

2002 Water Management Plan

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1.0 Introduction

1.1 Preparation of Plans

This Water Management Plan for 2002 has been prepared as part of the implementation planning process outlined in the 2000 Biological Opinions (BiOps). This plan describes how the Federal Columbia River Power System (FCRPS) reservoirs will be operated for the 2002 water year (October 1, 2001 through September 30, 2002) to implement the water management measures in the BiOps. In addition to implementing the RPAs indicated in the BiOps the goal is to meet the performance standards specified in the NMFS 2002 BiOp. The FCRPS hydrosystem performance standards are presented in section 8. This plan will also describe any special operations or water management activities planned for the 2002 water year.

Per the BiOps, the action agencies will annually prepare a 1-year water management plan that covers FCRPS hydro operations in the upcoming water year. These plans will generally be drafted in July and completed by the end of September. The plan will cover the upcoming water year, which begins on October 1 and ends on September 30 the following year. This one-year plan will be written when very little information is known about the future year's water supply. Therefore, the annual water management portion of the 1-year implementation plan will generically describe 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.

The action agencies will also develop more detailed in season action plans to describe how the FCRPS projects will be operated under actual conditions with current water supply forecasts. The first action plan will be prepared in the fall to address the fall/winter operation of the FCRPS projects. A spring update will be drafted in January and finalized in the March/April time period to address the spring/summer operation of the FCRPS projects.

1.2 Strategy

The overall strategy for the water management plan is to enhance juvenile and adult fish survival through a coordinated set of hydro project management actions to achieve performance standards. The plan is structured to address the following substrategies associated with this overall strategy:

1. Reservoir Operations to enhance fish survival: Actions under this substrategy are generally specific project operations that benefit fish at or near the project or its reservoir.
2. System Flow Management to enhance fish survival: This substrategy includes coordinated system operations for mainstem flow management and redd protection.

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.
4. Juvenile fish transport actions to enhance fish survival: This substrategy includes actions to collect juvenile fish at selected projects for transport past mainstem dams.
5. Other actions to enhance water management: This substrategy includes water management related actions that are being done to improve fish survival, such as studies, water quality actions and water conservation improvements.

1.3 Changes From Last Year's Plan

This is the first water management plan developed under the 2000 BiOps.

Prior to 2001, the Technical Management Team (TMT) had developed annual Water Management Plans. These plans primarily described operations needed to comply with existing biological opinions, as well as relevant factors affecting those operations and any special research operations planned for the year. Similarly, this 2002 Water Management Plan contains most of the operational actions contained in TMT's plans. The operational actions outlined in this plan are intended to help the Action Agencies achieve the performance standards in the 2000 BiOps by improving hydro system survival of juvenile and adult salmon, steelhead, white sturgeon and bull trout. The Action Agencies intend to seek input from TMT on this plan prior to its finalization.

Last year in response to the low water conditions and unprecedented power market conditions, in March 2001, six Federal agencies (U.S. Army Corps of Engineers (USACE), Bureau of Reclamation (Reclamation), Bonneville Power Administration, U.S. Fish & Wildlife Service (USFWS), National Marine Fisheries Service (NMFS), and Environmental Protection Agency) developed a set of power system reliability criteria and priorities for fish operations for water year 2001 operations. In April, the agencies developed an operations plan to guide water management decisions in consideration of the established criteria and prioritization of operations from the 2000 BiOps. Input from states, tribes, and other regional parties were considered in the development of this plan. The convergence of both a low water year and an electrical shortage in 2001 were a very unique occurrence. It is anticipated that in future years the actions called for in the BiOps will be implemented consistent with any modifications made through adaptive management and reflected in annual and 5-year implementation plans.

2.0 Hydro System Operation

2.1 Priorities

The NMFS and USFWS BiOps 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 spawning and incubation flow below Bonneville Dam.

The Action Agencies have reviewed these strategies and other actions called for in the BiOps and developed the following priorities (in order) for flow management and individual reservoir operations:

- Operate storage reservoirs (Hungry Horse, Libby and Albeni Falls) to meet criteria for bull trout and sturgeon.
- Refill the storage projects by June 30 to provide summer flow augmentation.
- Operate storage projects to be at their April 10 Base –CRT63 flood control elevation or VARQ elevation (which ever is in effect) to increase available flows for spring flow management.
- Provide fall and winter flows for chum spawning.

The Action Agencies implement several independent FCRPS project operations to benefit fish at or near the project or its reservoir. Reservoirs are to be operated to meet project minimum outflows, to reduce outflow fluctuations to avoid stranding resident fish, 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 and not likely to change.

In an operating year that begins on October 1, the flow needs are not encountered in the same order as the BiOp priorities, i.e., the first decision to be made is for chum spawning flows which ultimately have a lower priority than summer flows. So chronologically, the Action Agencies will attempt to operate during the year as follows.

The initial objective is to operate the storage reservoirs (Dworshak, Hungry Horse, Libby, Albeni Falls, and Grand Coulee) to be at flood control levels by early April. This level varies by runoff forecast. Reaching early April Base –CRT63 flood control levels or VARQ elevation (which ever is in effect) will be affected by how much water was released for flood control, power generation, and fishery flows to support both chum and Hanford reach spawning. There may be

years when chum and Hanford Reach flows may need to be reduced in order to be at the early April flood control levels.

The next objective is to attempt to refill the storage reservoirs by about June 30 to maximize available storage of water for the benefit of summer migrants. The June 30 refill in general has priority over spring flow (April, May, June) objectives, while attempting to meet the spring flow objectives and other fish needs.

The final objective is the management of available storage to augment summer (July and August) flows to achieve flow objectives and for water temperature moderation. The storage reservoirs will be drafted to their specified August 31 draft limits to augment summer flows. These limits are a higher priority than the summer flow targets in order to meet other project uses and reserve water in storage for 2003.

These objectives are intended as general guidelines in overall system operations. The BiOps also 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 of our management actions on it, as opposed to following a rigid set of rules. Some items to be considered are current information on stock status, biological requirements, biological effectiveness, and hydrologic and environmental conditions. System managers recognize that there is often insufficient water to meet all the actions specified in the BiOps and meet other system uses 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. Therefore, the Action Agencies, in coordination with regional parties through the TMT, endeavor to consider the multiple uses of the system, while providing, as a high priority the measures to benefit listed species.

2.2 Conflicts

As stated above, there often is not enough water available in the Columbia River basin to meet every action item stated in the BiOps and provide 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 BiOps require 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 protection. The 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 BiOps call 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

Again, 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. 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 fills too early in the spring, late season rain or snowmelt may cause flood damage downstream and potentially produce higher dissolved gas levels.

2.2.3 Chum flows versus refill/Spring flows

Setting the flow level for chum spawning and incubation in recognition of the spring refill priority is one of the decisions that the Action Agencies in consultation with TMT have to make with the least amount of reliable information. Decisions about the flow level for chum spawning and incubation are made in the October/November time period, long before the action agencies have reliable information on the coming year's expected water supply. If the flow level selected is too high there is a risk of refill failure. Choosing to refill runs the risk of reducing the flow level and dewatering chum redds. A chum salvage plan is now being prepared to ensure that some level of chum salmon production will occur in the event chum flows cannot be provided.

2.2.4 Sturgeon pulse versus summer flow augmentation

Water released from Libby Dam for the spring sturgeon pulse during May through June may reduce the water available for summer flow augmentation from Libby. If the pulsed water cannot be stored in Grand Coulee, spring flows will be provided, potentially at the expense of summer flows. The Action Agencies are currently working with the state of Montana and the USFWS on the sturgeon tiered flows.

2.2.5 Fish operations versus other project uses

In addition to flood control operation, there are operations carried out for the purpose of enhancing fish survival that may conflict with other project purposes. For example, keeping the flow steady below a project for resident and anadromous fish needs conflicts with the ability to use a project to follow electrical load changes; spilling water for juvenile fish passage reduces the amount of power that can be generated to meet demand; and augmenting flows during fish migration periods may conflict with the shape of power demand. Additionally, irrigation demands and recreation elevations at headwater reservoirs may impact the amount of water available for spring flows.

2.2.6 Conflicts and priorities

The conflicts described above pose many challenges to the Action Agencies in meeting the multiple uses of the Federal hydro system. Given these challenges, the priorities for flow management and individual reservoir operations outlined in section 2.1 will guide the Action Agencies in their operational decision-making when conflicts arise. Discussion of conflicts between operations and alternatives for addressing such conflicts will occur in TMT.

2.3 Emergencies

The 2000 BiOps acknowledge that unexpected events/emergencies occur and may cause deviations from fish operations. Such deviations may be short in duration, such as a deviation to

respond to an unexpected unit outage or power line failure, or longer in duration, such as experienced this past year in response to the low water conditions and unprecedented power market conditions. The TMT has developed Emergency Protocols to be followed to respond to short-term emergencies.

(See TMT homepage at <http://www.nwd-wc.usace.army.mil/TMT> for current version of protocols.)

2.4 Research

Research studies sometimes require special operations that differ from routine operations otherwise described in the Biological Opinion's. These studies are generally developed through technical workgroups of the Regional Forum (e.g., SCT) and the USACE' Anadromous Fish Evaluation Program (FFDRWG and SRWG) and further described in 1- and 5-Year Implementation Plans. In most cases, operations associated with research entail relatively minor changes from routine operations and are coordinated in technical forums (e.g., TMT, FPOM). In some cases, the nature or magnitude of operational changes for research may require further coordination and review in policy forums (e.g., 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 spring to accommodate anticipated unique circumstances and/or to reallocate resources to obtain the greatest value given the circumstances.

3.0 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 BiOps. Other decision points, such as setting weekly flow augmentation levels, require much discussion and coordination. Some of the decision points given below are spelled out in the BiOps and some are based on experience. These decisions are made by the action agencies in consideration of actions called for in the BiOps and input received through the Regional Forum (TMT, IT, Regional Executives).

Table 1. Water Management Decision Points/Actions

	Early October	Winter (December - March)	Early April	Early May	June	Early July
Operations	<ul style="list-style-type: none"> Assess potential of providing flows for chinook populations below Bonneville Dam (<i>Non-BiOp Action</i>) Assess potential 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 (<i>Non-BiOp Action</i>) Calculate Integrated Rule Curves at Hungry Horse and Libby 	<ul style="list-style-type: none"> 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 (<i>Non-BiOp Action</i>) Begin spring transport discussions Hanford Reach Operations Discussed (<i>Non-BiOp Action</i>) Outlook for meeting flow objectives prepared 	<ul style="list-style-type: none"> 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 	<ul style="list-style-type: none"> Use May final forecast to calculate the appropriate volume of the sturgeon tiered flow release from Libby using new, coordinated formula 	<ul style="list-style-type: none"> 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) 	<ul style="list-style-type: none"> Grand Coulee summer reservoir draft limit determined by July final volume forecast
Plans	Develop fall/winter update to the	Preliminary work on spring/summer update to the annual water	Start operational plans for	Libby and Hungry Horse		

	annual water management plan	management plan	Libby and Hungry Horse Dams	operational plans due		
Forecast s		January, February, and March volume forecasts released by the RFC	April final forecast released by RFC		June final forecast released by RFC	

Water supply forecasts

Water supply forecasts are used as a guide to how much water is available for fish and other operations.

The National Weather Service's Northwest River Forecast Center, USACE Northwest Division Hydrologic Engineering Branch, Reclamation, and others prepare water supply forecasts to manage the Columbia River. Table 2 below lists the forecasts that are referenced by the NMFS 2000 BiOp and the USFWS 2000 BiOp.

Table 2. Water Supply Forecasts

Forecast Point	Forecast period	Forecast	What does it control	BiOp reference	RPA Action Item
Lower Granite	April - July	April Final	Spring Flow objective at Lower Granite	NMFS BiOp at Section 9.6.1.2.1 Page 9-57	NMFS Action 14
Lower Granite	April - July	June Final	Summer Flow objective at Lower Granite	NMFS BiOp at Section 9.6.1.2.1 Page 9-57	NMFS Action 14
The Dalles	April - August	April Final	Spring Flow objective at McNary Dam	NMFS BiOp at Section 9.6.1.2.1 Page 9-57	NMFS Action 14
Hungry Horse	April - August	March Final provided by Reclamation	Hungry Horse minimum flows	NMFS BiOp at Section 9.6.1.2.3 Page 9-63 USFWS BiOp at Section 3.A.1 Page 6	NMFS Action 19
Hungry Horse	April - August	March Final provided by Reclamation	Columbia Falls minimum flow	NMFS BiOp at Section 9.6.1.2.3 Page 9-63 USFWS BiOp at Section 3.A.1 Page 7	NMFS Action 19
The Dalles	April - August	July Final	Grand Coulee Summer Draft Limit	NMFS BiOp at Section 9.6.1.2.3 Page 9-64	NMFS Action 19
Libby	April - August		Volume of Water for Sturgeon Flow at Bonners Ferry and Minimum bull trout flows between	USFWS BiOp at Section 8.1 Page 74 and USFWS BiOp at Section 3.A.2 Page 15	USFWS Action f-3

			sturgeon and salmon flows		
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4.0 Sub-Strategies: Reservoir Operations and System Flow Management to Enhance Fish Survival

These substrategies include individual and system operations of the FCRPS. The two substrategies Reservoir Operations and System Flow Management are discussed in one section in the water management plan in order to conveniently group the operational actions for individual projects or group of projects in one section.

The substrategy “Reservoir Operations to enhance fish survival” generally includes independent FCRPS projects operations which benefit fish at or near the project or its reservoir and increases system survival by improving mainstem passage conditions. Reservoirs are to be operated to meet project minimum outflows, to reduce outflow fluctuations to avoid stranding resident fish, to reduce cross sectional area to speed juvenile passage, to make specific temperature releases to improve water temperatures for fish, and to provide for reproduction of listed resident fish.

Table 3 summarizes the major fish-related reservoir and flow operations by project. More detailed descriptions of each of these operations follows.

Table 3. Major Fish Related Reservoir and Flow Operations

Project	Flood Control & Refill	Sturgeon	Bull Trout	Spring Anadromous	Summer Anadromous	Chum
Libby	<p><u>Winter:</u> Operate to flood control rule curve and achieve appropriate elevation by April 10</p> <p><u>Spring:</u> Refill by June 30 and operate to meet flow objectives</p>	<p><u>May-June:</u> Augment flows at Bonners Ferry for sturgeon pulse</p>	<p><u>Year Round:</u> Operate to minimum flows and project ramping rates to minimize adverse affects of flow fluctuations</p>	<p>Operate to meet flow objectives and June 30 refill</p>	<p><u>July/August:</u> Draft for summer flow augmentation, not to exceed reservoir draft limit of 2,439 feet</p>	<p>Fall / winter storage may be used to support chum flows</p>
Hungry Horse	<p><u>Winter:</u> Operate to flood control</p> <p><u>Spring:</u> Refill by June 30 and operate to meet flow objectives</p>		<p><u>Year Round:</u> Operate to Columbia Falls minimum flows and project ramping rates to minimize adverse affects of flow fluctuations</p>		<p><u>July/August:</u> Draft for summer flow augmentation, not to exceed reservoir draft limit of 3,540 feet</p>	<p>Fall / winter storage may be used to support chum flows</p>
Albeni Falls	<p><u>Winter:</u> Operate to flood control rule curve by April 10</p> <p><u>Spring:</u> Refill by June 30 and operate to meet flow objectives</p>		<p><u>Fall/Winter:</u> Maintain elevation 2,051 feet until kokanee fry emergence (approximately end of April)</p>			<p>Fall / winter storage may be used to support chum flows</p>
Grand Coulee	<p><u>Winter:</u> Operate to flood control rule curve by April 10</p> <p><u>Spring:</u> Refill by June 30 and operate to meet flow objectives</p>				<p><u>July-August:</u> Draft for summer flow augmentation, not to exceed reservoir draft limit of 1,280 feet (>= 92 maf fcast at The Dalles) or 1,278 feet (< 92 maf fcast at The Dalles)</p>	<p>Fall / winter storage may be used to support chum flows</p>

Project	Flood Control & Refill	Sturgeon	Bull Trout	Spring Anadromous	Summer Anadromous	Chum
Grand Coulee (continued)					July/August: Operate Banks Lake at elevation 5 feet less than full to provide more water for summer flow augmentation	
Dworshak	<p><u>Winter</u>: Operate to flood control rule curve by April 10</p> <p><u>Spring</u>: Refill by June 30 and operate to meet flow objectives</p>				Draft for summer flow augmentation and water temperature reduction, not to exceed reservoir draft limit of 1,520 feet	Fall / winter storage may be used to support chum Flows
Lower Granite				<p>Flow objective of 85-100 kcfs</p> <p>Operate within 1 foot of MOP to reduce juvenile travel time</p> <p><u>Mar 15-Nov 30</u> Operate to 1% peak efficiency</p>	<p>Flow objective of 50-55 kcfs</p> <p>Operate within 1 foot of MOP to reduce juvenile travel time</p> <p><u>Mar 15-Nov 30</u> Operate to 1% peak efficiency</p>	
Little Goose				<p>Operate within 1 foot of MOP to reduce juvenile travel time</p> <p><u>Mar 15-Nov 30</u> Operate to 1% peak efficiency</p>	<p>Operate within 1 foot of MOP to reduce juvenile travel time</p> <p><u>Mar 15-Nov 30</u> Operate to 1% peak efficiency</p>	
Lower Monumental				<p>Operate within 1 foot of MOP to reduce juvenile travel time</p> <p><u>Mar 15-Nov 30</u> Operate to 1% peak efficiency</p>	<p>Operate within 1 foot of MOP to reduce juvenile travel time</p> <p><u>Mar 15-Nov 30</u> Operate to 1% peak efficiency</p>	

Project	Flood Control & Refill	Sturgeon	Bull Trout	Spring Anadromous	Summer Anadromous	Chum
Ice Harbor				Operate within 1 foot of MOP to reduce juvenile travel time <u>Mar 15-Nov 30</u> Operate to 1% peak efficiency	Operate within 1 foot of MOP to reduce juvenile travel time <u>Mar 15-Nov 30</u> Operate to 1% peak efficiency	
McNary				Flow objective of 220-260 kcfs <u>Mar 15-Oct 31</u> Operate to 1% peak efficiency	Flow objective of 200 kcfs <u>Mar 15- Oct 31</u> Operate to 1% peak efficiency	
John Day				<u>Apr 10-Sep 30</u> Operate within 1.5 foot of MIP to reduce juvenile travel time <u>Mar 15-Oct 31</u> Operate to 1% peak efficiency	<u>Mar 15-Oct 31</u> Operate to 1% peak efficiency	
The Dalles				<u>Mar 15-Oct 31</u> Operate to 1% peak efficiency	<u>Mar 15-Oct 31</u> Operate to 1% peak efficiency	
Bonneville				<u>Mar 15-Oct 31</u> Operate to 1% peak efficiency	<u>Mar 15-Oct 31</u> Operate to 1% peak efficiency	If hydrologic conditions indicate system can likely maintain minimum flow below BON of 125 kcfs Nov 1-April, implement mainstem chum flows. If not, provide flows below BON to enable access to creeks for spawning.

4.1 Flow Objectives

The purpose of the flow objectives is to aid in achieving the hydro system performance standards by providing better instream flow to aid in juvenile salmon and steelhead migration and enhance water quality. However, as recognized in the BiOps, it is not possible to achieve the flow objectives in many water years because there is limited water and reservoir storage. This Water Management Plan strives to achieve the best possible conditions recognizing the priorities established in this document and the need to balance the limited water and storage resources available in the region.

4.1.1 Lower Granite

4.1.1.1 Spring anadromous fish

The April final runoff volume forecast at Lower Granite Dam for April to July determines the spring flow objective at Lower Granite Dam.¹ When the forecast is less than 16 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 flow objective are from April 3 to June 20.

4.1.1.2 Summer anadromous fish

The summer flow objective at Lower Granite Dam is determined by the June final runoff volume forecast at Lower Granite Dam for April to July.¹ When the forecast is less than 16 maf the flow objective will be 50 kcfs. If the forecast is between 16 maf and 20 maf the flow objective will be linearly interpolated between 50 kcfs and 55 kcfs. If the forecast is greater than 20 maf the flow objective will be 55 kcfs. The planning dates for the flow objective will be from June 21 to August 31.

4.1.2 Priest Rapids—Spring anadromous fish

The spring flow objective at Priest Rapids dam is 135 kcfs.¹ The planning dates are from April 10 to June 30.

4.1.3 McNary

4.1.3.1 Spring anadromous fish

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.¹ 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 flow objective will be from April 10 to June 30.

¹ NMFS BiOp at Section 9.6.1.2.1 Page 9-57, Action 14

4.1.3.2 Summer anadromous fish

The summer flow objective at McNary Dam is 200 kcfs.² The planning dates for the flow objective will be from July 1 to August 31.

4.2 All Storage Projects

The purpose of the following actions is to refill FCRPS storage projects as much as possible for spring flows and summer flow augmentation.

The FCRPS dams will be operated during the winter season in order to achieve a high probability of water surface elevations within 0.5 foot of the flood control rule curve by April 10 and to refill by June 30, except as specifically provided by the TMT.³

During the spring, the Action Agencies shall operate the FCRPS to meet the flow objectives and refill the storage reservoirs (Albeni Falls, Dworshak, Grand Coulee, Hungry Horse, and Libby) by approximately June 30.⁴ If both these objectives cannot be achieved, the TMT will make an in-season recommendation, weighing considerations unique to each particular year. Because research results indicate that increased flows have more direct survival benefits for summer migrants than for spring migrants, modest reductions in spring flows to facilitate reservoir refill would generally be preferable to refill failure.

During the summer, the Action Agencies draft mainstem storage reservoirs within the 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.

4.3 Libby

4.3.1 Flood Control

Libby will be operated during the winter season in order to achieve a high probability of water surface elevations within 0.5 foot of the Base-CRT63 flood control elevation or VARQ elevation (whichever is in effect) by April 10 and to refill by June 30, except as specifically provided by the TMT.³

During the spring, the Action Agencies shall operate Libby to contribute to meeting the flow objectives and refill by approximately June 30.⁴

² NMFS BiOp at Section 9.6.1.2.1 Page 9-58, Action 14

³ NMFS BiOp at Section 9.6.1.2.1 Page 9-56, Action 14 and NMFS BiOp at Section 9.6.1.2.3 Page 9-61, Action 18

⁴ NMFS BiOp at Section 9.6.1.2.3 Page 9-61, Action 18

4.3.2 Sturgeon

The purpose of the actions below is to provide water for sturgeon spawning.

Water shall be stored in Libby reservoir and supply, at a minimum, water volume during May and June based upon water availability or the "tiered" approach as defined through coordinated reevaluation to take place in 2002 among USACE, USFWS, MDFWP and other interested parties and summarized in the table below. This water shall be in addition to storage needs for listed bull trout, salmon, and the 4,000 cfs minimum releases from Libby Dam. Accounting on these total tiered volumes shall begin when the USFWS determines benefits to conservation of sturgeon are most likely to occur. This may include releases timed to enhance survival of eggs, yolk sac larvae, or larvae reared under the preservation stocking program and released into the Kootenai River. Releases may be timed to serve both wild fish and hatchery eggs/fish. 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.⁵

Table 4. "Tiered" volumes of water for sturgeon flow enhancement to be provided from Libby Dam according to the April - August volume runoff forecast at Libby. Actual flow releases would be shaped according to seasonal requests from the Service and in-season management of water actually available.

Forecast runoff Volume (maf*) at Libby	Sturgeon flow volume (maf) from Libby Dam on May-June
0.00 < forecast < 4.80	Sturgeon flows not requested
4.80 < forecast < 6.00	0.4
6.00 < forecast < 6.70	0.5
6.70 < forecast < 8.10	0.7
8.10 < forecast < 8.90	1.2
8.90 < forecast	1.6

(USFWS BiOp, page 15 and part of Appendix A of the USFWS BiOp)

**maf = million acre-feet*

The purpose of the actions below is to provide for the annual sturgeon pulse.

Libby outflow will fulfill the operational guidelines provided by the USFWS annually prior to and during the sturgeon spawning/incubation period. Specific release recommendations will be

⁵ USFWS BiOp at Section 8.1.c Page 73, Action-f 3

developed in consultation with action agencies and submitted annually through the TMT or similar regional process.⁶

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 control of Libby Dam.)⁷

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.⁸

The following minimum flows to protect bull trout between the sturgeon and salmon flows will be provided based on the April - August volume runoff forecast at Libby.

Table 5. Minimum bull trout releases in July from Libby Dam.

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

(USFWS BiOp at Section 3.A.2 Page 13)

*maf = million acre-feet

The Action Agencies are currently working with the state of Montana and the USFWS on the sturgeon tiered flows.

4.3.3 Summer anadromous fish

During the summer (July-August) the Action Agencies shall operate Libby to help meet the flow objectives for juvenile salmon out

⁶ USFWS BiOp at Section 8.2.c Page 80, Action-f 20

⁷ USFWS BiOp at Section 8.3.b Page 80, Action-f 23

⁸ USFWS BiOp at Section 8.3.g Page 81, Action-f 28

migration in the lower Columbia. Retention of July/August water in Lake Kootenay is possible under a Libby-Arrow water exchange but is not guaranteed. This exchange agreement also reduces the second flow peak created by July/August salmon flow through Kootenay Lake July and August. An agreement will be sought by October 2001.⁹ The purpose of this action is to reduce or eliminate the second peak. (Note: This type of exchange is allowed under the current Libby Coordination Agreement, which was signed February 16, 2000. Because the operation must have mutual benefit and the magnitude of the water year is not known earlier, the operation for a given water year is not finalized until June or July of that year.)

The summer reservoir draft limit is 2,439 feet.¹⁰ If Libby is below 2,439 on July 1 Libby will provide the USFWS bull trout minimum flow.¹¹ This limit determines the maximum draft available for summer flow augmentation from Libby.

4.3.4 Bull Trout

The purpose of the following actions is to provide better conditions for resident fish by limiting the flow fluctuations and setting minimum flow levels.

Operational constraints will be implemented at Libby Dam intended to minimize adverse effects of rapid and severe river flow fluctuations on bull trout, including year-round minimum flows and ramping rates, seasonal water management, conducting studies to monitor the adequacy of the constraints, and providing for modification of the operational constraints depending on study results.¹² Exact operational constraints are shown in paragraphs below.

The following ramp rates will be used.

Table 6. Prescribed ramp rates to protect resident fish and their food organisms, and to minimize levee erosion, in the Kootenai River.

Daily and Hourly Maximum Ramp Up Rates for Libby Dam (as measured by daily flows, not daily averages, restricted by hourly rates)			
Flow Range	Ramp Up Unit (Daily max)	Ramp Up (Hourly max) 1 Oct - 30 Apr	Ramp Up (Hourly max) 1 May - 30 Sep
4,000 - 6,000 cfs	Limit ramp up to one unit per day (approx. 5,000 cfs per day)	2,000 cfs/hr	1,000 cfs/hr

⁹ USFWS BiOp at Section 8.1.e Page 75, Action-f 5

¹⁰ NMFS BiOp at Section 9.6.1.2.3 Page 9-63, Action 19

¹¹ USFWS BiOp at Section 11.A..1.a Page 93, Action-f 59

¹² USFWS BiOp at Section 10.A.1 Page 87, Action-f 42

6,000 - 9,000 cfs	Limit ramp up to one unit per day (approx. 5,000 cfs per day)	2,000 cfs/hr	1,000 cfs/hr
> 9,000 - 17,000 cfs	Limit ramp up to one unit per day (approx. 10,000 cfs per day)	3,500 cfs/hr	2,000 cfs/hr
> 17,000 cfs	No limit	7,000 cfs/hr	3,500 cfs/hr

(USFWS BiOp at Section 3.A.2 Page 13)

Daily and Hourly Maximum Ramp Down Rates for Libby Dam (as measured by daily flows, not daily averages, restricted by hourly rates)			
Flow Range	Ramp Down Unit (Daily Max)	Ramp Down (Hourly max) 1 Oct - 30 Apr	Ramp Down (Hourly max) 1 May - 30 Sep
4,000 - 6,000 cfs	Limit ramp down to 500 cfs per day	500 cfs/hr	500 cfs/hr
> 6,000 - 9,000 cfs	Limit ramp down to 1,000 cfs per day	500 cfs/hr	500 cfs/hr
> 9,000 - 17,000 cfs	Limit ramp down to 2,000 cfs per day	1,000 cfs/hr	1,000 cfs/hr
> 17,000 cfs	Limit ramp down to one unit per day (approx. 5,000 cfs per day)	5,000 cfs/hr	3,500 cfs/hr

(USFWS BiOp at Section 3.A.2 Page 14)

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.¹³

Variations to ramping rates during years where runoff forecasting or shortage shortfalls occur, or variations are necessary to provide augmentation water for other listed species, will be negotiated through the TMT process. This is expected in only the lowest 20th percentile water years.¹⁴

Note: 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. The action agencies will provide additional information to the USFWS describing operations outside the "rough zone."¹⁴

Daily load following in the outflow from Libby Dam will be limited to the extent that levees in Kootenai Valley are no

¹³ USFWS BiOp at Section 3.A.2 Page 14

¹⁴ USFWS BiOp at Section 3.A.2 Page 13

longer damaged, and public outreach materials addressing this issue shall be provided.¹⁵

4.3.5 Coordination

Libby dam flows shall be regulated consistent with existing treaties, Libby Project authorization for public safety, other laws, and the 1938 International Joint Commission order, to achieve water volumes, water velocities, water depths, and water temperature at a time to maximize the probability of allowing significant sturgeon recruitment.¹⁶

4.4 Hungry Horse

4.4.1 Flood Control

Hungry Horse will operate using VARQ starting January 1, 2001.¹⁷ The purpose of this action is to provide more water for flow augmentation.

Hungry Horse will be operated during the winter season in order to achieve a high probability of water surface elevations within 0.5 foot of the flood control rule curve by April 10 and to refill by June 30, except as specifically provided by the TMT.¹⁸

4.4.2 Refill

During the spring, the Action Agencies shall operate Hungry Horse to contribute to meeting the flow objectives and refill by approximately June 30.¹⁹

4.4.3 Summer anadromous fish

During the summer (July – August) the Action Agencies shall operate Hungry Horse to help meet the flow objectives. The summer reservoir draft limit is 3,540 feet.²⁰ This limit determines the maximum draft available for summer flow augmentation from Hungry Horse.

4.4.4 Bull Trout

The purpose of the following actions is to provide better conditions for resident fish by limiting the flow fluctuations and setting minimum flow levels.

Operational measures will be implemented at Hungry Horse Dam to minimize adverse effects of rapid and severe river flow fluctuations on bull trout, including year-round minimum flows and ramping rates, and seasonal water management; conduct studies to monitor the adequacy of the constraints; and provide for modification of the operational constraints depending on study

¹⁵ USFWS BiOp at Section 8.3.f Page 81, Action-f 27

¹⁶ USFWS BiOp at Section 8.1.a Page 73, Action-f 1

¹⁷ NMFS BiOp at Section 9.6.1.2.3 Page 9-62 Action 19

¹⁸ NMFS BiOp at Section 9.6.1.2.1 Page 9-56, Action 14 and NMFS BiOp at Section 9.6.1.2.3 Page 9-61, Action 18

¹⁹ NMFS BiOp at Section 9.6.1.2.3 Page 9-61, Action 18

²⁰ NMFS BiOp at Section 9.6.1.2.3 Page 9-63, Action 19

results.²¹ Exact operational measures are shown in paragraphs below.

The following ramp rates will be used.

Table 7. Ramp rates prescribed for Hungry Horse Dam releases 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

(USFWS BiOp at Section 3.A.1 Page 8)

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

(USFWS BiOp at Section 3.A.1 Page 8)

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.²²

Variances to ramping rates during years where runoff forecasting or storage shortfalls occur, or variances are necessary to

²¹ USFWS BiOp at Section 10.A.1 Page 87, Action-f 43

²² USFWS BiOp at Section 3.A.1 Page 8

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.²³

Note: The ramp rates will be followed except when they would cause a unit(s) to operate 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.”²³

The minimum outflow for Hungry Horse Dam will be determined monthly starting with the January forecast, with final flows based on the March final runoff forecast for Hungry Horse Reservoir for the period April 1 to August 31. These forecasts will be provided by Reclamation to the TMT. If the April – August forecast is greater than 1,790 kaf the minimum flow shall be 900 cfs. If the forecast is less than 1,190 kaf the minimum flow shall be 400 cfs. If the forecast is between 1,190 and 1,790 kaf the minimum flow will be linearly interpolated between 400 and 900 cfs.²⁴ The minimum flow from Hungry Horse can be lowered to 145 cfs when the river at Columbia Falls reaches flood level (13 feet).

The minimum flow at Columbia Falls will be determined monthly starting with the January forecast, with the final flows based on the March final runoff forecast for Hungry Horse Reservoir for the period of April 1 to August 31. If the April – August forecast is greater than 1,790 kaf the minimum flow shall be 3,500 cfs. If the forecast is less than 1,190 kaf the minimum flow shall be 3,200 cfs. If the forecast is between 1,190 and 1,790 kaf the minimum flow will be linearly interpolated between 3,200 and 3,500 cfs.²⁵

4.5 Albeni Falls

4.5.1 Flood Control

Albeni Falls will be operated during the winter season in order to achieve a high probability of water surface elevations within 0.5 foot of the flood control rule curve by April 10 and to refill by June 30, except as specifically provided by the TMT.²⁶

4.5.2 Refill

During the spring, the Action Agencies shall operate Albeni Falls to meet the flow objectives and refill by approximately June 30.²⁷

4.5.3 Resident Fish

In the fall/winter 2001 (2002 water year) Albeni Falls shall be drawn down to an elevation 2,051 feet to cleanse shoreline gravels.²⁸ The purpose of this action is to provide for the

²³ USFWS BiOp at Section 3.A.1 Page 7

²⁴ NMFS BiOp at Section 9.6.1.2.3 Page 9-63, Action 19 and USFWS BiOp at Section 3.A.1 Page 6

²⁵ NMFS BiOp at Section 9.6.1.2.3 Page 9-63, Action 19 and USFWS BiOp at Section 3.A.1 Page 7

²⁶ NMFS BiOp at Section 9.6.1.2.1 Page 9-56, Action 14 and NMFS BiOp at Section 9.6.1.2.3 Page 9-61, Action 18

²⁷ NMFS BiOp at Section 9.6.1.2.3 Page 9-61, Action 18

²⁸ NMFS BiOp at Section 9.6.1.2.3 Page 9-64, Action 19; USFWS BiOp at Section 10.A.1.4 Page 89, Action-f 45; and USFWS BiOp at Section 11.A.1.4.a Page 94, Action-f 65

alternating lake drawdown and draw-up operation as part of the, kokanee egg-to-fry survival study at Lake Pend Oreille.

4.6 Upper Snake River Reservoir Operation for Flow Augmentation

The purpose of this action is to provide water from the upper Snake Reservoirs for flow augmentation.

Reclamation will attempt to provide 427 kaf of flow augmentation from the Reclamation projects in the upper Snake River basin consistent with the NMFS 2002 Supplemental Biological Opinion.²⁹

4.7 Brownlee, Dworshak, and Grand Coulee Flood Control

Opportunities to shift flood control requirements from Brownlee and Dworshak to Grand Coulee shall be considered.³⁰ 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.

4.8 Dworshak

4.8.1 Flood Control

Dworshak will be operated during the winter season in order to achieve a high probability of water surface elevations within 0.5 foot of the flood control rule curve by April 10 and to refill by June 30, except as specifically provided by the TMT.³¹

4.8.2 Refill

During the spring, the Action Agencies shall operate Dworshak to meet the flow objectives and refill by approximately June 30.³²

After summer fish operations flows from Dworshak shall be limited to minimum one turbine operation (approximately 1,500 cfs) unless higher flows are required for flood control.³³ The purpose of this action is to assist in the filling of Dworshak reservoir.

4.8.3 Summer anadromous fish

During the summer (July–August) the Action Agencies shall operate Dworshak to help meet the flow objectives. The summer reservoir draft limit is 1,520 feet.³⁴ This limit determines the maximum draft available for summer flow augmentation from Dworshak.

²⁹ NMFS BiOp at Section 9.6.1.2.6 Page 9-70, Action 32

³⁰ NMFS BiOp at Section 9.6.1.2.3 Page 9-65, Action 21

³¹ NMFS BiOp at Section 9.6.1.2.1 Page 9-56, Action 14 and NMFS BiOp at Section 9.6.1.2.3 Page 9-61, Action 18

³² NMFS BiOp at Section 9.6.1.2.3 Page 9-61, Action 18

³³ NMFS BiOp at Section 9.6.1.2.3 Page 9-65, Action 19

4.8.4 Water quality

During the summer, releases shall be made from Dworshak to attempt to maintain water temperatures at the Lower Granite forebay water quality station at or below 68 F.³⁴ The purpose of this action is to improve water quality (by lowering water temperature) in the Lower Snake River.

4.9 Lower Snake Projects (Lower Granite, Little Goose, Lower Monumental, and Ice Harbor)

4.9.1 Reservoir Passage

All Lower Snake Projects will operate within 1 foot of MOP (Minimum Operating Pool) from approximately April 3 until small numbers of juvenile migrants are present.³⁴ Lower Granite Dam shall not return to normal operating pool until enough natural cooling has occurred in the fall, generally after October 1. The purpose of this action is to provide a smaller reservoir cross section to reduce juvenile salmon travel time.

4.9.2 Juvenile Fish Survival

Turbines at all Lower Snake projects will be operated within 1 percent of peak efficiency during the juvenile and adult migration seasons (March 15 through November 30).³⁵

4.10 Grand Coulee

4.10.1 Flood Control

Grand Coulee will be operated during the winter season in order to achieve an 85 percent probability of water surface elevations within 0.5 foot of the flood control rule curve by April 10. It will be operated to refill by July 4 if flow augmentation to meet summer flow objectives is not needed before July 4. The TMT may provide other specific operations.³⁶

4.10.2 Refill

During the spring, the Action Agencies shall operate Grand Coulee to meet the flow objectives and refill by approximately July 4.³⁷

4.10.3 Summer anadromous fish

During the summer (July–August) the Action Agencies shall operate Grand Coulee to help meet the flow objectives for juvenile salmon out migration. The summer reservoir draft limit is 1,280 feet in years where the April through August forecast for The Dalles is equal to or exceeds 92 maf. If the forecast is less than 92 maf the draft limit will be 1,278 feet.³⁸ This limit determines the maximum draft available for summer flow augmentation from Grand Coulee.

³⁴ NMFS BiOp at Section 9.6.1.2.3 Page 9-65, Action 20

³⁵ NMFS BiOp at Section 9.6.1.4.4 Page 9-93, Action 58

³⁶ NMFS BiOp at Section 9.6.1.2.1 Page 9-56, Action 14 and NMFS BiOp at Section 9.6.1.2.3 Page 9-61, Action 18

³⁷ NMFS BiOp at Section 9.6.1.2.3 Page 9-61, Action 18

³⁸ NMFS BiOp at Section 9.6.1.2.3 Page 9-64, Action 19

4.11 Banks Lake Summer Draft

Banks Lake will be drafted to elevation 1,565 feet by the end of August.³⁹ The purpose of this action is to provide more water for summer flow augmentation.

4.12 Hanford Reach Protection Flows

Grant County PUD limits outflow from Priest Rapids Dam to minimize juvenile fish stranding. (Note: This is not a BiOp operation.)

4.13 Vernita Bar Protection Flows

Flow operations are conducted at Vernita Bar so fall chinook salmon can establish redds (spawn) at an elevation that redds will not be dewatered later. Flows are generally reduced in October and November when redds are being established. Flow reductions are limited through fish emergence in early May. (Note: This is not a BiOp operation but is included pursuant to the Vernita Bar Settlement Agreement.)

4.14 Lower Columbia Projects (McNary, John Day, The Dalles, Bonneville)

To enhance juvenile passage survival, turbines at all the Lower Columbia projects will be operated within 1 percent of peak efficiency during the juvenile and adult migration seasons (March 15 through October 31).⁴⁰

4.15 John Day

John Day pool shall operate within a 1½-foot range of the minimum level that provides irrigation pumping from April 10 to September 30.⁴¹

4.16 Bonneville Dam Chum Flows

The purpose of the following actions is to provide spawning areas and protect redds of chum salmon.

Flows will be regulated below Bonneville Dam to support spawning of chum salmon if the best hydrologic data available by early October indicate that precipitation, runoff, and reservoir storage are likely to support the operation from the start of spawning (late October or early November) until the end of emergence (generally through the start of the spring flow management season in April). The chum spawning operation cannot adversely affect implementation of NMFS' 2000 FCRPS RPA or the parties' ability to comply with the Vernita Bar agreement. If these conditions cannot be met, the Action Agencies will work with NMFS and the regional salmon managers to identify operations that would benefit salmon while maintaining these other fish protection measures. Such operations may include intentionally managing flows below what is necessary for mainstem spawning to

³⁹ NMFS BiOp at Section 9.6.1.2.4 Page 9-67, Action 23

⁴⁰ NMFS BiOp at Section 9.6.1.4.4 Page 9-93, Action 58

⁴¹ NMFS BiOp at Section 9.6.1.2.3 Page 9-65, Action 20

discourage redds from being established in the area or shaping flows in a manner that would discourage redd development (reverse load factoring). The chum spawning operation calls for the FCRPS projects to provide a minimum flow below Bonneville Dam of 125 kcfs (or more as coordinated) from when chum salmon are found in the area around Ives and Pierce islands (but no later than November 1) through December 31. The flows from Bonneville Dam will be maintained within 5 kcfs of the established minimum.⁴² Operating to the Bonneville tailwater gauge was found to be an effective management tool during the 2001-operating year. The tailwater gauge better reflects the effects of tides, tributary inflow and groundwater influence below Bonneville Dam.

If water supply conditions indicate that it is not possible to provide a minimum flow of 125 kcfs from Bonneville Dam, flow will be provided during the chum-spawning season at times to allow access to Hamilton and Hardy Creeks. Details will be set through coordination in TMT.⁴³

From January 1 to the start of spring flows April 10, if the chum operation is possible, the flow from Bonneville dam will be the daily minimum flow or minimum water surface elevation established by coordination in the TMT.⁴²

If the minimum flow established for the fall chum operation is 125 kcfs the minimum flow shall be 125 kcfs or the equivalent tailwater gauge elevation. If the minimum flow for the fall chum operation is 135 kcfs or greater, the minimum flow for the winter chum operation will be 10 kcfs lower than the fall minimum chum flow. The minimum flow in no case will be greater than 150 kcfs.

A salvage operation for the chum population residing below Bonneville Dam is being considered for the 2001 spawning season. This operation is being considered because of the record low stream flows being experienced going into the fall of 2001. Also, chum salmon will be captured this year and used as broodstock to initiate a spawning population in the recently restored habitat of Duncan Creek. The Duncan Creek project established the logistics for a brood capture and fry rearing 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 tributary or mainstem spawning. The salvage program is a safety net program and is not viewed as the preferred alternative to providing access to and sustenance of rearing habitat for the chum salmon.

⁴² NMFS BiOp at Section 9.6.1.2.1 Page 9-58, Action 15

⁴³ NMFS BiOp at Section 9.6.1.2.1 Page 9-60, Action 16

5.0 Sub-Strategy: Spill Operations for Project Passage

This substrategy addresses spill at certain FCRPS projects to provide improved survival and better project passage for juvenile fish while avoiding adult fallback problems and creating greater than 120 percent saturation levels of total dissolved gas at the designated downstream monitoring stations.

Spring spill for juvenile fish migration shall occur from (planning dates) April 3 to June 20 in the Snake River, and April 10 to June 30 in the lower Columbia River.⁴⁴ Spill levels and times are indicated below.⁴⁵ Voluntary spill at all three Snake River collector projects shall occur when seasonal average flows are projected to meet or exceed 85 kcfs.⁴⁶

Summer spill for juvenile fish migration shall occur from (planning dates) June 21 to August 31 in the Snake River, and July 1 to August 31 in the lower Columbia River.⁴⁷ There will be no summer spill at the four collector projects (Lower Granite, Little Goose, Lower Monumental, and McNary).⁴⁸

Spill for the various projects are shown in the table below:

Table 8. Spill at run-of-river projects to aid out migration of juvenile anadromous fish.

Project	Spill Dates (Planning dates)	Time	Spring Spill	Summer Spill	Amount	Minimum Generation Requirements kcfs
Lower Granite	April 3- June 20	1800-0600	Yes	No	120/115 gas cap	11.5 ^a
Little Goose	April 3- June 20	1800-0600	Yes	No	120/115 gas cap	11.5 ^a
Lower Monumental	April 3- June 20	24 hours a day	Yes	No	120/115 gas cap	11.5 ^a
Ice Harbor	April 3- August 31	24 hours a day	Yes	Yes	120/115 gas cap 1800 - 0500 45 Kcfs 0500 - 1800	7.5 - 9.5 ^a
McNary	April 10- June 30	1800-0600	Yes	No	120/115 gas cap	50

⁴⁴ NMFS BiOp at Section 9.6.1.4.3 Page 9-88, Action 54

⁴⁵ NMFS BiOp at Section 9.6.1.4.4 Page 9-88, Action 54 and NMFS BiOp at Section 9.6.1.3.4 Page 9-76, Action 41

⁴⁶ NMFS BiOp at Section 9.6.1.3.2 Page 9-76, Action 40

⁴⁷ NMFS BiOp at Section 9.6.1.4.3 Page 9-88, Action 54

⁴⁸ NMFS BiOp at Section 9.6.1.3.2 Page 9-76, Action 42

Project	Spill Dates (Planning dates)	Time	Spring Spill	Summer Spill	Amount	Minimum Generation Requirements kcfs
John Day	April 10- August 31	1800-0600 1900 - 0600 May 15- July 31	Yes	Yes	60% of outflow Min spill 25%	50
The Dalles	April 10- August 31	24 hours a day	Yes	Yes	40% of outflow	50
Bonneville	April 10- August 31	24 hours a day	Yes	Yes	120/115 gas cap nighttime 75 kcfs daytime ^d 50 min flow	30

a - Minimum generation requirements at the Lower Snake River Projects may not be needed all the time.

b - Lower Monumental will not be spilling, for juvenile fish passage, for part or all of the juvenile fish passage season in 2002 due to stilling basin repair. At the time this report was written construction is scheduled to begin in May 2002.

c - Collection of subyearling fall chinook for transportation at McNary Dam shall not be initiated until inriver migratory conditions are deteriorating (i.e., no longer spring-like).⁴⁹ In general, the switch from spring to summer operation will occur on or about June 20. Spring-like is defined as favorable flow and water temperature conditions; i.e., river flows are at or above the spring flow target (220 to 260 kcfs) at McNary Dam, and ambient water temperatures are below 62°F (17°C). Actual dates shall be set by TMT coordination.

d - Day and nighttime vary during the spill season and are set in the Fish Passage Plan.

Spill for Spring Creek Hatchery Release

Water may be spilled at Bonneville Dam for a period of up to 10 days, normally only 3 to 4 days, to aid Bonneville Dam passage of the hatchery release from Spring Creek Hatchery. (Note: This is not a BiOp measure.)

⁴⁹ NMFS BiOp at Section 9.6.1.3.4 Page 9-77, Action 43

6.0 Sub-Strategy: Juvenile Fish Transport Actions to Enhance Fish Survival

This substrategy addresses actions to collect juvenile fish at some FCRPS projects while providing a balance between transported and in river juvenile fish migration.

6.1 Snake River Collector Projects

All non-research juvenile salmonids collected at the Snake River collector projects will be transported (Lower Granite, Little Goose, and Lower Monumental dams).⁵⁰

6.2 McNary

Juvenile spring migrants collected at McNary Dam shall be bypassed.⁵¹

Collection of subyearling fall chinook for transportation at McNary Dam shall not be initiated until inriver migratory conditions are deteriorating (i.e., no longer spring-like).⁴⁹ In general, the switch from spring to summer operation will occur on or about June 20. Spring-like is defined as favorable flow and water temperature conditions; i.e., river flows are at or above the spring flow target (220 to 260 kcfs) at McNary Dam, and ambient water temperatures are below 62°F (17°C). Actual dates shall be set through coordination with TMT.

⁵⁰ NMFS BiOp at Section 9.6.1.3.2 Page 9-76, Action 40

⁵¹ NMFS BiOp at Section 9.6.1.3.4 Page 9-76, Action 41

7.0 Sub-Strategy: Other Actions to Enhance Water Management

This substrategy includes water management related actions that are being done to improve fish survival, such as studies, water quality actions and water conservation improvements.

7.1 Libby

7.1.1 Spill test

A Libby spill test will be conducted in 2002 under sufficiently high discharge levels during the sturgeon conservation operation to reliably estimate the dissolved gas saturation levels that result from varying levels of spill, including mixing from simultaneous turbine flow with a total release during the test that will not exceed 28,000 cfs through a combination of spillways and up to five turbines. Possible changes in dissolved gas concentrations in the Kootenai River at least as far as Kootenai Falls shall be evaluated (Kootenai Falls "resets" gas levels to about 112 percent). This test shall also include monitoring for adverse effects of the spill on bull trout and other fish in the Kootenai River.⁵² This fish monitoring is not a bioassay of effects of dissolved gas; rather, if any symptoms of gas bubble disease are observed in any fish, the test will be terminated, to better ensure that no fish are permanently harmed or killed. The purpose of this action is to see if the spillway can be used without modification to at least partially increase release capacity from Libby Dam as called for in the USFWS BiOp for the sturgeon pulse. It is also to determine a level of spill that is not likely to harm fish in the event spill is forced due to refill prior to flow levels dropping to within turbine capacity, even without any increase in release capacity. In conjunction with this test, condition of the spillway surface will be evaluated. Because of freeze-thaw damage which has already occurred, the spillway surface will probably need to be repaired before it can be used routinely.

7.1.2 Water temperature monitoring

Water temperature profiles in the south end (near-dam area) of Lake Kooconusa during May and June will be monitored to provide information necessary for timing of sturgeon spawning/rearing flow augmentation.⁵³ The purpose of this action is to provide better information of the timing of the sturgeon pulse.

7.1.3 Libby VARQ

The purpose of VARQ is to better ensure reservoir refill and to provide more (and more reliable) water for spring flows without reducing flood control protection.

⁵² USFWS BiOp at Section 8.2.a.1

⁵³ USFWS BiOp at Section 8.3.h Page 82, Action-f 29

An Environmental Impact Statement (EIS) is being prepared and additional public and Canadian (Columbia River Treaty) coordination will be conducted before implementation of VARQ can be implemented at Libby, Hungry Horse and Grand Coulee for the long term. EIS activities scheduled for 2002 include hydrologic study, and initial work on drafting of the EIS. Consequently, VARQ at Libby will not be implemented in 2002.⁵⁴

Reclamation intends to operate under VARQ at Hungry Horse in 2002. The draft EIS for long-term operation is scheduled to be completed in late 2003, following completion of studies, and a final EIS is scheduled for spring or summer 2004. The preferred alternative would be implemented in 2005 under that schedule.

To better address schedule requirements in the USFWS BiOp for VARQ implementation, the Action Agencies have also coordinated with the USFWS and NMFS on a process to decide in December 2002 whether it is feasible to implement VARQ at Libby and Hungry Horse on a one-year interim basis in 2003. That decision will use available hydrologic study information, the results of the Libby spill test, and public and Canadian coordination to prepare an Environmental Assessment and decision document.

7.1.4 Libby Storage Reservation Diagram and Forecast Procedure

The purpose of the Libby storage reservation diagram study and investigating a new forecast procedure is to see if more water can be made available for spring flows without reducing flood control protection.

In water year 2002 the investigation of a new forecast procedure should be completed. Work on a new Libby storage reservation diagram will begin this water year.⁵⁵

7.1.5 Coordination

An annual operational schedule to be supplemented on a monthly basis will be provided to the USFWS annually, on or about May 1 but not later than May 10. The annual schedule shall include month-end estimates of water surface elevation at Koochanusa Reservoir and estimates of monthly discharge from Libby Dam. The monthly supplement shall include a report of actual operations over the previous month and shall include daily water surface elevation at Koochanusa Reservoir and hourly spill and releases at Libby Dam.⁵⁶ The purpose of this action is to provide for better coordination.

7.1.6 Increased Flow Capacity at Libby

The purpose of the following actions is to provide for a higher flow level during the sturgeon pulse.

⁵⁴ NMFS BiOp Section 9.6.1.2.3 Page 63, Action 19; NMFS BiOp Section 9.6.1.2.3 Page 9-66, Action 22; and USFWS BiOp Section 8.1 page 73, Action-f2

⁵⁵ NMFS BiOp Section 9.6.1.2.6 Page 33, Action 36; USFWS BiOp at Section 8.1.h Page 76, Action-f 8; and USFWS BiOp at Section 8.1.i Page 76, Action-f 9

⁵⁶ USFWS BiOp at Section 11.A.1.1.c Page 93, Action-f 60

Pending funding approval, the USACE will begin an evaluation (with completion in 2003) of flood control levels and public safety concerns along the banks of the Kootenai River below Libby Dam, and the feasibility of increasing releases above any identified channel capacity constraints through structural or non-structural means.⁵⁷ NEPA documentation will be required for this action, and may be addressed for the flows themselves (but not the means by which additional capacity would be achieved) through the VARQ EIS.

No work is scheduled in 2002 on the following BiOp actions, related to increasing flow capacity at Libby, because of the delay of the Libby Spill test due to lack of water last year.

USFWS BiOp at Section 8.2.a.3 Page 78, Action-f 12

USFWS BiOp at Section 8.2.a.4 Page 78, Action-f 13

USFWS BiOp at Section 8.2.a.5 Page 79, Action-f 14

7.1.7 Kootenai River Investigation

The purpose of the following actions is to provide for a higher flow level during the sturgeon pulse.

A report has already been prepared on the effects of load following on levee integrity throughout the Kootenai Valley over the last 26 years.⁵⁸

Cross sectional data for the report of the proposed Kootenai River channel capacity investigation has begun to be collected.⁵⁹

The Report on the effects of groundwater seepage associated with the magnitude and duration of sturgeon flows on crops in the Kootenai Valley will be completed this year.⁶⁰

7.2 Hungry Horse Coordination

An annual operational schedule to be supplemented on a monthly basis will be provided by Reclamation to the USFWS annually, on or about May 1 but not later than May 10. The annual schedule shall include month-end estimates of water surface elevation at Hungry Horse Reservoir and estimates of monthly discharge from Hungry Horse Dam. The monthly supplement shall include a report of actual operations over the previous month and shall include daily water surface elevation at Hungry Horse Reservoir and hourly spill and releases at Hungry Horse Dam. The purpose of this action is to provide for better coordination.⁶¹

Reclamation will fulfill the USFWS recommendation for annual and monthly reporting by contributing to the annual water management plan and presenting weekly and biweekly reports

⁵⁷ USFWS BiOp at Section 8.3.a Page 80, Action f-22

⁵⁸ USFWS BiOp at Section 8.3.e Page 81, Action-f 26

⁵⁹ USFWS BiOp at Section 8.2.a 2 Page 78, Action-f 11

⁶⁰ USFWS BiOp at Section 8.3.c Page 81, Action-f 24

⁶¹ USFWS BiOp at Section 11.A.2.A

of Hungry Horse operations through the TMT process. Reclamation will also fulfill the USFWS 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://mac1.pn.usbr.gov/pn6200/esatea.html>. These actions are described in accordance with the US Bureau of Reclamation, Pacific Northwest Region Findings and Commitments Implementing December 2000 Biological Opinions for the Federal Columbia River Power System and Other Related Actions, Section III, B, 2, paragraph 23.

7.3 Water Quality Actions

7.3.1 Water Quality Plans

One- and five-year water quality plans are to improve fish passage and survival through water quality improvement measures. The intent of the water quality plans is to recommend FCRPS facility and operational improvements related to water quality, total dissolved gas (TDG) and water temperature monitoring, and related studies. The BiOp also includes RPAs 130 to 143 which are water quality actions.⁶²

Operationally oriented water quality RPAs 131 and 132 are addressed in the annual Water Management Plan. RPA 143 has long-term water management planning goals and is also addressed in the Water Management Plan. The other capital investment water quality RPAs related to facility improvements will be addressed in the 1-year and the 5-year Research, Monitoring, and Evaluation Plans.

7.3.2 Total Dissolved Gas Monitoring

High levels of TDG can be lethal to fish. Environmental monitoring at the dams is necessary to ensure that gas levels do not exceed TDG thresholds established in the BiOp and variance levels established by the state water quality agencies. According to RPA 131 of the BiOp, the physical monitoring program is to include: QA/QC components; redundant and backup monitors at as many locations as the Water Quality Team determines necessary; calibration of monitoring equipment at least every 2 weeks; adequate funds for spot-checking monitoring equipment, error checking, correcting, and recording functions for CROHMS data; and daily reporting.

There are two purposes for the Corps to monitor total dissolved gas (TDG) and water temperature at ten 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.

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).

⁶² NMFS BiOp Section 9.4.2.4 Page 9-29, Action 5

One component of the NMFS 2000 BiOp water quality strategy was for the Corps to take the actions necessary to implement the spill program at the dams called for in the BiOp, including obtaining variances from appropriate State water quality agencies. The Corps took the necessary actions to prepare for the 2002 spill season. The variance from the State of Oregon was issued on March 8, 2002.

The variance provides for a revision of the total dissolved gas standard from 110 percent to a revised standard of 115 percent in the forebays and 120 percent in the tailwaters of McNary, John Day, The Dalles, and Bonneville dams, and the Camas location, from April 1, 2002 to August 31, 2002. The 115 percent and 120 percent caps are based on the 12 highest hourly measurements per calendar day. Also, a cap of total dissolved gas of 125 percent, based on the two highest hours, is in effect.

In 1999, the State of Washington had issued a modified TDG water quality standard, which is in effect through the 2002 water year. Additional actions with the State of Washington were not required for the 2002 water year.

The State of Idaho was not approached in 2002 concerning a variance to water quality standards. The State, in conjunction with the Tribes, provided a set of conditions in 2001 to be met as part of the variance process. Due to the conditions provided by the State and Tribes, the forecasted drought conditions and the foreseen use of Dworshak water releases, there was no further pursuit of a water quality variance by the Corps for the 2001 water year. The Corps did not pursue obtaining a variance from the State of Idaho for 2002.

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 percent TDG, and the tailwater levels are close to, but do not exceed, daily (12 highest hours) average of 120 percent TDG. Also, a cap of total dissolved gas of 125 percent, based on the two highest hours, is in effect.

The Corps prepares a Total Dissolved Gas Management Plan each year. It is a supporting document for the Water Management Plan. The Plan summarizes the roles and responsibilities of the Corps as they relate to dissolved gas monitoring. The 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.

The Corps will be monitoring similarly to what occurred in 2000 and 2001.

See:

<http://www.nwd-wc.usace.army.mil/TMT/>

The 2002 Plan of Action can be found listed under the TDG category of the Reservoir Control Center Water Quality Team page on the following web site:

<http://www.nwd-wc.usace.army.mil/TMT/wqwebpage/mainpage.htm>

The QA/QC components of the Total Dissolved Gas Management Plan are to be reviewed by the Action Agencies annually in coordination with the Water Quality Team.

The physical monitoring element of RPA 131 will be addressed in the manner described in the paragraph above, except for the redundant monitoring. The Action Agencies will establish data quality objectives, in coordination with the Water Quality Team, to replace the redundancy identified in the BiOp. As part of the QA/QC component of the program, achievements of the data quality objectives are to be evaluated by the Action Agencies annually, in coordination with the Water Quality Team.⁶³

In an effort to address the issue of redundant monitoring the Corps has drafted Data Quality Criteria for the fixed monitoring stations at its projects. The Data Quality Criteria describe the accuracy, precision and completeness of the data needed at each station. The fixed monitoring stations will be assessed at the end of the monitoring season against these criteria and a performance report will be created. Adjustments will be made to the individual fixed monitoring stations that do not perform to the objectives described. The Data Quality Criteria approach is being recommended instead of the redundant and backup monitoring, and spot-checking approach described in the BiOp since it will provide greater flexibility with equipment and has less impact on program cost escalation.

The Corps is proposing the following Data Quality Criteria as an alternative to the redundant stations in RPA 131 and as a regional standard for TDG monitoring stations.

7.3.2.1 PROPOSED DATA QUALITY CRITERIA

The proposed data quality criteria for fixed monitoring station cover laboratory calibration, field instrument post-calibration; field performance check; and general criteria. The items are described as following:

1. Laboratory calibration

There are four data quality criteria associated with laboratory calibration, including calibration of the following: the secondary TDG standard; the secondary barometric pressure standard; the field instrument TDG sensor; and the secondary standard thermistor. Each is described as follows:

1. Calibration of Secondary TDG Standard (instrument calibrated with a primary standard)
Calibrate the TDG sensor at two points using the primary National Institute of Standards and Technology certified (NIST) standard. The TDG pressure must be +/- 2 mm Hg at both pressures; otherwise the secondary standard is recalibrated. Pressures at which the sensor is calibrated must bracket the expected range of field measurements.

⁶³ NMFS BiOp Section 9.6.1.7.2 Page 9-122, Action 131

2. Calibration of Secondary Barometric Pressure Standard
Calibrate the secondary standard barometer at ambient barometric pressure to the NIST standard. The barometer must be +/- 1 mm Hg of the primary standard (NIST certified instrument) otherwise the secondary standard is recalibrated.
3. Calibration of Field Instrument TDG sensor
The two point TDG sensor calibration must agree within +/- 2 mmHg at both pressures, otherwise the sensor is recalibrated. Pressures at which the sensor is calibrated must bracket the expected range of field measurements.
4. Calibration of Secondary Standard Thermistor
The instrument's thermistor must agree within +/- 0.2°C with the primary NIST standard. This variance will be monitored and if the probe performs outside this range, it will be returned to the manufacturer for maintenance. A check or verification still constitutes a calibration and should be documented in records.

2. Field instrument post-calibration

There are three data quality criteria associated with field instrument post-calibration: two fixed points; two point TDG sensor calibration and suspected parameters. Each is described as follows:

1. Two Fixed Points: In order to reduce TDG calibration variability, two fixed points should be chosen and incorporated in the TDG calibration protocol. For example, calibrate the first point to ambient barometric pressure, and the second point to 200 mmHg over barometric pressure. The calibrated range for this example brackets 100-126 percent TDG saturation. This ensures the same calibration curve is established each time for every instrument.
2. Two Point TDG Sensor Calibration: Following a two-week deployment, a two point TDG sensor calibration must agree within +/- 4 mmHg at both pressures. Pressures at which the sensor is calibrated must bracket the expected range of field measurements. If the pressure is not +/- 4 mmHg of the standard, the data will be reviewed and appropriately corrected. If, after data review, a correction cannot be applied, the data will be removed from the database. Sensor drift can be handled using a linearly prorated correction, but it is entirely possible for someone to enter incorrect calibration values, which would result in a shift affecting all readings equally.
3. Suspected Parameters: If any parameter is considered suspect following these calibration checks on return to the laboratory, the data collected for the previous time period will be reviewed and if applicable, corrections will be applied or the data will be removed from the database.

3. Field Performance check

There are four data quality criteria associated with field performance check: TDG pressure compared to secondary standard; standby probes deployed; thermistor compared to secondary standard; and field barometer compared to secondary standard. Each is described as follows:

1. TDG Pressure Compared to Secondary Standard: After the deployment period, prior to removal of the field instrument, the TDG pressure will be compared to the secondary standard. The actual decision point regarding adjusting the data would be in the lab following the two point TDG sensor calibration described in field instrument post calibration. The field comparison actually involves sampling precision and should not be used as a decision point for shifting data.
2. Standby Probe Deployed: During initial deployment of a new instrument, after sufficient time for equilibration (up to one hour), the TDG pressure must be +/- 10 mmHg of the secondary standard otherwise another (standby) probe is deployed.
3. Thermistor Compared to Secondary Standard: During initial deployment of the new instrument, the thermistor will be +/- 0.4°C of the secondary standard, corrected for calibration, or the instrument will be replaced with a standby.
4. Field Barometer Compared to Secondary Standard: At each visit the field barometer reading should be the same as the secondary standard or the field barometer will be calibrated.

4. General Criteria

1. Depth of Sensor: The sensor must be deployed to a depth greater than the compensation depth; otherwise the TDG measurements may be underestimated. If the site does not accommodate maintaining the probe at greater than the compensation depth for more than 95 percent of the measurements, investigations will begin to relocate the fixed monitoring station.
2. Data Set Completeness: As a goal, data collected at each site will be 95 percent of the data that could have been collected during the defined monitoring period. The calculation of data set completeness is based on temperature and percent TDG, encompassing barometric pressure and TDG pressure, not the completeness of each parameter measured.

In 2002 we plan to establish data quality objectives, at existing stations, instead of establishing redundant stations. The NMFS 2000 Biological Opinion RPA 198 stipulates “The Action Agencies, in coordination with NMFS, USFWS, and other Federal agencies, NWPPC, state, and Tribes, shall develop a common data management system for fish population, water quality, and habitat data.” NWPPC’s February 15, 2002 draft Data Management in Support of the Fish and Wildlife Program Summary encourages the development of regional data standards in support of a consistent and standardized database. The development of data quality criteria for TDG monitoring stations could be one of the regional standards towards the long-term goal of a consistent, standardized regional database.

RPA 131 and 132 also have biological monitoring components. However, tracking the biological monitoring is not part of RPAs 131 and 132. A complete discussion of juvenile fish passage monitoring is described in the BiOp, at 10.5.1.4, Monitoring Juvenile Fish Passage at Dams. BPA is responsible for funding the smolt monitoring program coordinated and

implemented by the Fish Passage Center, and the Corps is responsible for funding sampling relative to the juvenile fish transportation program and facility operations. A report on gas bubble trauma is a condition of the Oregon TDG variance for 2002 and a condition of the modified Washington TDG standard of 115 percent in the forebays and 120 percent in the tailwaters for juvenile salmonid passage. The Corps relies on the NMFS for two products that are submitted to the Oregon Department of Environmental Quality and the Washington Department of Ecology to meet their water quality conditions. The two products are a copy of the Fish Passage Center annual report and a concurrence letter from NMFS agreeing with the Fish Passage Center conclusions. The Corps forwards the two products, along with the other reports, to meet the conditions of the states of Washington and Oregon.

Total Dissolved Gas Monitoring Review

TDG measurements in the forebays and tailwaters of the dams have been monitored as part of the NMFS spill program. In-season management to improve juvenile fish survival relies on the TDG monitoring program. Based on review of possible biases in the TDG data, NMFS believes that some forebay locations, such as the Camas site, may need to be changed to provide a more representative measure of TDG in the water passing through the dams. A detailed technical evaluation has been developed, in coordination with the WQT. It is possible that spill could be increased if current forebay locations over-represent the level of gas saturation in the water of the forebays.

RPA 132 addresses the development of a plan to systematically review and evaluate TDG fixed monitoring site forebays at all the mainstem Columbia and Snake dams, especially the Camas site. The plan is to be included as part of the first annual water quality improvement plan. The Action Agencies are to change the location of the fixed monitoring sites, as warranted, based on an evaluation of the review results.⁶⁴

The NMFS Forum Water Quality Team organized a Fixed Monitoring Site Subcommittee to address RPA 132 in the fall of 2001. Criteria were developed to evaluate the Fixed Monitoring Sites. They included site evaluation based on: fish experience, data consistency, real-time spill management, and the affect of project releases on water quality. The fish experience criterion was to identify whether the water quality data was representative of likely fish habitat used by migrating anadromous salmon. The data consistency criterion was to insure that the data was reliable and the Fixed Monitoring Site was serviceable, and its performance predictable. The real-time criterion focused on whether the data was relevant to spill management decision-making. The criterion of project releases affecting water quality was used to determine whether each site reflected alterations in project operations and spill changes.

Detailed recommendations of the subcommittee were made to the Water Quality Team at the February 2002 meeting. The Skamania fixed monitoring Site will be terminated for the 2002 spill season. A non-real-time experimental station at Corbett will be evaluated in 2002. An experimental station will be added to the west end of the The Dalles powerhouse. An

⁶⁴ NMFS BiOp Section 9.6.1.7.2 Page 9-123, Action 132

experimental station in a John Day scrollcase will be explored. Stations in the Snake River system will continue in service, and will be the subject of continued discussion in 2002.

Field studies to address the representatives' issues related to Camas were conducted during the summer of 2001. A report will be prepared by May 31, 2002.

7.3.3 Total Dissolved Gas Model

TDG caused by large volumes of water spilled over dams can result in injury and mortality of juvenile salmonids. Development and continued refinement of a systemwide TDG model would assist with in-season management of voluntary and involuntary spill.

The USACE developed TDG models to be used as a river operations management tool. The USACE is to develop the tool(s). The USACE is to coordinate the systemwide management applications of the gas abatement model(s) with the annual planning process, the Transboundary Gas Group, the Mid-Columbia Public Utilities, and other interested parties.⁶⁵

Use of two DGAS models (SYSTDG and MASS1) were initiated in 2001. Regional training to action agencies and salmon manager stakeholders on the use of SYSTDG was provided on March 27 and 28, 2001 and on April 6 and 7, 2001. Because of the drought year, SYSTDG was not used to provide operational guidance since the SYSTDG dataset did not include an extreme low flow year. Because of the drought year, MASS1 was used to provide guidance concerning the range of water temperatures that could be expected in the lower Snake and lower Columbia rivers during 2001. The model results were presented to TMT and the Water Quality Team during the summer 2001.

Use of the SYSTDG model as a water management planning tool needs ongoing development. The original data set used to develop the model included 1994 to 1998 data. The model could be used as a management tool to simulate flow conditions experienced between 1994 to 1998. The Corps will work with the SYSTDG model developer in 2002 to scope an effort to expand the data set to include 1994 to 2001 data sets. This addition will increase the model's range of use as a planning tool. In 2002 we plan to update TDG production equation relationships at relevant projects. We also plan to update the SYSTDG users manual and documentation and do a technical review of the model. The Corps is also planning on doing a statistical summary of historic gas data. The Corps will develop staff capability at the Northwestern Division Reservoir Control Center to use SYSTDG for evaluation of 2002 conditions, using a similar flow year from the 1994-2001 data sets.

7.3.4 Temperature Model and Temperature Monitoring Needs

Water temperature changes related to the by impoundment of pools behind dams can result in increases in the water temperature regime of the river, potentially causing injury and mortality of juvenile salmonids. Development and continued refinement of a system wide water temperature model would assist with in-season management of voluntary and involuntary spill. The model is to be used as a pre-season-planning tool to provide predicted operations in real time to assist in the in-season water management decisions.

⁶⁵ NMFS BIOP Section 9.6.1.7.2 Page 9-124, Action 133

The geographic scope of the model described in BiOp RPA 143 (page 9-127) has been clarified based on discussion at the February 2002 Water Quality Team meeting. The discussion section of RPA 143 included a reference to Bonneville Dam, but the Water Quality Team clarified that the intent of RPA 143 was directed to only the Snake River.

The anticipated action will be to develop a model to address operations of only the Snake River projects, as intended in RPA 143.

Tasks include: identification of team members, additional data collection, database creation (see RPA 198), model development, definition of simulations, execution of simulations, analysis and reporting, coordination, and project management.

In 2002 the Action Agencies plan to review and select models and review meteorological and hydrological data needs. The Corps started discussion about data needs, databases, and numerical models at the February 2002 NMFS Forum Water Quality Team meeting. A water temperature subcommittee, open to any Water Quality Team entity, is being organized to address interagency modeling development. In addition, BPA notified the NWPPC on March 6, 2002, that it will fund a three-year project by PNNL to conduct physical modeling and data collection on the Lower Snake river to ascertain the effects of temperature and other water quality factors on migrating salmon.

7.3.5 Water Quality Database

As part of Cumulative Risk Initiative evaluations, NMFS has focused on the need for a single comprehensive data management system to ensure integration of monitoring and evaluation information with information from other sources. The application of performance standards and measures will require additional data collection and analysis. Validation of the approach, and of specific actions taken, will require continual confirmation that the measures are sufficient to avoid jeopardy and facilitate recovery of listed salmonids.⁶⁶

The Action Agencies, in coordination with NMFS, USFWS, and other Federal agencies, NWPPC, states, and Tribes, have been designated to develop a common data management system for fish populations, water quality, and habitat data.

The Action Agencies evaluated database approaches in 2001. The Corps is moving to develop a regional water quality database for use in all Corps Districts in the Northwestern Division. In 2002, the Corps began to evaluate the use of an internal USACE Water Quality database called DASLER, which is STORET compatible. Their goal is to have a database (DASLER or another system) compatible with other Federal, State, Tribal and regional STORET - compatible systems. As such it would fit into the distributed architecture of any unified data / information management system developed under the proposed Columbia River Information Management System. That regional superstructure will emerge from the pending MOU between the NWPPC and NMFS to develop this unified system in corporation with USFWS, and other Federal, State and Tribal agencies.

⁶⁶ NMFS BiOp Section 9.6.5.4 Page 9-127, Action 198

The NWPPC will rely on the expertise of its contractor, Science Applications International Corporation, SAIC, to conduct a survey of the information needs of Regional stakeholders, and their information management capabilities. A final SAIC report will recommend steps needed to achieve a coordinated information management system for the Region. The Bonneville Power Administration has become the lead action agency in this effort and will hire a contractor to work with the NWPPC, NMFS and others to express and re-interpret complex ideas pertaining to data and information management.

7.3.6 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 shall be requested and negotiated with BC Hydro to be provided and released during the migration season.⁶⁷

BPA and the Corps shall continue to request, and negotiate with BC Hydro for storage of water in non-Treaty storage space during the spring for 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.⁶⁸

The shaping and release of water behind Canadian Treaty storage projects in July and August shall be requested and negotiated with BC Hydro.⁶⁹

7.4 Albeni Falls Coordination

The action agencies, the USFWS, and Idaho Department of Fish & Game shall meet annually to evaluate Lake Pend Oreille kokanee monitoring results and make necessary adjustments through subsequent in-season management.⁷⁰ The purpose of this action is to provide for better coordination.

7.5 Public Coordination

The purpose of the following actions is to provide for better regional coordination.

Actions in the Water Management Plan will be coordinated with NMFS, USFWS, and the states and tribes in preseason planning and in-season management of flow and spill operations. This coordination shall occur in the Technical Management Team process.⁷¹

At all appropriate decision points the action agencies shall 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 shall include notification of

⁶⁷ NMFS BiOp at Section 9.6.1.2.5 Page 9-67, Action 24

⁶⁸ NMFS BiOp at Section 9.6.1.2.5 Page 9-67, Action 25

⁶⁹ NMFS BiOp at Section 9.6.1.2.5 Page 9-67, Action 26

⁷⁰ USFWS BiOp at Section 11.A.1.4.d Page 94, Action-f 68

⁷¹ NMFS BiOp at Section 9.4.2.2 Page 9-27, Action 3 and NMFS BiOp at Section 9.4.2.2 Page 9-60, Action 17

all meetings and decision points and provision of opportunities to advise the action agencies during meetings and in writing as appropriate.⁷²

7.6 System Flood Control Study

The purpose of the various flood control studies is to see if more water can be available for spring flow management with out reducing flood control protection.

USACE will conduct a systemwide flood control study. No work is scheduled in 2002 pending appropriation of funds.⁷³

7.7 Banks Lake Flow Augmentation

Reclamation will assess effects of drafting Banks Lake to elevation 1,560 feet by the end of August. Reclamation is preparing an EIS for National Environmental Policy Act compliance to implement this action in August 2002.⁷⁴

The purpose of the proposed operation at Banks Lake is to enhance and attempt to meet target flows in the Columbia River during the juvenile out migration of ESA listed salmonid stocks by altering the August drawdown of Banks Lake from elevation 1,565 feet down to 1,560 feet.

7.8 Dworshak Draft to 1,500' Adult Evaluation

The purpose of the Dworshak draft to 1,500 feet is to evaluate whether releasing approximately 200 kaf of water during September provides a benefit to adult migrants. The ongoing temperature monitoring and field evaluations will continue in 2002. The Computational Fluid Dynamic model of the Lower Snake and Clearwater is scheduled to be completed this year.⁷⁵

7.9 Other Reclamation Water Management Actions

The following actions from the NMFS BiOp are intended to provide additional benefits to listed fish.

Reclamation will consult with NMFS before committing any of its uncontracted storage space or entering into new contracts. No contracts are scheduled for review in 2002.⁷⁶

Reclamation shall pursue water conservation improvements at its projects. Reclamation annually receives numerous proposals for conservation projects from its irrigation districts and others. FY 2002 project selection criteria have been developed with a new ESA emphasis and will be applied to proposals considered for Reclamation projects.⁷⁷

⁷² USFWS BiOp at Section 8.1.g Page 76, Action-f 7

⁷³ NMFS BiOp Section 9.6.1.2.6 Page 72, Action 35

⁷⁴ NMFS BiOp at Section 9.6.1.2.6 Page 9-70, Action 31

⁷⁵ NMFS BiOp at Section 9.6.1.2.6 Page 9-71, Action 34

⁷⁶ NMFS BiOp Section 9.6.1.2.6 Page 68, Action 27

⁷⁷ NMFS BiOp Section 9.6.1.2.6 Page 68, Action 28

Reclamation will provide NMFS with a report on unauthorized use of Reclamation project water. Although unauthorized use is not a federal action, Reclamation will work with its districts and their water users to prepare a report by December 2002.⁷⁸

Reclamation shall complete ESA consultations on its tributary projects below Chief Joseph Dam. Consultations are in progress and scheduled to be completed in 2002 for the Crooked River, Deschutes, Arnold, Umatilla, Yakima, and Tualatin Projects.⁷⁹

The Action Agencies shall acquire water for instream use from Reclamation's Upper Snake River Projects. Reclamation, NMFS, and others are participating in settlement discussions under the Snake River Basin Adjudication. Implementation of flow augmentation in 2002 will involve a settlement, another ESA consultation on the Upper Snake projects, and authorizing legislation from Idaho.⁸⁰

On the Columbia Basin Project, Reclamation will identify and evaluate salmon attraction problems in the wasteways and drains, initiate water quality monitoring and evaluation of return flows, and complete the construction of screens at the Burbank No. 2 and 3 pumps in 2002.⁸¹

⁷⁸ NMFS BiOp Section 9.6.1.2.6 Page 69, Action 29

⁷⁹ NMFS BiOp Section 9.6.1.2.6 Page 69, Action 30

⁸⁰ NMFS BiOp at Section 9.6.1.2.6 Page 9-70, Action 32

⁸¹ NMFS BiOp Section 9.6.1.2.7, Page 74-75, Actions 37, 38, 39

8.0 FCRPS Hydrosystem Performance Standards

Table 9. FCRPS hydrosystem survival performance rates (%) for affected life stages.

ESU	Adult Survival Rate		Juvenile Survival Rate		
	FCRPS System	Per FCRPS Project ¹	FCRPS Inriver Only		FCRPS Combined ² (Transport + Inriver + Differential Mortality of Transported Fish)
			System	Per Project ¹	
Chinook Salmon					
SR spring/summer	85.5	98.1	49.6	91.6	57.6
SR fall	74.0	96.3	14.3	78.4	12.7
UCR spring	92.2	98.1	66.4	90.3	66.4
UWR	N/A	N/A	N/A	N/A	N/A
LCR	98.1	98.1	90.7	90.7	90.7
Steelhead					
SR	80.3	97.3	51.6	92.1	50.8
UCR	89.3	97.3	67.7	90.7	67.7
MCR	89.3	97.3	67.7	90.7	67.7
UWR	N/A	N/A	N/A	N/A	N/A
LCR	97.3	97.3	90.8	90.8	90.8
CR chum salmon	N/A	N/A	N/A	N/A	N/A
SR sockeye salmon	88.7	98.5	N/A	N/A	N/A

(NMFS BiOp Section 9.2.2.2.1, Page 9-12, Table 9.2-3)

Source: Adult standards taken from Table 9.7-2. Juvenile standards taken from Table 9.7-1.

¹ Per-project inriver survival rate calculated as the xth root of the system inriver survival rate (where x = number of FCRPS projects encountered). They are provided for illustrative purposes only. They are *NOT* intended to be interpreted as project-specific standards, or to be used in any way to support curtailment of survival improvement measures at an individual project.

² Values represent averages over the water years and D values in Table 9.7-1.

9.0 Conclusion

This 2002 Water Management Plan 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.