the Ives/Pierce complex (i.e. Multnomah Falls/I-205).
Any spill required for the March release of the Spring Creek Hatchery including the use of the corner collector can produce high TDG levels that may impact emerging chum salmon at a very vulnerable stage in their lifecycle
When spring flows are low and the spill season has begun it might be necessary to delay spill at Bonneville Dam to avoid impacting any emerging chum with excess TDG.

5.3.1.5. Considerations for Dewatering Chum Redds

While a conservative approach to managing tailwater elevations during spawning reduces the risk of dewatering redds, it does not eliminate dewatering as a possibility. The conditions in each year vary too dramatically to allow for the development of set criteria for whether or not to dewater redds, therefore the basis for a dewatering decision depends greatly on in-season conditions so are best made in TMT. Factors that should be considered in making a dewatering decision include:

- The number and percentage of the total redds which would be affected by the decision
- The percentage of the total chum population that spawned in the creeks
- The percentage of the total chum population that spawned at other locations
- The component of the overall population that these redds represent
- Status of the FCRPS reservoir elevations
- Expected benefit to reservoir levels and river operations which would be provided by the dewatering decision
- Precipitation and runoff forecasts
- Expected river operations due to power market environment
- Status of the upriver listed stocks
- Existence and status of a brood contingency plan

5.3.1.6. Dewatering Options

Consideration of options to minimize the impacts should a decision be made to lower the protection level for the spawning, incubation and egress follow:.

1. If water supply conditions indicate that it is not possible to maintain this minimum tailwater elevation at Bonneville Dam, flow will be provided at times during the chum- emergence season to allow juveniles to depart from Hamilton and Hardy Creeks. Details will be set through coordination in TMT.

2. Early season forecasts can be used by TMT to determine a level of caution when choosing the spawning elevations to provide below Bonneville. A general apprehension to provide tailwater elevations above 11.5' is prudent in most years. Fall precipitation can lead to chum spawning at higher elevations than intended. It may be difficult to commit to providing those elevations without a solid water supply forecast.

3. Manage flows below what is necessary for mainstem spawning to discourage redds from being established in the area.

4. Shaping flows in a manner that would discourage redd development above a particular elevation. Reverse load factoring with nighttime discharges more than 75 kcfs over the daytime discharge level have occurred without impacting where chum redds were placed.

5. Shaping flows as low as possible during the day with one or two spikes of flow as short of duration as possible can also discourage redd development.

6. If water supply conditions indicate that it is not possible to maintain this minimum tailwater elevation at Bonneville Dam, flow will be provided at times during the chum-spawning season to allow access to Hamilton and Hardy Creeks if the creeks are flowing

5.3.1.7. Broodstock Collection

The NPCC's Duncan Creek project outlines the logistics for the brood movement and fry-rearing program. Lower Columbia River adult chum salmon will continue to be captured for broodstock in 2008 to maintain the Duncan Creek Program. The salvage operation would expand the numbers of fish captured and reared in this newly established brood collection program to make up for the lack of mainstem spawning. Also, the Implementation Team requested that criteria used by NOAA Fisheries be included in making decisions regarding the provision of water for chum salmon spawning. A memo responding to this request is attached in Appendix 5.

5.4. Public Coordination

The purpose of the following actions is to provide for better regional coordination. Actions in the WMP will be coordinated with NOAA Fisheries, USFWS, and the states and tribes in preseason planning and in-season management of flow and spill operations. This coordination will occur in the Technical Management Team process.
At all appropriate decision points, the Action Agencies will routinely seek timely input and concurrence from the USFWS on all matters affecting USFWS listed fish through the Columbia River Treaty, International Joint Commission Orders, and all other decision making processes involving transboundary waters in the Columbia River basin. This will include notification of all meetings and decision points and provision of opportunities to advise the Action Agencies during meetings and in writing, as appropriate.

6. Water Quality

6.1. Water Quality Plans

The Corps completed a comprehensive Water Quality Plan (WQP) outlining the physical and operational changes that could be used to improve the overall water quality in the mainstem waters of the Clearwater, Snake, and Columbia rivers. The plan was first completed in April 2003 and updated in December 2003 and again in November 2006. The goals of the WQP are as follows:

- To assist in understanding system wide loading capacity and loading allocation by assessing the existing effects at Federal and non-Federal dams and tributaries.
- To provide an organized, coordinated approach to improving water quality, with the long-term goal of meeting water quality standards that the states and Tribes can integrate into their water quality management programs.
- To provide a framework for identifying, evaluating, and implementing reasonable actions for dam operators to use as they work toward reducing temperature and dissolved gas levels.
- To provide a record of the actions that are and are not feasible for structural and operational improvements aimed at improving water quality conditions and meeting water quality standards. This information may provide a basis for future beneficial use and water quality criteria revisions.
- To bring basin wide information into the decision processes regarding dissolved gas and temperature, and to provide technical assessment of a project's relative value in terms of water quality.
- To integrate dissolved gas and temperature work into one process for both Federal and non-Federal dams on the mainstem Columbia River and Snake River system.

Over the long term, with a focus on water quality, WQP implementation anticipates that EPA, NOAA, and the Federal Action Agencies will properly integrate with TMDL development and implementation activities on the mainstem and in the sub-basins.

6.1.1. Total Dissolved Gas Monitoring

Exposure to high levels of TDG over long periods of time can be harmful or lethal to fish. Environmental monitoring at the dams is necessary where voluntary spill is employed for juvenile fish passage to ensure that gas levels do not exceed TDG thresholds established in the NOAA BiOp, and variance levels established by the state water quality agencies. There are two purposes for the Corps to monitor TDG and water temperature at 10 Columbia River Basin dams: 1) to monitor project performance in relation to water quality standards, and 2) to provide water quality data for anadromous fish passage at Columbia/Snake mainstem dams. The monitoring program is considered an integral part of the Corps' Reservoir Control Center water management activities.

The physical TDG monitoring program is to include the QA/QC provisions stipulated in the "Data Quality Criteria for Fixed Monitoring Stations" completed in 2002 and approved by the Water Quality Team. This report describes the accuracy, precision, and completeness of data required at each fixed monitoring station. To achieve these goals, procedural methodologies are specified. These methodologies are characterized in three parts: calibration protocols (data quality control), data review and corrections (data quality assurance), and completeness of data (a substitute quality assurance program for station redundancy). Each fixed monitoring station will be assessed at the end of the monitoring season against these criteria and a performance report will be included in the Annual Dissolved Gas and Water Temperature Monitoring Report provided to the states of Oregon and Washington.

TDG is the primary water quality parameter monitored. High saturation level TDG can cause physiological damage to fish. Water temperature is also measured because it affects TDG saturation levels, and because it influences the health of fish and other aquatic organisms. Both TDG and water temperature are closely linked to project water management operations (e.g., water released over the spillways, releases through the powerhouses and other facilities, and forebay and tailwater water surface elevations). One component of the water quality strategy was for the Corps to take the actions necessary to implement the spill program at the dams indicated in the UPA, including obtaining variances from appropriate State water quality agencies. In December 2002, the Corps provided information to the Oregon Department of Environmental Quality in support of a modification in the TDG standard to spill water over McNary, John Day, The Dalles, and Bonneville dams to assist out-migrating threatened and endangered juvenile salmon smolts. This Oregon Environmental Quality Commission approved the modification from April 1st to August 31st through the 2007 fish passage season. In January 2005, the Corps provided information to the Washington Department of Ecology (WDOE) in support of an adjustment in the Washington State TDG standard to spill water over lower Columbia and Snake River dams to assist downstream migration of juvenile salmonids. The WDOE approved this adjustment for all spills related to fish passage through March 31st, 2008. These rule modifications/adjustments provide for a revision of the TDG standard from 110% to a revised standard of 115% in the forebays and 120% in the tailwaters of the lower Columbia and Snake River projects. The 115% and 120% caps are based on the 12 highest hourly measurements per calendar day. Also, a cap of TDG of 125%, based on the one highest hour (Washington) or highest two hours (Oregon), is in effect.

The Reservoir Control Center is responsible for monitoring the TDG and water temperature conditions in the forebays and the tailwaters of the lower Columbia River/lower Snake River dams, and selected river sites. The operational water management guidelines in Oregon are to change spill levels and, subsequently, spill patterns at the dams (daily if necessary) so that the forebays are as close to, but do not exceed, daily (12 highest hours) average of 115% TDG, and the tailwater levels do not exceed, daily (12 highest hours) average of 120% TDG.
The Corps prepares a Total Dissolved Gas Management Plan (TDG Management Plan) each year (see Appendix 4), which is a supporting document for the WMP. The TDG Management Plan summarizes the roles and responsibilities relating to dissolved gas monitoring. The TDG Management Plan stipulates what to measure, how, where, and when to take the measurements, and how to analyze and interpret the resulting data. The Plan also provides for periodic review and alteration or redirection of efforts when monitoring results and/or new information from other sources justifies a change. The Plan identifies channels of communication with other cooperating agencies and interested parties.

7. FCRPS Hydrosystem Performance Standards

The Action Agencies will operate the FCRPS hydrosystem as described in this WMP, in an adaptive management framework, to make progress towards meeting biological performance goals. Those goals are contained in the 2004 UPA and addressed in the 2004 NOAA Fisheries Biological Opinion. Adult and juvenile fish survival estimates from research, monitoring, and evaluation studies will be considered in annual planning as future plans are developed.

8. Conclusion

This final 2008 WMP has been coordinated with the Technical Management Team. Seasonal action plans will be developed as described in the introduction to this plan. Additionally, operations may be adjusted in-season based on recommendations from the TMT.