Endangered Species Act Section 7 Consultation
Biological Opinion
and
Magnuson-Stevens Fishery Conservation and Management Act
Essential Fish Habitat Consultation

Habitat Improvement Program
All Columbia River Basin ESUs
Columbia River Basin
Oregon, Washington, and Idaho

Lead Action Agency: Bonneville Power Administration

Consultation Conducted By: National Marine Fisheries Service (NOAA Fisheries), Northwest Region

Date Issued: August 1, 2003

Issued by: For Michael R Crouse
D. Robert Lohn
Regional Administrator

Refer to: **2003/00750**

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Northwest Region
7600 Sand Point Way N.E., Bldg. 1
Seattle, WA 98115

Ms. Therese B. Lamb
Bonneville Power Administration
Acting Vice President for Environment, Fish and Wildlife
905 NE Eleventh Avenue
Portland, OR 97232

Re: Programmatic Biological Opinion and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Consultation for the Bonneville Power Administration Habitat Improvement Program (HIP) in the Columbia River Basin

Dear Ms. Lamb:

Enclosed is NOAA's National Marine Fisheries Service's (NOAA Fisheries) programmatic biological opinion (Opinion) concluding formal Endangered Species Act consultation on the Bonneville Power Administration (BPA) Habitat Improvement Program (HIP) in the Columbia River Basin as described in BPA's biological assessment (BA) dated June 9, 2003.

This Opinion considers Snake River fall-run chinook salmon (*Oncorhynchus tshawytscha*), Snake River spring/summer-run chinook salmon (*O. tshawytscha*), Lower Columbia River chinook salmon (*O. tshawytscha*), Upper Willamette River chinook salmon (*O. tshawytscha*), Upper Columbia River spring-run chinook salmon (*O. tshawytscha*), Columbia River chum salmon (*O. keta*), Snake River sockeye salmon (*O. nerka*), Upper Columbia River steelhead (*O. mykiss*), Snake River Basin steelhead (*O. mykiss*), Lower Columbia River steelhead (*O. mykiss*), Upper Willamette River steelhead (*O. mykiss*), and Middle Columbia River steelhead (*O. mykiss*)

NOAA Fisheries has determined that the proposed action is not likely to jeopardize the continued existence of the listed species described above, or destroy or adversely modify designated critical habitat. An Incidental Take Statement provides non-discretionary terms and conditions to minimize the potential for incidental take of listed species.

This document also serves as consultation on essential fish habitat for coho and chinook salmon, groundfish and coastal pelagic species under the Magnuson-Stevens Fishery Conservation and Management Act and its implementing regulations (50 C.F.R. Part 600).

We appreciate the considerable effort and cooperation provided by Nancy Weintraub, of your staff, in completing this consultation. If you have any questions regarding this Opinion, please contact Nora Berwick, of my staff in the Oregon Habitat Branch at 503.231.6887.

Sincerely,

For Michael R Crouse

D. Robert Lohn
Regional Administrator

bcc: F/NWR - CHRON file
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j/adminpdx/ohb/programmatics/2003/Habitat Improvement Program (HIP)…

OHB file #: **OHB2003-0143-PEC**
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TABLE OF CONTENTS

LIST OF APPENDICES

1. INTRODUCTION

The Endangered Species Act (ESA) of 1973 (16 USC 1531-1544), as amended, establishes a national program for conserving threatened and endangered species of fish, wildlife, plants, and the habitat on which they depend. Section 7(a)(2) of the ESA requires Federal agencies to consult with U.S. Fish and Wildlife Service (USFWS) and NOAA's National Marine Fisheries Service (NOAA Fisheries), as appropriate, to ensure that their actions are not likely to jeopardize the continued existence of endangered or threatened species or adversely modify or destroy their designated critical habitats. This biological opinion (Opinion) is the product of an interagency consultation pursuant to section 7(a)(2) of the ESA and implementing regulations 50 CFR 402.

The analysis also fulfills the essential fish habitat (EFH) requirements under the Magnuson-Stevens Fishery Conservation and Management Act (MSA). The MSA, as amended by the Sustainable Fisheries Act of 1996 (Public Law 104-267), established procedures designed to identify, conserve, and enhance EFH for those species regulated under a Federal fisheries management plan. Federal agencies must consult with NOAA Fisheries on all actions, or proposed actions, authorized, funded, or undertaken by the agency, that may adversely affect EFH (§305(b)(2)).

The Bonneville Power Administration (BPA) proposes to fund habitat improvement activities under its Habitat Improvement Program. The purpose of the Habitat Improvement Program is to implement comprehensive habitat improvement projects that will contribute to the recovery of the listed threatened and endangered species, and protect, mitigate, and enhance fish and wildlife affected by the development and operation of the Federal Columbia River Power System (FCRPS). The BPA is proposing the action according to its authority under the Pacific Northwest Electric Power Planning and Conservation Act of 1980 (Public Law 96-501), and in response to the requirements of the 2000 Biological Opinion on the Operation of the Federal Columbia River Power System (FCRPS 2000 Opinion) (NMFS 2000e)[1]. The administrative record for this consultation is on file at the Oregon Habitat Branch office.

1.1 Background and Consultation History

1.1.1 Discussion of the Federal Action and Legal Authority

In 1980, Congress passed the Pacific Northwest Electric Power Planning and Conservation Act of 1980 (Public Law 96-501), which authorized the states of Idaho, Montana, Oregon, and Washington to create the Northwest Power Planning Council (NWPPC). The Act directed the

[1] A Federal District Court in Oregon found that NOAA Fisheries considered improper factors in its Section 7(a)(2) analysis for the FCRPS 2000 Biological Opinion and thus held that NOAA Fisheries' issuance of the opinion was contrary to the Administrative Procedures Act. The Court remanded the opinion to NOAA Fisheries for further proceedings consistent with this ruling. National Wildlife Federation v. NMFS, CV 01-640-RE (D. OR. June 2, 2003). Nevertheless, by an order dated July 1, 2003, the Court explicitly left the legal effect of this biological opinion in effect during the one year remand proceedings and BPA continues implement its RPA for the FCRPS, including the offsite mitigation component relevant to this consultation. Id.

NWPPC to prepare a program to "protect, mitigate and enhance fish and wildlife, including related spawning grounds and habitat, on the Columbia River and its tributaries … affected by the development, operation, and management of [hydroelectric projects] while assuring the Pacific Northwest an adequate, efficient, economical and reliable power supply." BPA's authority and responsibility to fund fish and wildlife habitat improvement actions derives from this law.

The NWPPC's Columbia River Basin Fish and Wildlife Program (the Fish and Wildlife Program) (NWPPC 2000) is the largest regional effort in the nation to recover, rebuild, and mitigate hydropower impacts on fish and on wildlife. BPA, the U.S. Army Corps of Engineers (Corps), and the Bureau of Reclamation (BOR) implement the Fish and Wildlife Program. The goals, objectives, scientific foundation and actions of the Fish and Wildlife Program are structured in a "framework," an organizational concept for fish and wildlife mitigation and recovery efforts that brings together ESA requirements for recovering listed species, the broader requirements of the Northwest Power Act, and the policies of the states and Native American tribes of the Columbia River Basin into a comprehensive program that has a solid scientific foundation.

Under the NWPPC's Fish and Wildlife Program, BPA funds about 500 fish and wildlife projects a year. They range from repairing and improving fish spawning habitat, to studying fish diseases, to supplementing fish populations, to resident fish mitigation, to protecting and improving wildlife habitat. Fish and wildlife projects are identified for BPA funding through the NWPPC's Provincial Review Process that includes review by an independent scientific review panel, regional fish and wildlife agencies and Native American tribes, and BPA.

With the listing of a number of anadromous fish species in the 1990's, BPA began a series of consultations with NOAA Fisheries and USFWS on the operation and maintenance of the Federal Columbia River Hydropower System (FCRPS). The latest of these is the FCRPS 2000 Opinion, a multi-species Biological Opinion that addresses the aggregate effects of continued operation and maintenance of the Columbia and Snake River hydropower system by BPA, the Corps, and BOR, on the tributaries, mainstem, and estuary and plume, on listed species (NMFS 2000e). The framework for the FCRPS 2000 Opinion is the Basinwide Salmon Recovery Strategy, also known as the All-H Strategy (Federal Caucus 2000), developed by the Federal Caucus.[2] The Basinwide Salmon Recovery Strategy recognized that, in addition to the impacts of the hydrosystem on salmon in the Columbia River Basin, impacts from harvest and hatchery practices, as well as impacts to habitat, all contributed to the decline of the listed fish and must be addressed in a comprehensive recovery strategy. The recovery strategies identified by the Federal Caucus for each of the "Hs" are listed below:

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[2] The Federal Caucus is a group of Federal agencies in the Columbia River Basin with responsibilities for recovering listed salmon and steelhead. The Federal Caucus consists of the following Federal agencies: Army Corps of Engineers, BPA, Bureau of Indian Affairs, Bureau of Land Management, Bureau of Reclamation, Environmental Protection Agency, Fish and Wildlife Service, Forest Service, and NOAA Fisheries.

- Habitat
    - Take immediate actions to restore streamflow, remove passage barriers, protect high quality habitat, and screen diversions.
    - Complete subbasin assessments and plans to prioritize longer-term actions.
- Hydropower
    - Maximize survival in the hydropower system through flow, spill, passage, and water quality measures and maintain dam breaching as a future option depending on progress in fish recovery.
- Hatcheries
    - Prevent extinction with safety net projects.
    - Reform hatchery practices to reduce risks to wild fish and contribute to recovery goals.
- Harvest
    - Constrain harvest levels.
    - Expand fishing opportunities where possible, including selective fish programs.

The FCRPS 2000 Opinion adopted the Basinwide Salmon Recovery Strategy and identified, as Reasonable and Prudent Alternatives (RPAs), a number of mandatory actions to improve habitat conditions towards salmon survival and recovery (RPAs 149-163). Since BPA is one of the parties to the FCRPS 2000 Opinion and a member of the Federal Caucus, the habitat improvement actions proposed under the Habitat Improvement Program (HIP) include many of the habitat actions required by the FCRPS 2000 Opinion.

The Basinwide Salmon Recovery Strategy and FCRPS 2000 Opinion also address implementation of the strategy and opinion through the use of performance standards and designated check-in reviews. Therefore, timely consultation on implementation of habitat improvement actions that address the strategy and FCRPS 2000 Opinion is essential, and underpins the need for a programmatic approach to habitat improvement section 7 consultations.

1.1.2 Consultation History

Beginning in mid-1998 with the listing of bull trout and the proposed listing of a number of additional anadromous fish Evolutionary Significant Units (ESUs),[3] BPA, NOAA Fisheries and USFWS staffs began to explore the possibility of initiating programmatic consultation under section 7 of the ESA for implementation of habitat improvement actions under the Fish and Wildlife Program. While the proposed habitat improvement projects are, in the long term, beneficial to many listed species, some actions produce short-term adverse effects. Many of the proposed activities are minor in nature and their effects are similar. Because of the new ESA listings and the increasing number of habitat improvement projects being implemented under the

[3] ESU (evolutionary significant unit): A salmon population or group of populations that is substantially reproductively isolated from other conspecific population units, and contributes substantially to ecological/genetic diversity of the biological species as a whole

Fish and Wildlife Program, the number and intensity of ESA section 7 consultations were rapidly increasing the workload for BPA, USFWS, and NOAA Fisheries.

To address the escalating number of ESA section 7 consultations, BPA and NOAA Fisheries staffs met several times in summer of 1999 to discuss the possibility of a programmatic consultation on habitat improvement activities. Concurrently, BPA continued to explore the possibilities of programmatic consultation with USFWS staff. While all three agencies agreed that the programmatic approach could help reduce the consultation workload, NOAA Fisheries staff initially asked BPA to defer initiating consultation on the habitat improvement actions until the completion of the FCRPS programmatic consultation, since the FCRPS 2000 Opinion would provide overall direction and guidance for the habitat improvement projects in the Columbia River Basin.

In April of 2000, BPA again contacted both NOAA Fisheries and USFWS staffs to discuss the possibility of initiating programmatic consultation. Both NOAA Fisheries and USFWS agreed, in fall of 2000, to provide staff to assist BPA in this effort. Since that time, the agencies have had numerous telephone conversations, e-mail exchanges, and meetings to clarify the scope and implementation of the HIP.

In December of 2000, NOAA Fisheries published the FCRPS 2000 Opinion. The list of habitat improvement actions BPA proposes to address in the HIP is consistent with the mandatory habitat actions required in the FCRPS 2000 Opinion, as well as with the habitat improvement components of the Fish and Wildlife Program.

During 2001, BPA held a series of meetings with NOAA Fisheries and USFWS to discuss approaches for the consultation. USFWS staff suggested a GIS-based approach for the Opinion that would include a spatial component in the analysis of effects process (see section 1.1.3, "Analytical Approach" for discussion of this approach).

In June of 2001, BPA hired Shapiro and Associates, Inc. to assist the agencies to prepare the Biological Assessment (BA) and Opinion. Meetings with the NOAA Fisheries and USFWS staffs continued and NOAA Fisheries staff suggested a proactive streamlined approach for the consultation by including, as conservation measures in the BA, terms and conditions that address the habitat improvement activities from previous biological opinions. BPA then incorporated the terms and conditions from the pertinent biological opinions issued after January 1, 1999 as conservation measures for the proposed action.

As we moved to complete the BA document, it became apparent that, due to heavy workloads, the USFWS staff would not available to continue with the consultation. BPA, USFWS, and NOAA Fisheries agreed that the consultation should be split between USFWS and NOAA Fisheries. Otherwise, the consultation would be delayed. Therefore, this Opinion addresses only the anadromous fish species under the purview of NOAA Fisheries.

Throughout the remainder of the pre-consultation period prior to submission of the BA, BPA and NOAA Fisheries staffs refined the approach, and incorporated the latest information from NOAA Fisheries' programmatic and individual section 7 consultations. NOAA Fisheries provided comment and direction so that all information required for BPA's proposed Habitat Improvement Program programmatic section 7 was included in BPA's BA submittal package to initiate formal ESA section 7 consultation with NOAA Fisheries on BPA's Habitat Improvement Program.

The BPA provided a complete biological assessment (BA) and EFH assessment on the Habitat Improvement Program to NOAA Fisheries on June 12, 2003 and formal consultation was initiated at that time.

Because the action is likely to affect Tribal trust resources, NOAA Fisheries has contacted the Confederated Tribes of the Colville Reservation, Shoshone-Bannock Tribes, Confederated Tribes of the Umatilla Indian Reservation, Confederated Tribes of the Warm Springs Reservation of Oregon, Nez Perce Tribe, Yakama Nation, and the Columbia River Intertribal Fish Commission pursuant to the Secretarial Order (June 5, 1997). On December 18, 2002, the BPA and NOAA Fisheries met with staff from the Nez Perce Tribe. This coordination resulted in productive comments that were incorporated into the BA and this Opinion.

1.1.3 Analytical Approach

Integrating ESA and EFH consultations for BPA's habitat improvement activities is a complex task. There are a large number of proposed activities with a wide range of project types, spread over the entire Columbia River Basin. The Columbia River is an integrated biophysical system that is too large to analyze as a single entity. In order for BPA and NOAA Fisheries to discuss baseline environmental conditions in a way that will be meaningful for monitoring, restoration, accomplishment tracking, and subsequent subbasin planning work, it is necessary not only to consider project design criteria, but also to assess the baseline conditions in a spatially explicit manner.

An initial challenge was to agree on a uniform system for mapping and organizing the presentation of environmental baseline conditions and effects analyses for the consultation. There are a number of different entities that have proposed classification systems for the diverse range of physiographic and climatic conditions of the Columbia River Basin, e.g., the U.S. Forest Service mapping system based on ecoregions (Bailey 1995), the U.S. Geological Survey (USGS), the NWPPC, the Interior Columbia Basin Ecosystem Management Project (ICBEMP), and the Northwest Forest Plan Regional Ecosystem Office (REO). The geographical relationship among all of these various ecologic/hydrologic classification systems can be confusing.

The U.S. Forest Service developed a mapping system based on ecoregions to "provide a general description of the ecosystem geography of the nation…" (Bailey, 1995). In this system, the two broadest categories - domains and divisions - are based on ecological climate zones because of climate's overriding effect on the composition and productivity of ecosystems from region to region. Divisions are divided into ecosystem provinces based on biophysical characteristics.

The most consistent, detailed hydrologic classification currently available that covers the entire proposed action area is the Hydrologic Unit Mapping System used by the USGS. The basic unit for this system is the cataloging unit, commonly called the 4th field Hydrologic Unit Code (HUC). The USGS hydrologic classification has been further delineated to include watersheds and subwatersheds, commonly known as 5th and 6th field HUCs, respectively, by two joint U.S. Forest Service and Bureau of Land Management projects (ICBEMP and the Northwest Forest Plan under the REO). Individual states have also performed this watershed delineation within their boundaries using approved Federal methodologies.

The NWPPC has organized the more than 50 subbasins of the Columbia River Basin into 11 ecological provinces, which are groups of adjoining ecologically related subbasins with similar hydrology, climate, and regional geology. Ecological provinces are distinct subdivisions of the landscape containing ecologically adjoining hydrologic subbasins. The NWPPC classification scheme with its two levels - ecological provinces and subbasins - is essentially a hybrid of Bailey's (1995) ecoregion mapping system and the USGS hydrologic unit classification system. Ecological provinces are the larger units that are somewhat analogous to the USGS 3rd field accounting units, while subbasins are subsets of the ecological provinces and are somewhat analogous to the USGS 4th field cataloging units. Table 1-1 and Figure 1-1 illustrate the relationships between these various classification systems.

Ecosystems, landscapes, communities and populations are usefully described as hierarchies of nested components distinguished by their appropriate spatial and time scales. Higher-level ecological patterns and processes constrain, and in turn reflect, localized patterns and processes. Recognizing that most pathways for effects on species are mediated by biophysical patterns and because of its emphasis on biophysical as well as hydrologic characteristics, NOAA Fisheries and BPA have decided to use the NWPPC Ecological Provinces as the basic unit for the document structure, with environmental baseline discussions at the NWPPC Subbasin level.

Table 1-1. Relationship between NWPPC Classification System and Hydrologic Classification System

NWPPC Province	USGS ACU	USGS ACU Hydrologic Code	NWPPC Subbasin	NOAA Fisheries Priority Subbasins	USGS Cataloging Unit Code ("4th Field HUC")	Listed Fish ESUs*
Columbia River Estuary	1/3 Lower Columbia	170800	Columbia Estuary			All
			Grays			4,5
			Elochoman			4,5
Lower Columbia	2/3 Lower Columbia	170800	Cowlitz	Upper Cowlitz	17080004	4,5,6
			Kalama			4,5,6
			Lewis	Lewis	17080002	4,5,6
			Washougal			4,5,6
			Columbia Lower			4,5,6
			Sandy			4,5,6
	Willamette	170900	Willamette	Willamette-Clackamas	17090012	4,5,6,11,12
				Clackamas	17090011	4, 6,11
				McKenzie	17090004	11
				North Santiam	17090005	11,12
Columbia Gorge	1/3 Middle Columbia	170701	Little White Salmon			4
			Big White Salmon			4
			Wind			4,6
			Klickitat			7
			Columbia Gorge			5,7
			Hood			4,6
			Fifteenmile			7
Columbia Plateau	Deschutes	170703	Deschutes			7
	John Day	170702	John Day	John Day Upper Fork	17070201	7
				John Day Middle Fork	17070203	7
				John Day North Fork	17070202	7
	2/3 Middle Columbia	170701	Lower 2/3 - Columbia Lower Middle			7
			Umatilla			7
			Walla Walla			7
	1/2 Lower Snake	170601	Snake Lower			1,2,3
			Palouse			1,3

* NOAA Fisheries Listed Fish ESU Key:

1 = Snake River chinook fall run
2 = Snake River chinook spring/summer run
3 = Snake River Basin steelhead
4 = Lower Columbia River chinook
5 = Columbia River chum
6 = Lower Columbia River steelhead
7 = Middle Columbia River steelhead
8 = Upper Columbia River steelhead
9 = Upper Columbia River chinook spring run
10 = Snake River sockeye
11 = Upper Willamette River chinook
12 = Upper Willamette River steelhead

Note: The mainstem reaches downstream of each ESU serve as migration corridors to the mouth of the Columbia.

Table 1-1: Continued

NWPPC Province	USGS ACU	USGS ACU Hydrologic Code	NWPPC Subbasin	NOAA Fisheries Priority Subbasins	USGS Cataloging Unit Code ("4th Field HUC")	Listed Fish ESUs*
Columbia Plateau (cont.)	1/2 Lower Snake (cont.)		Tucannon			1,2,3
	Yakima	170300	Yakima			7
	1/3 Upper Columbia	170200	Upper 1/3 - Columbia Lower Middle			7,8
			Crab			none
Columbia Cascade	1/3 Upper Columbia	170200	Columbia Upper Middle			8,9
			Wenatchee	Wenatchee	17020011	8,9
			Entiat	Entiat	17020010	8,9
			Lake Chelan			none
			Methow	Methow	17020008	8,9
			Okanogan			8,9
Intermountain	1/3 Upper Columbia	170200	Columbia Upper			none
			Sanpoil			none
	Spokane	170103	Spokane			none
			Coeur D'Alene			none
	1/5 Pend Oreille	170102	Pend Oreille			none
Blue Mountain	1/2 Lower Snake	170601	Asotin			2,3
			Grande Ronde			1,2,3
			Imnaha			1,2,3
			Snake Hells Canyon			1,2,3
Mountain Snake	Clearwater	170603	Clearwater	Middle Fork Clearwater	17060304	1,3
	Salmon	170602	Salmon	Little Salmon	17060210	1,2,3,10
				Lemhi	17060204	2,3
				Upper Salmon	17060201	1,2,3,10
Mountain Columbia	Kootenai	170101	Kootenai			none
	4/5 Pend Oreille	170102	Flathead			none
			Clark Fork			none
			Bitterroot			none
			Blackfoot			none

* NOAA Fisheries Listed Fish ESU Key:

1 = Snake River chinook fall run; 4 = Lower Columbia River chinook; 7 = Middle Columbia River steelhead; 10 = Snake River sockeye
2 = Snake River chinook spring/summer run; 5 = Columbia River chum; 8 = Upper Columbia River steelhead; 11 = Upper Willamette River chinook
3 = Snake River Basin steelhead; 6 = Lower Columbia River steelhead; 9 = Upper Columbia River chinook spring run; 12 = Upper Willamette River steelhead

Note: The mainstem reaches downstream of each ESU serve as migration corridors to the mouth of the Columbia.

Table 1-1: Continued

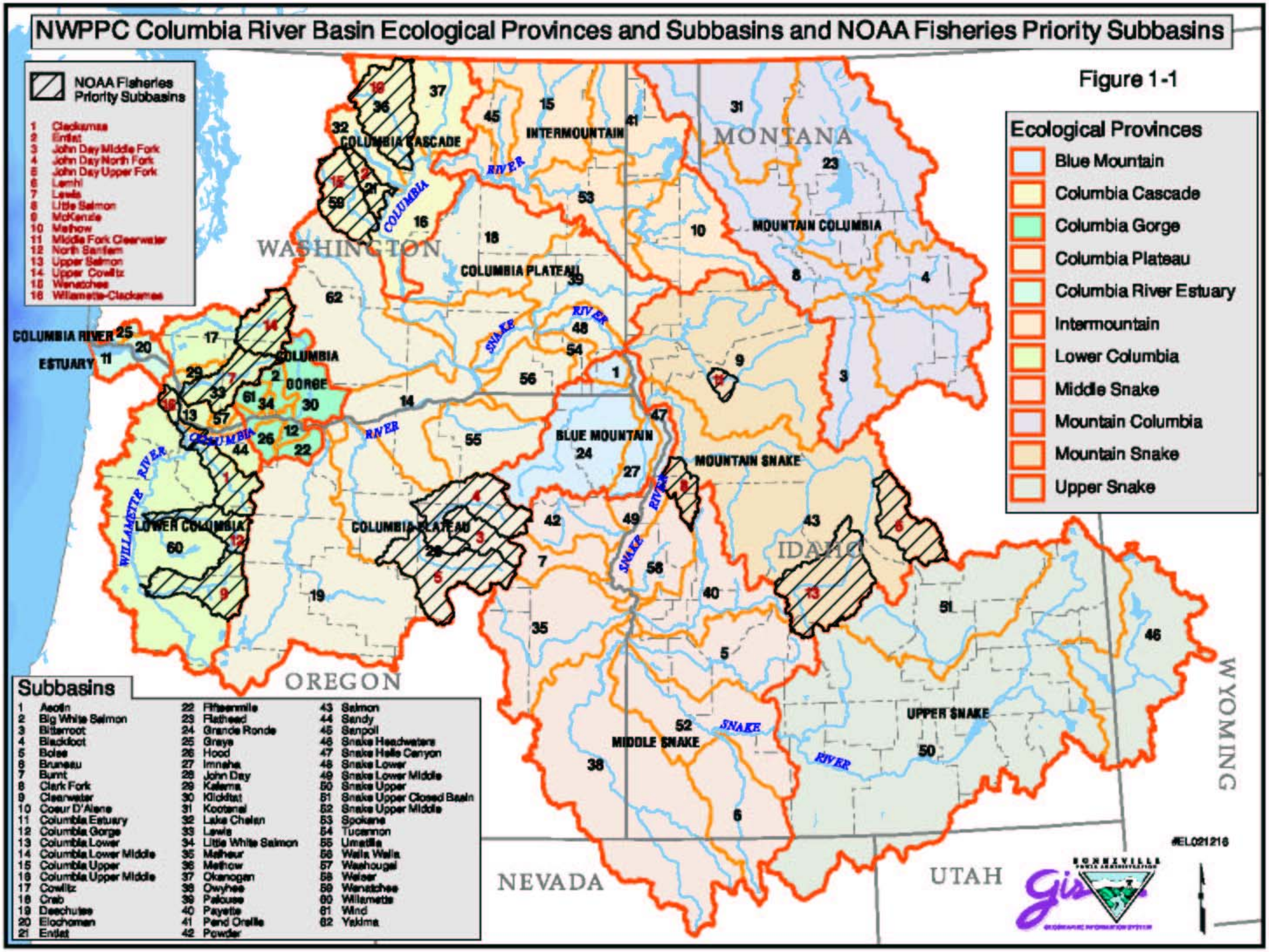
NWPPC Province	USGS ACU	USGS ACU Hydrologic Code	NWPPC Subbasin	NOAA Fisheries Priority Subbasins	USGS Cataloging Unit Code ("4th Field HUC")	Listed Fish ESUs*
Middle Snake	Middle Snake - Powder	170502	Snake Lower Middle			none
			Powder			none
			Burnt			none
	Middle Snake - Boise	170501	Weiser			none
			Payette			none
			Malheur			none
			Boise			none
			Owyhee			none
			Snake Upper Middle			none
			Bruneau			none
Upper Snake	Upper Snake	170402	Snake Upper			none
			Snake Upper Closed Basin			none
	Snake Headwaters	170401	Snake Headwaters			none

* NOAA Fisheries Listed Fish ESU Key:

1 = Snake River chinook fall run
2 = Snake River chinook spring/summer run
3 = Snake River Basin steelhead
4 = Lower Columbia River chinook
5 = Columbia River chum
6 = Lower Columbia River steelhead
7 = Middle Columbia River steelhead
8 = Upper Columbia River steelhead
9 = Upper Columbia River chinook spring run
10 = Snake River sockeye
11 = Upper Willamette River chinook
12 = Upper Willamette River steelhead

Note: The mainstem reaches downstream of each ESU serve as migration corridors to the mouth of the Columbia.

Figure 1-1. NWPPC Columbia River Basin Ecological Provinces and Subbasins and NOAA Fisheries Priority Subbasins



A second challenge was to locate suitable data sets for these mapped areas that could be used to document the baseline conditions. The most comprehensive set of GIS-based data and information is available at the 5th and 6th field scale from the ICBEMP Geographic Information System (GIS) database. However, the ICBEMP database only addresses the interior Columbia Basin east of the Cascade Range and not the entire Columbia River Basin. The BPA and the REO are working on more comprehensive GIS databases. However, these databases are still in preparation and full coverage for the entire Columbia River Basin is not currently available.

Under the auspices of the NWPPC's Fish and Wildlife Program, Subbasin Summaries have been developed for all of the NWPPC subbasins. These subbasin documents summarize the known available watershed-type data for each subbasin. Portions of these data are in GIS format. The NWPPC Subbasin Summaries represent the most recent syntheses of the best scientific and commercially available information in the proposed action area and were a source of information for the environmental baseline discussions of this Opinion (see Section 2.1.3, "Factors Affecting the Environmental Baseline in the Action Area").

The NWPPC is currently also developing Subbasin Assessments and Plans for each subbasin. The Subbasin Assessment is a technical exercise designed to identify the biological potential of each subbasin and the opportunities for habitat improvement. Based on these assessments, fish and wildlife managers, land managers, private landowners, and other people responsible for fish and wildlife and habitat conditions in the respective subbasins will develop Subbasin Plans. These plans delineate goals, objectives, strategies, and proposed actions that are consistent with the objectives and criteria in the Fish and Wildlife Program and with listed species recovery goals.

BPA intends to use the subbasin assessments and plans, as they are developed, to iteratively update information provided in this BA. BPA will also perform and report on the site-specific project reviews, monitoring, and evaluation components of this consultation at the 5th and 6th field HUC levels as the pertinent GIS databases become available. See Section 1.1.5.3 "Data Management" for more information on how the monitoring and evaluation will be conducted.

The proposed GIS informational and hierarchical structure allows BPA and NOAA Fisheries to perform site-specific analyses that are repeatable and spatially explicit. In addition, the approach has the following attributes:

- As data are iteratively refined through the cycle of collecting monitoring data, evaluation, and reporting, the information base will always be current.
- The subbasin analytical approach allows implementation of a monitoring strategy based on observed variation at the landscape scale that will be a less costly and more informative approach than a standard, project-by-project-based monitoring program.
- The approach will provide Federal land managers ready access to previously developed data, as well as provide a common medium for accumulating and sharing spatial data in the future.

- The hierarchical approach will promote efficient organization of analyses and subsequent documentation, given the large area where projects may be proposed, the potential for a large number of projects, and the range of project activities.
- Using a hierarchical structure allows the subbasin sections of the consultation document to stand alone, be updated, and provided to cooperators, etc., more efficiently.
- The GIS information and hierarchical structure will allow BPA and NOAA Fisheries to evaluate and refine existing information on the distribution and habitat use of listed species throughout the action area.

1.1.4 Overview of Proposed Habitat Improvement Activities

Habitat improvement projects to be funded by BPA are selected based on: (1) The NWPPC's Subbasin Assessments and Plans (when they become available) with documented goals and habitat improvement needs identified through the NWPPC's Provincial Review process; and (2) for listed species, consistency with the Basinwide Salmon Recovery Strategy and the reasonable and prudent measures in the FCRPS 2000 Opinion. The habitat improvement projects are intended to restore habitat functions that have been lost or degraded because of human-induced alterations to fish passage, wetland hydrology, water quality, native plant communities, riparian vegetation, and stream channel characteristics. To the extent practicable, the projects will be designed to be an integral part of a self-sustaining watershed habitat improvement process. The majority of these projects will occur on non-federal lands.

For purposes of the consultation, BPA identified a number of specific, frequently proposed actions that have minor and predictable effects that can be controlled through conservation measures. BPA proposed to consult programmatically on these habitat improvement actions, which are listed below in Table 1-2 and described in detail in Section 1.2, "Proposed Action."

Table 1-2. List of Actions and Activities

CATEGORY OF ACTION/ACTIVITY
1. Planning and Habitat Protection Actions
Stream Channel, Floodplain, and Uplands Surveys/ Installation of Stream Monitoring Devices
Fee-Title or Easement Acquisition, Cooperative Agreements, and/or Leasing of Land and/or Water
2. Small Scale Instream Habitat Actions
Streambank Protection using Bioengineering Methods
Install Habitat-Forming Natural Material Instream Structures (large wood and boulders)
Improve Secondary Channel Habitats
Riparian and Wetland Habitat Creation, Rehabilitation, and Enhancement
Fish Passage Activities
3. Livestock Impact Reduction
Construct Fencing for Grazing Control
Install Off-Channel Watering Facilities
Harden Fords for Livestock Crossings of Streams
4. Control of Soil Erosion from Upland Farming
Implement Upland Conservation Buffers
Implement Conservation Cropping Systems
Soil Stabilization *via* Planting and Seeding
Implement Erosion Control Practices
5. Irrigation and water delivery/ management actions
Convert Delivery System to Drip or Sprinkler Irrigation
Convert Water Conveyance from Open Ditch to Pipeline or Line Leaking Ditches and Canals
Convert from Instream Diversions to Groundwater Wells for Primary Water Source
Install New or Upgrade/Maintain Existing Fish Screens
Remove, Consolidate, or Improve Irrigation Diversion Dams
Install or Replace Return Flow Cooling Systems
6. Native Plant Community Protection and Establishment
Vegetation Planting
Vegetation Management by Physical Control
Vegetation Management by Herbicide Use
7. Road Actions
Road Maintenance
Bridge, Culvert, and Ford Maintenance, Removal or Replacement
Road Decommissioning
8. Special Actions
Install/Develop Wildlife Structures

1.1.5 Implementation Procedures

BPA NEPA/ESA staff will individually review each project through information submitted by the project sponsor to ensure ESA section 7 compliance under this Opinion for each site-specific project. A number of entities, including state fish and wildlife agencies, Indian tribes, soil and water conservation districts, irrigation districts, and other Federal agencies, propose projects to BPA for funding through the NWPPC's Fish and Wildlife Program. Once the projects are approved through the NWPPC Provincial Review process, BPA contracts with the project sponsors to implement the projects. BPA NEPA/ESA staff will review a submittal packet[4] from the project sponsor for each project to: (1) Verify whether a listed species or a designated critical habitat is reasonably certain to occur within the action area of the proposed project; and (2) verify consistency with the Habitat Improvement Program Biological Opinion. Details of this process are provided below in Section 1.1.5.1, "Pre-Project Review."

If BPA NEPA/ESA staff are satisfied that the project can and will be implemented according to the Opinion's requirements, and BPA decides to move forward with project implementation, the BPA project reviewer will place documentation of his or her conclusion, along with the submittal packet, into the project file and notify the project sponsor of the BPA finding. The project may then proceed without further consultation with NOAA Fisheries. If, however, BPA or the project sponsor determines that the project cannot be implemented according to the Opinion, changes will be made to the project design so that it can be implemented according to the Opinion, or BPA and the project sponsor will initiate appropriate individual section 7 consultation with NOAA Fisheries on the identified action.

Each project sponsor will send a monitoring report to BPA within 120 days of project completion. The report will describe the project's success in meeting the Terms and Conditions of the Opinion (see Section 1.1.5.4, "Compliance and Reporting Requirements"). The report will provide a narrative assessment and photos documenting habitat conditions before, during, and after project completion.

BPA will provide NOAA Fisheries an annual summary of project implementation activities by January 31 of each year. BPA will also gather any other data or analyses it deems necessary or helpful to complete an assessment of habitat trends in stream and riparian conditions resulting from implemented habitat improvement actions. By March 31 of each year, BPA will meet with NOAA Fisheries to discuss any actions necessary to make the habitat improvement program more effective.

1.1.5.1 Pre-Project Review

The project sponsor will use Form 1: "Habitat Improvement Program Biological Opinion Consistency Form for BPA-funded Fish and Wildlife Habitat Projects" (Appendix A) to document compliance with the Opinion for each site-specific project. Initially each project sponsor will:

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[4] The habitat project submittal package includes: the NWPPC Project Proposal and documentation of compliance with the Terms and Conditions issued under the HIP Opinion using Form 1: "Habitat Improvement Programmatic Consultation Consistency Form for BPA-funded Fish and Wildlife Habitat Projects" (Appendix A).

- Give a detailed description of the proposed project (what, where, when, how, intended result, *etc.*).
- Refer to the GIS database or coordinate with NOAA Fisheries endangered species staff to obtain a species list for the site.
- Determine that the proposed activities are within the action area covered by the Opinion.
- Determine and document specifically which habitat improvement activity(ies) addressed in the Opinion describe(s) the project.
- Use best professional judgment to determine if the effects of the project activities are within the range of effects addressed in the Opinion.
- Determine the applicable terms and conditions from the Opinion for the particular actions of the project.
- Determine whether the project activities can be implemented according to the applicable terms and conditions.

After the project sponsor documents all of the pertinent information, and <u>if</u> they find that the project complies with the Opinion, the project sponsor will send the completed Form 1: "Habitat Improvement Program Biological Opinion Consistency Form for BPA-funded Fish and Wildlife Habitat Projects" (Appendix A) along with a copy of the NWPPC Project Proposal to BPA as the project submittal package.

The BPA NEPA/ESA staff will review the form to make the final consistency determination The staff will:

- Confirm that a listed species or a designated critical habitat is reasonably certain to occur within the action area of the proposed project.
- Confirm that the proposed activities are <u>within the action area</u> covered by the Opinion.
- Confirm that the proposed activities are <u>within in the categories of habitat improvement activities</u> addressed in the Opinion.
- Confirm that <u>all the direct and indirect effects</u> of the proposed action and its interrelated and interdependent activities on the species and/or critical habitat are <u>within the range of effects</u> considered in the Opinion.
- Confirm that the project sponsor has identified the <u>correct terms and conditions</u> for the specific activities and locations of the project.

If the BPA reviewing staff person determines that the project is consistent with the Opinion, BPA staff will place documentation of their conclusion and place it with the submittal packet in the project file without requesting further consultation with NOAA Fisheries and notify the project sponsor of their finding.

If at any time there are uncertainties in interpreting the reasonable and prudent measures and terms and conditions of the Opinion, or doubts about the consistency with the Opinion, the project sponsor, in conjunction with BPA NEPA/ESA staff, will coordinate with NOAA

Fisheries to address these concerns and resolve any outstanding issues. Any requests for *minor*[5] project-specific deviations from the activities addressed and/or the Terms and Conditions of the Opinion will be documented on Form 2: "Request for Approval of Minor Deviation from the Categories of Habitat Improvement Activities or Terms and Conditions in the Habitat Improvement Program Biological Opinion" (Appendix A). NOAA Fisheries will provide written approval of the minor deviation(s) prior to work proceeding.

If the project sponsor or BPA NEPA/ESA staff determines that a proposed action is not consistent with the Opinion, or if NOAA Fisheries does not approve the request for minor deviation, changes will be made to the project design so that it can be implemented according to the Opinion, or the project sponsor and BPA will initiate appropriate individual section 7 consultation with NOAA Fisheries on the identified action.

In addition, if, during completion of a habitat improvement project, BPA or the project sponsor becomes aware of new information or unforeseen circumstances such that the project cannot be completed according to the scope of effects or terms and conditions of the Opinion, BPA will require that the project sponsor stop all project operations, except for efforts to avoid or minimize resource damage, pending completion of individual consultation on the project.

Table 1-3 is a dichotomous key to the implementation procedures for the consultation.

Table 1-3. Dichotomous Key to the Habitat Improvement Program Biological Opinion Implementation Procedures

1. <u>Project Sponsor Gathers Project Information and Completes Form 1: "Habitat Improvement Program Biological Opinion Consistency Form for BPA-funded Fish and Wildlife Habitat Projects" (Appendix A).</u>

A. Define specific project location and action area.
- Generate species and critical habitat list by consulting the HIP GIS database or by consulting the NOAA Fisheries web site.
- Determine if the project is within the range of a listed ESU or designated critical habitat.

B. Compile a complete project description, including a list of proposed habitat improvement activities.
- Determine whether the proposed activities are <u>within the action area</u> covered by the Opinion.
- Determine whether the proposed activities are <u>within in the categories of habitat improvement activities</u> addressed in the Opinion
- Determine whether <u>all the direct and indirect effects</u> of the proposed action and its interrelated and interdependent activities on the species and/or critical habitat are <u>within the range of effects</u> considered in the Opinion.

[5] Definition of minor deviation: One for which NOAA Fisheries may approve, in writing, the use of an alternative practice. These are specifically identified in the terms and conditions of the Opinion.

>>> *Are the proposed project habitat improvement activities consistent with the Opinion as per above?*

YES.....Go to 3.
NO......Inform BPA NEPA/ESA staff. Go to 2.

2. **<u>BPA NEPA/ESA Staff Coordinates Informally with NOAA Fisheries Staff</u>.**

A. Determine if the inconsistency is a *minor*[6] deviation from the activities addressed in the Opinion, and document on Form 2: "Request for Approval of Minor Deviation From the Categories of Habitat Improvement Activities or Terms and Conditions in the Habitat Improvement Program Biological Opinion" (Appendix A), or change the project design so that it can be implemented according to the Opinion.
B. Send form to NOAA Fisheries for approval.

>>> *Is NOAA Fisheries' staff satisfied that the effects from minor deviations from the Opinion are within the range of effects considered in the Opinion, or that changes to the project make it consistent with the Opinion?*

YES....NOAA Fisheries staff document approval of deviations not covered in the Opinion and the results of the coordination, or agreement that changes to the project make it consistent with the Opinion. **Go to 3.**

NO.....Go to 6.

3. **<u>Project Sponsor determines which terms and conditions apply to the project</u>.**

A. Compile list of the terms and conditions associated with the proposed habitat improvement activities from the Opinion, and document on Form 1.
B. Coordinate with project partners to ensure that all applicable terms and conditions of the Opinion will be met.

>>> *Can the proposed project be implemented according to all applicable reasonable and prudent measures and terms and conditions of the Opinion?*

YES.....Go to 5.

NO.....Notify BPA NEPA/ESA staff. Go to 4.

4. **<u>BPA NEPA/ESA Staff Coordinates Informally with NOAA Fisheries' Staff</u>.**

A. Describe "minor" deviations from the reasonable and prudent measures and terms

[6] Ibid.

and conditions of the Opinion necessary to implement project, and document on Form 2: "Request for Approval of Minor Deviation From the Categories of Habitat Improvement Activities or Terms and Conditions in the Habitat Improvement Program Biological Opinion" (Appendix A).

B. Determine whether the proposed deviation(s) from the reasonable and prudent measures and terms and conditions of the Opinion are <u>allowable</u> (must be anticipated in the Opinion, e.g., working outside in-water work windows under certain specific conditions), and document in writing.

>>> *Do NOAA Fisheries staff approve of the proposed deviations?*

YES.....NOAA Fisheries staff documents approval of deviation from the terms and conditions in writing via letter or e-mail. **Go to 5.**

NO.....Go to 6.

5. <u>BPA NEPA/ESA Staff Confirmation of Habitat Activity Compliance with the Opinion</u>.

A. Project Sponsor sends copy of NWPPC project proposal, Form 1 (and Form 2 and NOAA Fisheries' staff approval, if needed) to BPA NEPA/ESA staff via E-mail (preferred) or fax/regular mail.

B. BPA NEPA/ESA staff will review and:

- Confirm that a listed species or a designated critical habitat is reasonably certain to occur within the action area of the proposed project.
- Confirm that the proposed activities are <u>within the action area</u> covered by the Opinion.
- Confirm that the proposed activities are <u>within in the categories of habitat improvement activities</u> addressed in the Opinion.
- Confirm that <u>all the direct and indirect effects</u> of the proposed action and its interrelated and interdependent activities on the species and/or critical habitat are <u>within the range of effects</u> considered in the Opinion.
- Confirm that the project sponsor has determined the <u>correct terms and conditions</u> for the specific activities and locations of the project.

>>> *Is Project consistent with the Opinion?*

YES.....Go to 7.
NO.....Go to 6.

6. <u>Withdraw Project or Initiate Project-Specific Section 7 Consultation with NOAA Fisheries Staff</u>.

Complete individual project consultation with NOAA Fisheries for listed fish species and critical habitat under NOAA Fisheries' ESA jurisdiction for the action area.

7. CONSULTATION COMPLETE!

A. BPA staff will document consistency determination in writing on Form 1, return a copy of the form to the project sponsor, file the form(s) with the project file, and enter information into the HIP GIS database.
B. Project Sponsor will implement habitat improvement project, incorporating all Reasonable and Prudent Measures and Terms and Conditions of the Opinion.

1.1.5.2 Monitoring and Evaluation

Monitoring and evaluation are critical components of the effort to track habitat improvement activities. NOAA Fisheries and the FCRPS Action Agencies (including BPA) are working together to develop and implement a comprehensive regional Research, Monitoring, and Evaluation (RME) Program required by the FCRPS 2000 Opinion and the Basinwide Salmon Recovery Strategy (NOAA Fisheries and Action Agencies 2003). The resulting RME program is intended to provide information needed for assessment of Endangered Species Act (ESA) listed Columbia Basin salmon and steelhead populations at the 2005 and 2008 year FCRPS 2000 Opinion check-in evaluations. In addition, this program will inform the identification and prioritization of actions that are the most effective towards improved stock performance and provide information for the 2010 FCRPS Opinion. Significant elements of the RME program are identified through a number of specific action items called for within the FCRPS 2000 Opinion Reasonable and Prudent Alternatives (RPAs). Of the 199 RPA actions listed in the FCRPS 2000 Opinion, RPA actions 158-162 and 179-199 are explicit to RME.

Because the habitat activities addressed under this Opinion are partially in response to the requirements of the FCRPS 2000 Opinion and the Basinwide Salmon Recovery Strategy, BPA and NOAA Fisheries will develop and implement monitoring and evaluation for this Opinion that meshes with the regional RME Program. This RME program will also be integrated with the broader RME needs of the Federal Basinwide Salmon Recovery Strategy and the Northwest Power Planning Council's (NWPPC) Fish and Wildlife Program, in coordination with other regional Federal, state, and Tribal RME programs. For example, BPA will be reporting on the habitat improvement projects covered by this Opinion according to the Habitat Tracking Metrics Template developed by the Federal Habitat Team.

The RME plan identifies six principal components and their associated sub-components that must be addressed to meet the FCRPS 2000 Opinion requirements:

- Populations and Environmental Status Monitoring - abundance, trend, and condition of fish populations and key environmental attributes.
    - Ecosystem/Landscape - broad scale, periodic monitoring (Tier 1 of FCRPS 2000 Opinion)
    - Geographic Zone - localized, frequent monitoring (Tier 2 of FCRPS 2000 Opinion)
        - Tributary Habitat
        - Hydro-corridor
        - Estuary/Ocean

- Action Effectiveness Research - effects of hydro and off-site mitigation actions on fish survival and habitat attributes (Tier 3 of FCRPS 2000 Opinion).
    - Hydro
    - Habitat
    - Hatchery
    - Harvest
- Critical Uncertainty Research - addresses key uncertainties in population survival assessments (*e.g.,* extra mortality, hatchery spawner reproductive success)
- Project Implementation/Compliance Monitoring - tracking execution of management actions
- Data Management - support system for data storage and access
- Regional Coordination - across the various Federal, state, and Tribal RME programs

For the actions covered in the BPA Opinion, the FCRPS RME program will provide research and monitoring to cover 5 of the above categories:

1. Populations and environmental status monitoring.
2. Action effectiveness research.
3. Critical uncertainty research.
4. Data management.
5. Regional coordination.

(For specifics on the plans for each of these monitoring programs, see the detailed work plans in Appendices A, B, D, F, and G to NOAA Fisheries and Action Agencies 2003). However, BPA will require project implementation/compliance monitoring (#4 above) on a project-specific basis for each activity addressed in the Opinion and has included this requirement in the proposed conservation measures below. The Opinion implementation/ compliance monitoring will be coordinated with the FCRPS BIOP project implementation and compliance monitoring. A database will be developed by BPA NEPA/ESA staff to track the implementation and compliance monitoring (see Section 1.1.5.3 below).

- Implementation monitoring. BPA will require the following of each project sponsor as a condition of project funding: Each project sponsor will submit a monitoring report to BPA within 120 days of project completion describing the sponsor's success in meeting the conservation measures, reasonable and prudent measures, and associated terms and conditions of the Opinion. For projects that BPA determines to have a significant construction component[7], annual follow-up site rehabilitation monitoring reports will also be due by December 31 of each year following completion of construction as discussed in number 4 below. Each project-level monitoring report will include the following information, as applicable.
    1. Project identification
        a. Project sponsor name, BPA Fish and Wildlife project number, and project name.

[7] "Significant construction component" means a component of a project (e.g., instream construction, fish passage, road obliteration and decommissioning) that results in construction effects that can be meaningfully measured, detected, or evaluated.

   b. Opinion category of activity.
   c. Project location by 5th or 6th field HUC and by latitude and longitude as determined from the appropriate USGS 7-minute quadrangle map.
   d. BPA contract manager.
   e. Starting and ending dates for the habitat improvement work completed.
2. <u>Photo documentation</u>. Photo documentation of relevant habitat conditions at the project site before, during, and after project completion.[8]
   a. Include general views and close-ups showing details of the project and project area, including pre- and post-construction, for habitat improvement activities.
   b. Label each photo with date, time, project name, photographer's name, and documentation of the subject habitat improvement activity.
3. <u>Other data</u>. Additional project-specific data, as appropriate for individual projects.
   a. <u>Work cessation</u>. Dates work ceased because of high flows, if any.
   b. <u>Fish screen</u>. Compliance with NOAA Fisheries fish screen criteria[9].
   c. <u>Pollution and Erosion Control Plan.</u> A summary of pollution and erosion control inspections, including any erosion control failures, contaminant releases, and correction efforts.
   d. <u>Site preparation</u>.
      i. Total cleared area – riparian and upland.
      ii. Total new impervious area.[10]
   e. <u>Isolation of in-water work area, capture and release</u>.
      i. Supervisory fish biologist – name and address.
      ii. Methods of work area isolation and take minimization.
      iii. Stream conditions before, during and within one week after completion of work area isolation.
      iv. Means of fish capture.
      v. Number of fish captured by species.
      vi. Location and condition of all fish released.
      vii. Any incidence of observed injury or mortality of listed species.
   f. <u>Streambank protection</u>.
      i. Type and amount of materials used.
      ii. Project size – one bank or two, width and linear feet.

[8] Relevant habitat conditions may include characteristics of channels, eroding and stable streambanks in the project area, riparian vegetation, water quality, flows at base, bankfull and over-bankfull stages, and other visually discernable wildlife environmental conditions at the project area, and upstream and downstream of the project.
[9] NOAA Fisheries *Juvenile Fish Screen Criteria* (revised February 16, 1995) and *Addendum: Juvenile Fish Screen Criteria for Pump Intakes* (May 9, 1996) (guidelines and criteria for migrant fish passage facilities, and new and existing inadequate pump intake screens) (http://www.nwr.noaa.gov/1hydrop/hydroweb/ferc.htm). Note: new criteria are currently being drafted by NOAA Fisheries (2003).
[10] Impervious area defined: That part of the action area that is sufficiently compacted or otherwise covered by constructed, non-filtrating surfaces like concrete, pavement or buildings such that runoff is likely to contribute to the storm runoff response of the downstream channel.

g. Road construction, repairs and improvements. The justification for permanent road crossings design (*i.e.,* road realignment, full-span bridge, streambed simulation, or no-slope design culvert).
h. Site rehabilitation. Photo or other documentation that site rehabilitation performance standards were met.

4. Site rehabilitation monitoring. In addition to the 120-day implementation report, each project sponsor for a project that BPA determines to have a significant construction component[11] will submit an annual report by December 31 that includes the written record documenting the date of each visit to a project rehabilitation site, and the site conditions and any corrective action taken during that visit. Reporting will continue from year to year until BPA certifies that site rehabilitation performance standards have been met.

- Annual monitoring report. BPA will provide NOAA Fisheries with an annual monitoring report by January 31 of each year that describes BPA's efforts in carrying out the activities under the Opinion. See discussion under Section 1.1.5.4 "Compliance and Reporting Requirements."

- Annual coordination. BPA will meet annually with NOAA Fisheries to review the monitoring reports and determine if revisions or addenda are necessary to further implementation of the Opinion. See discussion under Section 1.1.5.5, "Annual Review and Revisions to the Opinion."

1.1.5.3 Data Management

Currently the region's information management system relating to fish and wildlife habitat restoration and management and listed species recovery is an ad-hoc distributed information system that lacks essential components, and more importantly, coherent organization, standards, protocols, shared responsibility, and structure. Because natural resource management is so highly dependent on information, and there is currently no overall regional information system, the FCRPS 2000 Opinion RME Program includes a data management component to track and organize the results of the monitoring efforts associated with implementation of the FCRPS 2000 Opinion. That is, it will link implementation/compliance monitoring, effectiveness monitoring, and status monitoring results.

The FCRPS 2000 Opinion RPA 194 specifically calls for the Action Agencies to develop a common data management system for fish populations, water quality, and habitat data in coordination with NOAA Fisheries, USFWS, and other Federal agencies, NWPPC, states, and Indian tribes.

The Action Agency data management work plan identified four areas of need for meeting the requirements of the FCRPS 2000 Opinion:

[11] "Significant construction component" means a component of a project (e.g., instream construction, fish passage, road obliteration and decommissioning) that results in construction effects that can be meaningfully measured, detected, or evaluated.

- A more comprehensive scoping of existing regional data management projects/goals/ needs.
- A formal comparison of regional data management goals/needs compared to the FCRPS 2000 Opinion goals/needs.
- The development of a FCRPS RME information system architecture or blueprint that is consistent with regional needs.
- The development of an information system(s) from the ground up in a modular fashion so that the system(s) meets the practical needs of the local users while meeting the legal and administrative requirements of the region

These needs will be filled by: (1) Participation in the development of a regional (common) data management system while providing real-time data management support for the research, monitoring and evaluation needs of the FCRPS 2000 Opinion; and (2) implementation of a data management prototype for tributary habitat in the three subbasins that are proposed for status and effectiveness research monitoring. The work plan (Appendix F of NOAA Fisheries and Action Agencies 2003) lays out a series of work tasks and associated schedules and costs.

In coordination with the RME Plan, BPA proposes to develop and implement a database to track habitat actions and compliance/implementation monitoring data for the Opinion. This database will be incorporated as one of the implementation/compliance monitoring modules in the overall regional FCRPS 2000 Opinion RME Program database management system. The HIP database will track, compile, and archive habitat activities and monitoring results, and enable spatial analyses on a watershed or sub-basin scale using a Geographic Information System (GIS). BPA will develop the database in coordination with NOAA Fisheries. BPA will provide the resultant database reports to NOAA Fisheries on an annual basis along with the Annual Monitoring Report.

1.1.5.4 Compliance and Reporting Requirements

For activities implemented under the Opinion, BPA will ensure that project sponsors implement all terms and conditions in their entirety.

- <u>Violation of Habitat Improvement Program Biological Opinion Terms and Conditions</u>. To ensure compliance with the biological opinion terms and conditions, BPA will conduct random site evaluations of activities authorized under the Opinion. Through notification by complainants, BPA may specifically target an individual activity to determine if it is in compliance with the terms and conditions as authorized under the biological opinion. If BPA determines that a contractor is in violation of the terms and conditions or has deviated from the authorization, BPA will notify the contractor and NOAA Fisheries. BPA may enforce this by withdrawing funding from a project, if the violations are serious or ongoing.

  If a contractor is in violation of the terms and conditions or has engaged in unauthorized take of a listed species, the action is no longer covered by the incidental take statement and BPA must reinitiate consultation. Also, NOAA Fisheries may implement enforcement actions against the contractor under ESA regulations and procedures.

- Annual monitoring report. BPA will provide NOAA Fisheries with an annual monitoring report by January 31 of each year that describes BPA's efforts carrying out the activities under the HIP. The report will summarize project level monitoring information by activity and by 5th or 6th field HUC, with special attention to site rehabilitation and streambank protection. The report will also provide an overall assessment of program activity and cumulative effects. BPA will submit the annual report to the Oregon, Washington, and Idaho Offices of NOAA Fisheries.

  The monitoring reports will include:

  1. Activities Authorized:
     a. List of all the activities authorized under the Opinion in the reporting year, showing the BPA project number, contractor's name, and date of approval.
     b. List of projects authorized under the Opinion by activity (*i.e.,* removal of fish passage barrier, in-stream restoration).
     c. Discussion of which projects were modified from what was originally authorized under the Opinion and how.
     d. Discussion of which projects BPA determined to include a significant construction component and therefore required a site rehabilitation plan.
     e. Discussion of any compliance actions taken on projects authorized by the Opinion and how they were resolved.
  2. Activities not Authorized:
     a. Discussion of types of habitat improvement activities that did not qualify for authorization under the Opinion and why.
  3. Individual Project Monitoring:
     a. All implementation monitoring reports submitted for the period covered by the annual report.
     b. A list of projects that have implementation monitoring reports past due.
  4. Evaluation of the Habitat Improvement Program Consultation Success:
     a. Success of the project(s) to meet the habitat improvement objectives, where monitored.
     b. Failure of the project(s) to meet the habitat improvement objectives, where monitored.
     c. Unforeseen impacts associated with the project(s), both short- and long-term.
     d. Activities less impacting than anticipated in the Opinion.
  5. Proposed Opinion Revisions and/or Modifications:
     a. Recommendation as to whether the Opinion should be amended to include additional activities or exclude previously authorized activities.

1.1.5.5 Annual Review and Revisions to the Opinion

- Annual Review. BPA will meet annually by January 31 with NOAA Fisheries to review the monitoring reports and determine if revisions or clarifications to the Opinion are necessary.

- Revisions and Clarifications to Conservation Measures. BPA and NOAA Fisheries will specifically discuss exclusions, alterations, modifications, or additions to the HIP conservation measures identified during the site-specific project reviews. If conservation measures are consistently being excluded, altered, modified or added, NOAA Fisheries will amend the Opinion through reinitiation of consultation with BPA to reflect these changes.

- Expanding the Consultation. BPA may propose addenda to the Opinion for any activities previously unidentified or not covered under this Opinion if the proposal is accompanied by appropriate biological assessments for those activities and a request to reinitiate consultation.

- Rescinding the Opinion. At any time during the implementation of the Opinion, BPA and NOAA Fisheries have the right to rescind the Opinion. However, BPA and NOAA Fisheries will first meet to discuss any decisions to rescind the Opinion or portions thereof in an attempt to resolve issues or conflicts. If the HIP Coordinators for BPA and NOAA Fisheries do not resolve the issues or conflicts, the Vice President for Environment, Fish, and Wildlife of BPA may elevate the issue for discussion with the Regional Administrator of NOAA Fisheries. If the issue is still not resolvable, BPA's Vice President and the Regional Administrator for NOAA Fisheries will prepare written documentation of the decision to rescind the Opinion.

1.1.6 Federal Action History

BPA and other Federal agencies in the Pacific Northwest have consulted on a number of habitat improvement actions for fish and wildlife in the Columbia River Basin over the past several years. As far back as 1995, the USDA Forest Service was consulting on their land management plan impacts on listed Snake River salmonids (NMFS 1995). In 1998, the USFS and BLM began consulting on land management plans impacting other newly listed salmonids (NMFS 1998b; NMFS 1998). Also in 1998, the USFWS consulted with NOAA Fisheries on its Partners for Wildlife Program (NMFS 1998c). The Partners Program provides financial and technical assistance to private and non-federal landowners in partnership with other cooperating agencies and groups for habitat restoration, enhancement, creation, and management projects. In 1999, the USDA Farm Services Administration consulted with both USFWS and NOAA Fisheries on its Conservation Reserve Program (NMFS 1999). USFS and BLM also completed several consultations on their land management and habitat improvement actions, and the Corps of Engineers consulted on several bank stabilization projects.

In the years 2000 and beyond, numerous consultations were completed in the Columbia River Basin for fish and wildlife habitat improvement actions. A list of consultations by type of action is found in Appendix B. The most significant programmatic consultations included a series of consultations with the U.S. Army Corps of Engineers (Corps). In 2000, NOAA Fisheries completed a biological opinion on the Corps issuance of a Regional General Permit for Stream Restoration Activities in Oregon involving large wood and boulder placement (NMFS 2000c). This Opinion was reissued in 2001 (NMFS 2001e). Also in 2001, NOAA Fisheries issued a biological opinion on the Corps' issuance of permits for 15 categories of activities in Oregon

(NMFS 2001b) and on issuance of permits for four categories of fish passage restoration activities in Washington (NMFS 2001j). In 2002, NOAA Fisheries consulted with USFWS on its restoration activities in Washington (NMFS 2002), and reissued a biological opinion on the permitting of 15 categories of activities by the Corps as "Endangered Species Act Section 7 Consultation and Magnuson-Stevens Act Essential Fish Habitat Consultation Programmatic Biological Opinion Standard Local Operating Procedures for Endangered Species (SLOPES) for Certain Activities Requiring Department of the Army Permits in Oregon and the North Shore of the Columbia River" (NOAA Fisheries 2002). On July 8, 2003, NOAA Fisheries issued a revised programmatic SLOPES biological opinion, known as SLOPES II. (NOAA Fisheries 2003b). NOAA Fisheries is also currently in the process of consulting with itself on the NOAA Restoration Center habitat restoration activities in Washington, Oregon, and Idaho.

In addition to these consultations on habitat actions, a series of consultations have been completed on the FCRPS, as discussed above in Section 1.1.1, "Discussion of the Federal Action and Legal Authority." The proposed habitat activities in the Opinion are in response to the requirements of the FCRPS 2000 Opinion.

1.2 Proposed Action

Proposed actions are defined in NOAA Fisheries' regulations (50 CFR 402.02) as "all activities or programs of any kind authorized, funded, or carried out, in whole or in part, by Federal agencies in the United States or upon the high seas." Additionally, 16 U.S.C. 1855(b)(2) further defines a Federal action as "any action authorized, funded, or undertaken or proposed to be authorized, funded, or undertaken by a Federal agency." Because the BPA proposes to fund the actions that may affect listed resources, it must consult under ESA section 7(a)(2) and MSA section 305(b)(2).

1.2.1 Description of Program Purposes and Objectives

As discussed in Section 1.1.1, "Discussion of the Federal Action and Legal Authority," BPA funds numerous habitat improvement actions through the NWPPC Fish and Wildlife Program and in response to the FCRPS Opinion. BPA's purpose in funding these actions is twofold: (1) To mitigate for the construction, operation, and maintenance of the FCRPS as required under the Pacific Northwest Electric Power Planning and Conservation Act of 1980 (Public Law 96-501), and (2) to assist in the recovery of listed species affected by the construction, operation, and maintenance of the FCRPS as required under the ESA, as amended (16 U.S.C. 1531 *et seq.*).

The objective of the Fish and Wildlife Program is to rebuild healthy, naturally-producing fish and wildlife populations by protecting, mitigating, and rehabilitating habitats and the biological systems within them, including anadromous fish migration corridors. The long-term, overarching habitat objectives of the FCRPS Opinion and the Basinwide Salmon Recovery Strategy (All-H Strategy) are: (1) To protect existing high quality habitats; (2) to rehabilitate degraded habitats and connect them to other functioning habitats; and (3) to prevent further degradation of tributary and estuary habitat and water quality.

The activities addressed in this Opinion will help meet either the objectives of the Fish and Wildlife Program or the FCRPS Opinion, or both.

Table 1-2 is a summary list of the categories of actions and specific activities addressed in the Opinion. Each of the actions and activities are described individually in the sections below.

1.2.2 General Conservation Measures Applicable to All Actions

As discussed above, the activities addressed under the Opinion have the goal of protecting, mitigating, and enhancing wildlife and fish habitat affected by the construction and operation of hydroelectric facilities on the Columbia River and its tributaries. These activities are planned for the benefit of listed and other fish and wildlife species. However, the manner in which these activities are carried out may adversely affect listed species in the short term. In order to minimize these adverse effects, BPA will ensure that the proposed habitat activities will be carried out in accordance with conservation measures. BPA identified many of these measures by searching previous biological opinions that addressed similar activities. BPA then adopted many of the terms and conditions in the biological opinions reviewed as the conservation measures for the Opinion. Conservation measures applicable to all activities are listed directly below. Conservation measures applicable only to specific activities are included in the description of those activities.

- All applicable regulatory permits and official project authorizations [*e.g.,* National Environmental Policy Act, National Historic Preservation Act, Level I Contaminants Survey, the appropriate state agency's Hydraulic Project Approvals, and permits from the U.S. Army Corps of Engineers (Corps)] will be secured before project implementation. All conditions in these regulatory permits and other official project authorizations will be followed to eliminate or reduce adverse impacts to any endangered, threatened, or sensitive species or their critical habitats (NMFS 2002).
- All actions that may affect listed resident aquatic and terrestrial animal and plant species will also undergo consultation with USFWS.
- Modifications to an approved activity will be reviewed and approved by the project biologist and the cooperators and/or landowner(s) before the work can be carried out or continued. This would include changes requiring modifications of permits, or alterations to the scope, design, or intent of the project (NMFS 2002).
- Existing roadways or travel paths will be used for access to project sites whenever feasible (NMFS 2002).
- All garbage from work crews will be removed from the project site daily and disposed of properly. All waste from project activities will be removed from the project site before project completion and disposed of properly (NMFS 2002).

1.2.3 Surveying, Construction, Operation, and Maintenance Activities

Many of the proposed projects are likely to involve one or more of the following activities:

- Onsite activities before site alteration – surveying, minor vegetation clearing, placement of stakes and flagging guides, minor movements of machines and personnel over the action area.
- Construction of access roads – depending on the scope of the action, construction or reconstruction of access roads may entail subgrade stabilization, base course construction, aggregate production, and extension of other activities listed below.
- Establishment of construction staging area – when actions require heavy equipment, that equipment will be delivered to the site, fueled, maintained and stored in temporary facilities when not in use.
- Materials storage – soil, rocks or other materials may be hauled to, and stored at, the action site.
- Site preparation – removal of surface vegetation and major root systems that may be disposed of by natural decomposition or burning, or reserved for use in restoration activities. Construction can also involve the discharge of water for actions such as concrete washout, pumping for work area isolation, and washing vehicles.
- Earthwork – use of heavy machinery to move natural soils from one location to another by excavating, filling, and, usually, compacting.
- Site restoration and cleanup – protection of bare earth by seeding, planting, mulching, and fertilizing.
- Ongoing operation and maintenance of facilities.

For those projects that include the above construction activities, the following conservation measures will apply in addition to the general conservation measures listed above and the conservation measures for each specific type of activity. BPA will include these conservation measures as enforceable conditions of any contract issued by BPA under this Opinion. (All conservation measures in this section are from NOAA Fisheries 2003b unless otherwise noted):

- <u>Minimum area</u>. Construction impacts will be confined to the minimum area necessary to complete the project (NMFS 2002).
- <u>Timing of in-water work</u>. Work below the bankfull elevation[12] will be completed during the appropriate state or U.S. Army Corps of Engineers (COE) preferred in-water work period[13] as appropriate for the project area, unless otherwise approved in writing by NOAA Fisheries.

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[12] "Bankfull elevation" means the bank height inundated by a 1.5 to 2-year average recurrence interval and may be estimated by morphological features such average bank height, scour lines and vegetation limits.

[13] Oregon Department of Fish and Wildlife, *Guidelines for Timing of In-Water Work to Protect Fish and Wildlife Resources*, 12 pp (June 2000) (identifying work periods with the least impact on fish) (http://www.dfw.state.or.us/ODFWhtml/InfoCntrHbt/0600_inwtrguide.pdf); U.S. Army Corps of Engineers, Seattle District, Approved Work Windows for Fish Protection (Version: 13 October 2000) http://www.nws.usace.army.mil/PublicMenu/Menu.cfm?sitename=REG&pagename=work_windows
In-water work windows for work in the Snake River are set on a case by case basis by the Regulatory Branch of the COE Walla Walla District, based on input from the regional offices of Idaho Dept of Fish and Game (IDFG) and NOAA Fisheries. They are typically June 1 to August 15. (Daly, Brad, October 11, 2002, Chief of Regulatory, COE Walla Walla District Personal communication with Mark Pedersen, Shapiro and Associates, Inc., Seattle WA and Horton, Bill, October 2002. Anadromous Fish Coordinator, IDFG, Personal communication with Mark Pedersen, Shapiro and Associates, Inc., Seattle WA). In-water work windows for work in Montana are established in a similar manner to those for the Snake by either the Seattle or Omaha districts of the COE (Frazer, Ken October 9, 2002. Regional Fisheries Biologist, Fish and Wildlife Department, Billings MT. Personal communication with Pam Porter, Shapiro and Associates, Inc., Portland, OR).

- Cessation of work. Project operations will cease under high flow conditions that may result in inundation of the project area, except for efforts to avoid or minimize resource damage.
- Fish screens. All water intakes used for a project, including pumps used to isolate an in-water work area, will have a fish screen installed, operated, and maintained according to NOAA Fisheries' fish screen criteria.[14]
- Fish passage. Provide passage for any adult or juvenile salmonid species present in the project area during construction, unless otherwise approved in writing by NOAA Fisheries, and maintained after construction for the life of the project. Passage will be designed in accordance with NOAA Fisheries "Anadromous Salmonid Passage Facility Guidelines and Criteria" (NOAA Fisheries 2003). Upstream passage is not required during construction if it did not previously exist.
- Pollution and Erosion Control Plan. Prepare and carry out a Pollution and Erosion Control Plan to prevent pollution caused by survey, construction, operation, and maintenance activities. The Plan will be available for inspection upon request by BPA or NOAA Fisheries.

  Plan Contents. The Pollution and Erosion Control Plan will contain the pertinent elements listed below, and meet requirements of all applicable laws and regulations.

  1. The name and address of the party(s) responsible for accomplishment of the pollution and erosion control plan.
  2. Practices to prevent erosion and sedimentation associated with access roads, stream crossings, drilling sites, construction sites, borrow pit operations, haul roads, equipment and material storage sites, fueling operations and staging areas.
  3. Practices to confine, remove, and dispose of excess concrete, cement and other mortars or bonding agents, including measures for washout facilities.
  4. A description of any regulated or hazardous products or materials that will be used for the project, including procedures for inventory, storage, handling, and monitoring.
  5. A spill containment and control plan with notification procedures, specific cleanup and disposal instructions for different products, quick response containment and cleanup measures that will be available on the site, proposed methods for disposal of spilled materials, and employee training for spill containment.
  6. Practices to prevent construction debris from dropping into any stream or waterbody, and to remove any material that does drop with a minimum disturbance to the streambed and water quality.

  Inspection of erosion controls. During construction, monitor instream turbidity and inspect all erosion controls daily during the rainy season and weekly during the dry season, or more often if necessary, to ensure they are working adequately.[15]

  1. If monitoring or inspection shows that the erosion controls are ineffective, mobilize work crews immediately to make repairs, install replacements, or install additional controls as necessary.
  2. Remove sediment from erosion controls once it has reached one-third of the exposed height of the control.

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[14] National Marine Fisheries Service, *Juvenile Fish Screen Criteria* (revised February 16, 1995) and *Addendum: Juvenile Fish Screen Criteria for Pump Intakes* (May 9, 1996) (guidelines and criteria for migrant fish passage facilities, and new pump intakes and existing inadequate pump intake screens) (http://www.nwr.noaa.gov/1hydrop/hydroweb/ferc.htm). NOTE: new criteria are currently being drafted by NOAA Fisheries (2003).

[15] "Working adequately" means no more than a 10% cumulative increase in natural stream turbidity will be allowed, as measured relative to a control point immediately upstream of the turbidity causing activity.

- Construction discharge water. Treat all discharge water created by construction (e.g., concrete washout, pumping for work area isolation, vehicle wash water, drilling fluids) as follows:
    1. Water quality. Design, build, and maintain facilities to collect and treat all construction discharge water using the best available technology applicable to site conditions. Provide treatment to remove debris, nutrients, sediment, petroleum hydrocarbons, metals and other pollutants likely to be present.
    2. Discharge velocity. If construction discharge water is released using an outfall or diffuser port, velocities will not exceed 4 feet per second, and the maximum size of any aperture will not exceed 4 feet per second.
    3. Spawning areas, submerged estuarine vegetation. Do not release construction discharge water within 300 feet upstream of spawning areas or areas with submerged estuarine vegetation.
    4. Pollutants. Do not allow pollutants including green concrete, contaminated water, silt, welding slag, or sandblasting abrasive to contact any wetland or the 2-year floodplain, except cement or grout when abandoning a drill boring or installing instrumentation in the boring.
- Treated wood.
    1. Projects using treated wood[16] that may contact flowing water or that will be placed over water where it will be exposed to mechanical abrasion or where leachate may enter flowing water will not be used, except for pilings installed following NOAA Fisheries' guidelines.[17]
    2. Any treated wood used will be specified as being produced using American Wood-Preservers Association best management practices.
    3. Projects that require removal of treated wood will use the following precautions:
        - Treated wood debris. Take care to ensure that no treated wood debris falls into the water. If treated wood debris does fall into the water, remove it immediately.
        - Disposal of treated wood debris. Dispose of all treated wood debris removed during a project, including treated wood pilings, at an upland facility approved for hazardous materials of this classification. Do not leave treated wood pilings in the water or stacked on the stream bank.
- Preconstruction activity. Complete the following actions before significant[18] alteration of the project area:
    1. Marking. Flag the boundaries of clearing limits associated with site access and construction to prevent ground disturbance of critical riparian vegetation, wetlands, and other sensitive sites beyond the flagged boundary.
    2. Emergency erosion controls. Ensure that the following materials for emergency erosion control are onsite:
        a. A supply of sediment control materials (e.g., silt fence, straw bales[19]).

[16] "Treated wood" means lumber, pilings, and other wood products preserved with alkaline copper quaternary (ACQ), ammoniacal copper arsenate (ACA), ammoniacal copper zinc arsenate (ACZA), copper naphthenate, chromated copper arsenate (CCA), pentachlorophenol, or creosote.
[17] Letter from Steve Morris, National Marine Fisheries Service, to W.B. Paynter, Portland District, U.S. Army Corps of Engineers (December 9, 1998) (transmitting a document titled *Position Document for the Use of Treated Wood in Areas within Oregon Occupied by Endangered Species Act Proposed and Listed Anadromous Fish Species, National Marine Fisheries Service, December 1998*).
[18] "Significant" means an effect can be meaningfully measured, detected or evaluated.

b. An oil-absorbing, floating boom whenever surface water is present.

3. Temporary erosion controls. All temporary erosion controls will be in place and appropriately installed down slope of project activity within the riparian buffer area[20] until site rehabilitation is complete.

- Temporary access roads.
  1. Steep slopes. Do not build temporary roads mid-slope or on slopes steeper than 30 percent.
  2. Minimizing soil disturbance and compaction. Low-impact, tracked drills will be walked to a survey site without the need for an access road. Minimize soil disturbance and compaction for other types of access whenever a new temporary road is necessary within 150 feet[21] of a stream, waterbody, or wetland by clearing vegetation to ground level and placing clean gravel over geotextile fabric, unless otherwise approved in writing by NOAA Fisheries.
  3. Temporary stream crossings.
     a. Do not allow equipment in the flowing water portion of the stream channel where equipment activity could release sediment downstream, except at designated stream crossings.
     b. Minimize the number of temporary stream crossings.
     c. Design new temporary stream crossings as follows:
        i. Survey and map any potential spawning habitat within 300 feet downstream of a proposed crossing.
        ii. Do not place stream crossings at known or suspected spawning areas, or within 300 feet upstream of such areas if spawning areas may be affected.
        iii. Design the crossing to provide for foreseeable risks (*e.g.,* flooding and associated bedload and debris) to prevent the diversion of streamflow out of the channel and down the road if the crossing fails.
        iv. Vehicles and machinery will cross riparian buffer areas and streams at right angles to the main channel wherever possible.
  4. Obliteration. When the project is completed, obliterate all temporary access roads, stabilize the soil, and revegetate the site. Abandon and restore temporary roads in wet or flooded areas by the end of the in-water work period.

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[19] When available, certified weed-free straw or hay bales will be used to prevent introduction of noxious weeds.

[20] For purposes of this Opinion only, "riparian buffer area" means land: (1) within 150 feet of any natural water occupied by listed salmonids during any part of the year or designated as critical habitat; (2) within 100 feet of any natural water within 1/4 mile upstream of areas occupied by listed salmonids or designated as critical habitat and that is physically connected by an aboveground channel system such that water, sediment, or woody material delivered to such waters will eventually be delivered to water occupied by listed salmon or designated as critical habitat; and (3) within 50 feet of any natural water upstream of areas occupied by listed salmonids or designated as critical habitat and that is physically connected by an aboveground channel system such that water, sediment, or woody material delivered to such waters will eventually be delivered to water occupied by listed salmon or designated as critical habitat. "Natural water" means all perennial or seasonal waters except water conveyance systems that are artificially constructed and actively maintained for irrigation.

[21] Distances from a stream or waterbody are measured horizontally from, and perpendicular to, the bankfull elevation, the edge of the channel migration zone, or the edge of any associated wetland, whichever is greater. "Channel migration zone" means the area defined by the lateral extent of likely movement along a stream reach as shown by evidence of active stream channel movement over the past 100 years - *e.g.*, alluvial fans or floodplains formed where the channel gradient decreases, the valley abruptly widens, or at the confluence of larger streams.

- Heavy equipment. Restrict use of heavy equipment as follows:
  1. Choice of equipment. When heavy equipment will be used, the equipment selected will have the least adverse effects on the environment (*e.g.,* minimally-sized, low ground pressure equipment).
  2. Vehicle staging. Fuel, operate, maintain, and store vehicles as follows:
     a. Complete vehicle staging, cleaning, maintenance, refueling, and fuel storage, except for that needed to service boats, in a vehicle staging area placed 150 feet or more from any stream, waterbody or wetland, unless otherwise approved in writing by NOAA Fisheries.
     b. Inspect all vehicles operated within 150 feet of any stream, waterbody or wetland daily for fluid leaks before leaving the vehicle staging area. Repair any leaks detected in the vehicle staging area before the vehicle resumes operation. Document inspections in a record that is available for review on request by BPA or NOAA Fisheries.
     c. Before operations begin and as often as necessary during operation, steam clean all equipment that will be used below the bankfull elevation until all visible external oil, grease, mud, and other visible contaminates are removed.
     d. Diaper all stationary power equipment (*e.g.,* generators, cranes, stationary drilling equipment) operated within 150 feet of any stream, waterbody, or wetland to prevent leaks, unless suitable containment is provided to prevent potential spills from entering any stream or waterbody.
- Site preparation. Conserve native materials for site rehabilitation.
  1. If possible, leave native materials where they are found.
  2. If materials are moved, damaged or destroyed, replace them with a functional equivalent during site rehabilitation.
  3. Stockpile any large wood,[22] native vegetation, weed-free topsoil, and native channel material displaced by construction for use during site rehabilitation.
- Isolation of in-water work area. If adult or juvenile fish are reasonably certain to be present, or if the work area is less than 300 feet upstream of spawning habitats, completely isolate the work area from the active flowing stream using inflatable bags, sandbags, sheet pilings, or similar materials, unless otherwise approved in writing by NOAA Fisheries.
- Blasting. In-stream blasting is excluded from this consultation; however, in-stream rock splitting by chemical expansion or shot-shell powered rock splitting is included.
- Capture and release. Before and intermittently during pumping to isolate an in-water work area, attempt to capture and release fish from the isolated area using trapping, seining, electrofishing, or other methods as are prudent to minimize risk of injury.
  1. The entire capture and release operation will be conducted or supervised by a fishery biologist experienced with work area isolation and competent to ensure the safe handling of all ESA-listed fish.

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[22] For purposes of this consultation only, "large wood" means a tree, log, or rootwad big enough to dissipate stream energy associated with high flows, capture bedload, stabilize streambanks, influence channel characteristics, and otherwise support aquatic habitat function, given the slope and bankfull channel width of the stream in which the wood occurs. See, Oregon Department of Forestry and Oregon Department of Fish and Wildlife, *A Guide to Placing Large Wood in Streams*, May 1995 http://www.odf.state.or.us/divisions/protection/forest_practices/RefsList.asp

2. If electrofishing equipment is used to capture fish, comply with NOAA Fisheries' electrofishing guidelines, listed below.[23]
   a. Do not electrofish near adult salmon in spawning condition or near redds containing eggs.
   b. Keep equipment in good working condition. Complete manufacturers' preseason checks, follow all provisions, and record major maintenance work in a log.
   c. Train the crew by a crew leader with at least 100 hours of electrofishing experience in the field using similar equipment. Document the crew leader's experience in a logbook. Complete training in waters that do not contain listed fish before an inexperienced crew begins any electrofishing.
   d. Measure conductivity and set voltage as follows.

Conductivity (umhos/cm)	Voltage
Less than 100	900 to 1100
100 to 300	500 to 800
Greater than 300	150 to 400

   e. Use direct current (DC) at all times.
   f. Begin each session with pulse width and rate set to the minimum needed to capture fish. These settings should be gradually increased only to the point where fish are immobilized and captured. Start with pulse width of 500us and do not exceed 5 milliseconds. Pulse rate should start at 30Hz and work carefully upwards. In general, pulse rate should not exceed 40 Hz, to avoid unnecessary injury to the fish.
   g. The zone of potential fish injury is 0.5 meters from the anode. Care should be taken in shallow waters, undercut banks, or where fish can be concentrated because in such areas the fish are more likely to come into close contact with the anode.
   h. Work the monitoring area systematically, moving the anode continuously in a herringbone pattern through the water. Do not electrofish one area for an extended period.
   i. Have crew members carefully observe the condition of the sampled fish. Dark bands on the body and longer recovery times are signs of injury or handling stress. When such signs are noted, the settings for the electrofishing unit may need adjusting. End sampling if injuries occur or abnormally long recovery times persist.
   j. Whenever possible, place a block net below the area being sampled to capture stunned fish that may drift downstream.
   k. Record the electrofishing settings in a logbook along with conductivity, temperature, and other variables affecting efficiency. These notes, with observations on fish condition, will improve technique and form the basis for training new operators.
3. Do not use seining or electrofishing if water temperatures exceed 18 degrees centigrade.
4. Handle ESA-listed fish with extreme care, keeping fish in water to the maximum extent possible during seining and transfer procedures, to prevent the added stress of out-of-water handling.
5. Transport fish in aerated buckets or tanks. Release fish into a safe release site as quickly as possible, and as near as possible to capture sites.

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[23] National Marine Fisheries Service, *Backpack Electrofishing Guidelines* (December 1998) (http://www.nwr.noaa.gov/1salmon/salmesa/pubs/electrog.pdf).

6. If a listed fish is injured or killed at any point during the salvage operation, the NOAA Fisheries Law Enforcement Office will be contacted (NOAA Fisheries 2002b).
7. Do not transfer ESA-listed fish to anyone except NOAA Fisheries or USFWS personnel, unless otherwise approved in writing by them.
8. Obtain all other Federal, state, and local permits necessary to conduct the capture and release activity.
9. Allow NOAA Fisheries or USFWS or its designated representative to accompany the capture team during the capture and release activity, and to inspect the team's capture and release records and facilities.

- Earthwork. Complete earthwork (including drilling, excavation, dredging, filling and compacting) as quickly as possible.
    1. Excavation. During excavation, stockpile native streambed materials above the bankfull elevation, where it cannot reenter the stream, for later use. If culvert inlet/outlet protecting riprap is used, it will be class 350 metric or larger and topsoil will be placed over the rock and planted with native woody vegetation.
    2. Drilling and sampling. If drilling, boring, or jacking is used, the following conditions apply.
        - Isolate drilling operations in wetted stream channels using a steel pile, sleeve or other appropriate isolation method to prevent drilling fluids from contacting water.
        - If it is necessary to drill through a bridge deck, use containment measures to prevent drilling debris from entering the channel.
        - If directional drilling is used, the drill, bore or jack hole will span the channel migration zone and any associated wetland.
        - Sampling and directional drill recovery/recycling pits, and any associated waste or spoils will be completely isolated from surface waters, off-channel habitats and wetlands. All drilling fluids and waste will be recovered and recycled or disposed to prevent entry into flowing water.
        - If a drill boring conductor breaks and drilling fluid or waste is visible in water or a wetland, all drilling activity will cease pending written approval from NOAA Fisheries to resume drilling.
    3. Site stabilization. Stabilize all disturbed areas, including obliteration of temporary roads, following any break in work unless construction will resume within four days.
    4. Source of materials. Obtain boulders, rock, woody materials and other natural construction materials used for the project outside the riparian buffer area.
- Stormwater management. Prepare and carry out a stormwater management plan for any project that will produce a new impervious surface or a land cover conversion that slows the entry of water into the soil. Make the plan available for inspection on request by BPA or NOAA Fisheries
    1. Plan contents. The goal is to avoid and minimize adverse effects due to the quantity and quality of stormwater runoff for the life of the project by maintaining fully functioning salmonid habitat conditions, or by restoring more natural runoff conditions. The plan will meet the following criteria and contain the pertinent elements listed below, and meet requirements of all applicable laws and regulations.
        a. A system of management practices and, if necessary, structural facilities, designed to complete the following functions:

(1) Minimize, disperse and infiltrate stormwater runoff onsite using sheet flow across permeable vegetated areas to the maximum extent possible without causing flooding, erosion impacts, or long-term adverse effects to groundwater.
(2) Pretreat stormwater from pollution generating surfaces, including bridge decks, before infiltration or discharge into a freshwater system, as necessary to minimize any nonpoint source pollutant (*e.g.,* debris, sediment, nutrients, petroleum hydrocarbons, metals) likely to be present in the volume of runoff predicted from a 6-month, 24-hour storm.

b. Use permeable pavements for load-bearing surfaces, including multiple-use trails, to the maximum extent feasible based on soil, slope, and traffic conditions.
c. Install structural facilities outside wetlands or the riparian buffer area[24] whenever feasible, otherwise provide compensatory mitigation to offset any long-term adverse effects.
d. For projects that require engineered flow control facilities to meet the stormwater management goal, use a continuous rainfall/runoff model, where available, to ensure that the duration of post-project discharge matches the pre-developed duration from 50% of the 2-year peak flow up to the 50-year peak flow.
e. Document completion of the following activities according to a regular schedule for the operation, inspection and maintenance of all structural facilities and conveyance systems, in a log available for inspection on request by BPA and NOAA Fisheries.

(1) Inspect and clean each facility as necessary to ensure that the design capacity is not exceeded, heavy sediment discharges are prevented, and whether improvement in operation and maintenance are needed.
(2) Promptly repair any deterioration threatening the effectiveness of any facility.
(3) Post a warning sign on or next to any storm drain inlet that says, as appropriate for the receiving water, "Dump No Waste - Drains to Ground Water, Streams, or Lakes."
(4) Only dispose of sediment and liquid from any catch basins in an approved facility.

2. <u>Runoffs discharged into a freshwater system</u>. When stormwater runoff will be discharged directly into fresh surface water or a wetland, or indirectly through a conveyance system, the following requirements apply.
   a. Maintain natural drainage patterns and, whenever possible, ensure that discharges from the project site occur at the natural location.

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[24] For purposes of this Opinion only, "riparian buffer area" means land: (1) Within 150-feet of any natural water occupied by listed salmonids during any part of the year or designated as critical habitat; (2) within 100-feet of any natural water within 1/4 mile upstream of areas occupied by listed salmonids or designated as critical habitat and that is physically connected by an above-ground channel system such that water, sediment, or woody material delivered to such waters will eventually be delivered to water occupied by listed salmon or designated as critical habitat; and (3) within 50-feet of any natural water upstream of areas occupied by listed salmonids or designated as critical habitat and that is physically connected by an above-ground channel system such that water, sediment, or woody material delivered to such waters will eventually be delivered to water occupied by listed salmon or designated as critical habitat. "Natural water" means all perennial or seasonal waters except water conveyance systems that are artificially constructed and actively maintained for irrigation.

b. Use a conveyance system comprised entirely of manufactured elements (e.g., pipes, ditches, outfall protection) that extends to the ordinary high water line of the receiving water.
c. Stabilize any erodible elements of this system to prevent erosion.
d. Do not divert surface water from, or increase discharge to, an existing wetland if that will cause a significant adverse effect to wetland hydrology, soils or vegetation.

- Site rehabilitation. For projects that BPA determines to have a significant construction component[25], prepare and carry out a site restoration plan as necessary to ensure that all streambanks, soils and vegetation disturbed by the project are cleaned up and restored as follows. Make the written plan available for inspection on request by BPA or NOAA Fisheries.
  1. General Considerations.
     - Rehabilitation goal. The goal of site rehabilitation is renewal of habitat access, water quality, production of habitat elements (*e.g.,* large woody debris), channel conditions, flows, watershed conditions and other ecosystem processes that form and maintain productive fish habitats.
     - Streambank shaping. Restore damaged streambanks to a natural slope, pattern and profile suitable for establishment of permanent woody vegetation, unless precluded by pre-project conditions (*e.g.,* a natural rock wall).
     - Revegetation. Replant each area requiring revegetation prior to or at the beginning of the first growing season following construction. Use a diverse assemblage of species native to the project area or region, including grasses, forbs, shrubs and trees. Do not use noxious or invasive species.
     - Herbicides. Any herbicide application will follow the conservation measures listed under Section 1.2.9.3, "Vegetation Management by Herbicide Use."
     - Fertilizer. Do not apply surface fertilizer within 50 feet of any stream channel.
     - Fencing. Install fencing as necessary to prevent access to revegetated sites by livestock or unauthorized persons.
  2. Plan Contents. Include each of the following elements:
     - Prepare and carry out a site restoration plan as necessary to ensure that all streambanks, soils and vegetation disturbed by the project are cleaned up and restored as follows. Make the written plan available for inspection on request by BPA or NOAA Fisheries.
     - Baseline information. This information will be obtained from existing sources (*e.g.,* land use plans, watershed analyses, subbasin plans), where available.
       i. A functional assessment of adverse effects, *i.e.,* the location, extent and function of the riparian and aquatic resources that will be adversely affected by construction and operation of the project.
       ii. The location and extent of resources surrounding the restoration site, including historic and existing conditions.

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[25] "Significant construction component" means a component of a project (*e.g.,* instream construction, fish passage, road obliteration and decommissioning) that results in construction effects that can be meaningfully measured, detected, or evaluated.

- Goals and objectives. Restoration goals and objectives that describe the extent of site restoration necessary to offset adverse effects of the project, by aquatic resource type.
- Performance standards. Use these standards to help design the plan and to assess whether the restoration goal is met. While no single criterion is sufficient to measure success, the intent is that these features should be present within reasonable limits of natural and management variation.
    i. Bare soil spaces are small and well dispersed.
    ii. Soil movement, such as active rills or gullies and soil deposition around plants or in small basins, is absent or slight and local.
    iii. If areas with past erosion are present, they are completely stabilized and healed.
    iv. Plant litter is well distributed and effective in protecting the soil with few or no litter dams present.
    v. Native woody and herbaceous vegetation, and germination microsites, are present and well distributed across the site.
    vi. Vegetation structure is resulting in rooting throughout the available soil profile.
    vii. Plants have normal, vigorous growth form, and a high probability of remaining vigorous, healthy and dominant over undesired competing vegetation.
    viii. High impact conditions confined to small areas necessary access or other special management situations.
    ix. Streambanks have less than 5% exposed soils with margins anchored by deeply rooted vegetation or coarse-grained alluvial debris.
    x. Few upland plants are in valley bottom locations, and a continuous corridor of shrubs and trees provide shade for the entire streambank.
- Work plan. Develop a work plan with sufficient detail to include a description of the following elements, as applicable.
    i. Boundaries for the restoration area.
    ii. Restoration methods, timing, and sequence.
    iii. Water supply source, if necessary.
    iv. Woody native vegetation appropriate to the restoration site.[26] This must be a diverse assemblage of species that are native to the project area or region, including grasses, forbs, shrubs and trees. This may include allowances for natural regeneration from an existing seed bank or planting.
    v. A plan to control exotic invasive vegetation.
    vi. For wetland creation or rehabilitation projects, elevation(s) and slope(s) of the restoration area to ensure they conform with required elevation and hydrologic requirements of target plant species.
    vii. Geomorphology and habitat features of stream or other open water.
    viii. Site management and maintenance requirements.

[26] Use reference sites to select vegetation for the mitigation site whenever feasible. Historic reconstruction, vegetation models, or other ecologically based methods may be used as appropriate.

- Monitoring and maintenance plan
    1. A schedule to visit the restoration site the first year after completion and then every other year thereafter, as long as necessary to confirm that the performance standards are achieved.
    2. During each visit, inspect for and correct any factors that may prevent attainment of performance standards (*e.g.,* low plant survival, invasive species, wildlife damage, drought).
    3. Keep a written record to document the date of each visit, site conditions and any corrective actions taken.

- Long-term adverse effects[27]. Prepare and carry out a compensatory mitigation plan as necessary to ensure the proposed action meets the goal of 'no net loss' aquatic functions by offsetting unavoidable long-term adverse effects to streams and other aquatic habitats. Make the plan available for inspection on request by BPA or NOAA Fisheries.

Actions of Concern. The following actions require a Compensatory Mitigation Plan to offset long-term adverse effects:

- Riparian and aquatic habitats displaced by construction of structural stormwater facilities, or scour protection (*e.g.,* a footing facing, head wall, or other protection necessary to prevent scouring or downcutting of a culvert or bridge support).
- Other activities that prevent the development of properly functioning conditions through natural habitat processes.

General Considerations.

- Make mitigation plans compatible with adjacent land uses or, if necessary, use an upland buffer to separate mitigation areas from developed areas or agricultural lands.
- Base the level of required mitigation on a functional assessment of adverse effects of the proposed project, and functional replacement (*i.e.,* 'no net loss of function'), whenever feasible, or a minimum one-to-one linear foot or acreage replacement.
- Acceptable mitigation includes reestablishment or rehabilitation of natural or historic habitat functions when self-sustaining, natural processes are used to provide the functions. Actions that require construction of permanent structures, active maintenance, creation of habitat functions where they did not historically exist, or that simply preserve existing functions are not authorized, unless otherwise approved in writing by NOAA Fisheries.
- Whenever feasible, complete mitigation before, or concurrent with, project construction to reduce temporal loss of aquatic functions and simplify compliance.

[27] Long-term adverse effects are unavoidable net effects such as those resulting from replacing a culvert with a bridge. While the bridge will have a positive effect on the overall properly functioning stream condition, the bridge will add impervious surfaces adjacent to the stream, which can result in permanent conditions of increased runoff and reduced site permeability and infiltration. This conservation measure will ensure that such long-term adverse effects causing unavoidable permanent loss will be offset by compensatory mitigation such as planting additional riparian trees and shrubs or restoration of near shore habitats.

- When project construction is authorized before mitigation is completed, the applicant will show that a mitigation project site has been secured and appropriate financial assurances in place.
    i. Complete all work necessary to carry out the mitigation plan no later than the first full growing season following the start of project construction, whenever feasible.
    ii. If beginning the initial mitigation actions within that time is infeasible, then include other measures that mitigate for the consequences of temporal losses in the mitigation plan.
- Actions to complete a mitigation plan will also meet all applicable terms and conditions for this Opinion, or complete a separate consultation.

Plan Contents. Include all pertinent elements of a site rehabilitation plan, outlined above, and the following elements.

- Consideration of the following factors during mitigation site selection and plan development.
    i. Watershed considerations related to specific aquatic resource needs of the affected area.
    ii. Existing technology and logistical concerns.
- A description of the legal means for protecting mitigation areas, and a copy of any legal instrument relied on to secure that protection.

- Implementation Monitoring. BPA will require the following of each project sponsor as a condition of project funding: Each project sponsor will submit a monitoring report to BPA within 120 days of project completion describing the sponsor's success in meeting the conservation measures, reasonable and prudent measures, and associated terms and conditions of the Opinion. For projects that BPA determines to have a significant construction component[28], annual follow-up site rehabilitation monitoring reports will also be due by December 31 of each year following completion of construction as discussed in number 4 below. Each project-level monitoring report will include the following information.
    1. Project Identification
        a. Project sponsor name, BPA Fish and Wildlife project number, and project name.
        b. Opinion category of activity.
        c. Project location by 5th or 6th field HUC and by latitude and longitude as determined from the appropriate USGS 7-minute quadrangle map.
        d. BPA contract manager.
        e. Starting and ending dates for the habitat improvement work completed.
    2. Photo Documentation. Photo documentation of habitat conditions at the project site before, during, and after project completion[29].
        a. Include general views and close-ups showing details of the project and project area, including pre- and post-construction, for habitat improvement activities.

[28] "Significant construction component" means a component of a project (*e.g.,* instream construction, fish passage, road obliteration and decommissioning) that results in construction effects that can be meaningfully measured, detected, or evaluated.

[29] Relevant habitat conditions may include characteristics of channels, eroding and stable streambanks in the project area, riparian vegetation, water quality, flows at base, bankfull and over-bankfull stages, and other visually discernable wildlife environmental conditions at the project area, and upstream and downstream of the project.

  b. Label each photo with date, time, project name, photographer's name, and documentation of the subject habitat improvement activity.
3. Other Data. Additional project-specific data, as appropriate for individual projects.
  a. Work Cessation. Dates work ceased because of high flows, if any.
  b. Fish Screening. Compliance with NOAA Fisheries fish screen criteria.[30]
  c. Pollution and Erosion Control Plan. A summary of pollution and erosion control inspections, including any erosion control failures, contaminant releases, and correction efforts.
  d. Site Preparation.
    i. Total cleared area – riparian and upland.
    ii. Total new impervious area[31].
  e. Isolation of in-water work area, capture and release.
    i. Supervisory fish biologist – name and address.
    ii. Methods of work area isolation and take minimization.
    iii. Stream conditions before, during and within one week after completion of work area isolation.
    iv. Means of fish capture.
    v. Number of fish captured by species.
    vi. Location and condition of all fish released.
    vii. Any incidence of observed injury or mortality of listed species.
  f. Streambank protection.
    i. Type and amount of materials used.
    ii. Project size – one bank or two, width and linear feet.
  g. Road construction, repairs and improvements. The justification for permanent road crossings design (*i.e.,* road realignment, full-span bridge, streambed simulation, or no-slope design culvert).
  h. Site rehabilitation. Photo or other documentation that site rehabilitation performance standards were met.
4. Site Rehabilitation Monitoring. In addition to the 120-day implementation report, each project sponsor for a project that BPA determines to have a significant construction component[32] will submit an annual report by December 31 that includes the written record documenting the date of each visit to a project rehabilitation site, and the site conditions and any corrective action taken during that visit. Reporting will continue from year to year until BPA certifies that site rehabilitation performance standards have been met.

- Annual Monitoring Report. BPA will provide NOAA Fisheries with an annual monitoring report by January 31 of each year that describes BPA's efforts in carrying out the activities

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[30] NOAA Fisheries *Juvenile Fish Screen Criteria* (revised February 16, 1995) and *Addendum: Juvenile Fish Screen Criteria for Pump Intakes* (May 9, 1996) (guidelines and criteria for migrant fish passage facilities, and new pump intakes and existing inadequate pump intake screens) (http://www.nwr.noaa.gov/1hydrop/hydroweb/ferc.htm). Note: new criteria are currently being drafted by NOAA Fisheries (2003).

[31] Impervious area defined: That part of the action area that is sufficiently compacted or otherwise covered by constructed, non-filtrating surfaces like concrete, pavement or buildings such that runoff is likely to contribute to the storm runoff response of the downstream channel.

[32] "Significant construction component" means a component of a project (*e.g.,* instream construction, fish passage, road obliteration and decommissioning) that results in construction effects that can be meaningfully measured, detected, or evaluated.

under the Opinion. See discussion under Section 1.1.5.4 "Compliance and Reporting Requirements."

- Annual Coordination. BPA will meet annually with NOAA Fisheries to review the monitoring reports and determine if revisions or addenda are necessary to further implementation of the Opinion. See discussion under Section 1.1.5.5, "Annual Review and Revisions to the Opinion."

This concludes the discussion of the general survey, construction, operations, and maintenance actions and conservation measures. The following sections describe the specific habitat improvement activities and conservation measures proposed for this consultation.

1.2.4 Planning and Habitat Protection Actions

1.2.4.1 Stream Channel, Floodplain, and Upland Surveys and Installation of Stream Monitoring Devices such as Streamflow and Temperature Monitors

Purpose. To collect information about existing on-ground conditions relative to: (1) Habitat type, condition, and impairment; (2) species presence, abundance, and habitat use; and (3) conservation, protection, and rehabilitation opportunities or effects.

Description. Conduct habitat and animal inventories in uplands, floodplains, and streambeds and install monitoring equipment. Electroshocking for research purposes is not included, as this work must have a Section 10 research permit. Work may entail use of trucks, survey equipment, hand tools, and crew, and, includes the following:

- Measuring/assessing and recording physical measurements by visual estimates or with survey instruments.
- Manually installing rebar or other markers along transects or at reference points.
- Manually installing piezometers and staff gauges to assess hydrologic conditions.
- Manually installing recording devices for streamflow and temperature.
- Locating and measuring physical features associated with structures on watercourses (such as culverts, bridges, gauges, and dams).
- Visually locating and recording fish presence, redds, or carcasses.
- Conducting snorkel surveys to determine species of fish in streams and observing interactions of fish with their habitats.
- Conducting habitat evaluation procedures, making observations, and walking transects for wildlife habitat assessment.
- Visually locating, identifying, and recording plant presence, frequency, and condition.
- Excavating cultural resource test pits using hand shovel only.
- Inventorying roads for general condition, needed work, and sediment sources.

Conservation Measures. In addition to the general conservation measures and those for construction activities described above, BPA proposes the following conservation measures for stream channel, floodplain, and upland surveys and installation of stream monitoring devices such as streamflow and temperature monitors:

- Except for escapement (redd) surveys, no in-water work will occur within 300 feet of spawning areas during anadromous fish spawning and incubation times.
- Persons conducting redd surveys will be trained in redd identification, likely redd locations, and methods to minimize the likelihood of stepping on redds or delivering fine sediment to redds (PNF 2001e).
- Workers will avoid redds and listed spawning fish while walking within or near stream channels to the extent possible. Avoidance will be accomplished by examining pool tail outs and low gradient riffles for clean gravel and characteristic shapes and flows prior to walking or snorkeling through these areas (PNF 2001e).
- If redds or listed spawning fish are observed at any time, workers will step out of the channel and walk around the habitat unit on the bank at a distance from the active channel (PNF 2001e).
- Snorkel surveys will follow a statistically valid sampling design or rely on a single pass approach (NMFS 2000b).
- Surveyors will coordinate with other local agencies to prevent redundant surveys (NMFS 2000b).
- Excavated material from cultural resource test pits will be placed away from stream channels. All material will be replaced back into test pits when testing is completed (NMFS 2000b).
- Multiple stream sites will be used for field trips to minimize effects on any given stream or riparian buffer area (NMFS 2000b).
- BPA will prepare an annual report of activities, including stream mileage surveyed and inventoried, categorized by method and by WRIA, HUC, or other appropriate spatial information (NMFS 2000b).

1.2.4.2 Fee-title or Easement Acquisition, Cooperative Agreements, and/or Leasing or Land and/or Water

Purpose. To preserve existing habitat for fish and wildlife by preventing development or degradation; increase connectivity by reconnecting patches of high quality habitat or extending habitat out from a core area; and/or increase tributary water flow to: (1) Improve conditions in a 303d water quality limited stream; (2) improve fish spawning, rearing, and migration; and (3) restore riparian functions.

Description. BPA will fund the purchase or lease of, or implement cooperative agreements on good quality upland, riparian, and aquatic habitat. This includes funding the acquisition of riparian buffers under the Conservation Reserve Program administered by the Natural Resources Conservation Service. For most transactions, management of the property or rights will be conducted by a land managing or water conservation entity. For land habitat acquisitions, a long-term management plan will be developed. The acquisition of a water right for instream flow is an administrative process where water that otherwise would have legally been withdrawn from the stream, will instead remain instream for the benefit of fish and the riparian system as a whole. Water will be left instream, enhancing flow, improving water quality, and maintaining temperature. Management activities occurring subsequent to the acquisition, leasing, or agreement, such as fencing, revegetation, *etc.*, are not included in this description of the fee-title or easement acquisition, cooperative agreements, and/or leasing of land and/or water activity, since many of these potential management activities are addressed elsewhere in this consultation.

Reasonable and Prudent Alternative (RPA) 150 under the FCRPS Opinion states that BPA is to "fund protection of currently productive non-federal habitat, especially if at risk of being degraded." RPA 151 states that BPA is to, "in coordination with NMFS, experiment with innovative ways to increase tributary flows by, for example, establishing a water brokerage." RPA 153 states that BPA, "working with agricultural incentive programs such as the Conservation Reserve Program, will negotiate and fund long-term protection for 100 miles of riparian buffers per year." In addition, the Northwest Power Planning Council's Fish and Wildlife Program incorporates provisions for protecting upland, riparian and aquatic habitats and instream flows.

In response to RPA 151, BPA is developing a Water Transaction Program. BPA invited state agencies, Indian tribes, water trusts, water districts, watershed councils, irrigation districts, and other interested individuals and parties to apply for consideration as either a regional entity or local entity. BPA selected the National Fish and Wildlife Foundation (NFWF) – Pacific Northwest Regional Office as the regional entity that will receive, evaluate, and facilitate implementation of water transactions submitted by local entities. The regional entity will receive policy-level guidance from a steering committee, which will assist the entity in establishing region-wide priorities and criteria, addressing funding issues, and setting the goals and objectives of the program. Local entities will propose to the regional entity innovative ways to increase tributary flows within the Columbia River Basin (Washington, Oregon, Idaho, and western Montana). The program is experimental and will be evaluated for its efficacy at regular intervals by an objective independent party.

BPA will evaluate and prioritize these actions for funding according to criteria developed for RPAs 150 and 151.

RPA 150: Interim criteria and attributes developed by BPA, NOAA Fisheries, COE, and USBOR are as follows (pers. com., Steve Waste, BPA, 7/18/02):

Criteria

- The proposed project is located within an ESU with populations of species that are identified as jeopardized, endangered, or listed in the FCRPS.
- The proposed project is located on non-federal land.
- The proposed project protects currently productive habitat, especially if it is at risk of being degraded.
- The proposed project has measurable, quantitative, biological objectives and will result in clear benefits to species' survival.

Attributes To Be Considered in the Identification of Priorities:

- Habitat Connectivity. The proposed project connects patches of high-quality habitat or extends habitat out from a core area. Thus, the project emphasizes the linkages between habitat areas that provide a variety of functions for species at various points of their life cycle, thereby achieving synergy with existing projects, spatially and biologically.
- Results in Viable Habitat. The proposed project protects largely self-sustaining habitat after activities are completed.

- Subbasin Planning. The proposed project advances subbasin plan goals and objectives that relate to the conservation of listed salmonids.
- Areas of Historic Habitat Type Loss. The proposed project identifies areas of historic habitat and ascertains their viability.
- Not a Habitat Restoration Project. The proposed project is located on unimpaired habitat that currently possesses those self-sustaining ecosystem processes necessary for the conservation of listed salmonids, and does not require significant restoration efforts.
- Linkages to Reference Site(s). The proposed project facilitates determination of the effectiveness of restoration activities by serving as a "control" for evaluating habitat change; *i.e.,* by providing a relatively unaltered reference habitat in close proximity to restoration activities.

RPA 151: Draft interim criteria developed by the steering committee for the Water Transactions Program are as follows (pers. com., Chris Furey, BPA, 2002):[33]

1. The proposed project provides a watershed context:
   - The proposed project should summarize the issues related to watershed health, stream flows, and generally give background description and justification for the critical nature or importance of completing the proposed project.
2. The proposed project satisfies the following administrative components:
   - The entity demonstrates it has staff with appropriate expertise in securing/transferring water for proposal implementation.
   - The proposal for securing water is cost-effective in terms of local and regional markets.
   - The proposal documents how opportunities for cost sharing and collaboration with other entities were considered and developed.
   - The administrative costs are competitive and reasonable for the tasks undertaken.
   - The project budget is sufficiently detailed to document costs to specific implementation tasks.
   - A NEPA checklist has been submitted for the proposal.
   - A water transaction checklist has been submitted for specific water transactions.
3. The proposed project satisfies the transactional components:
   - The proposal will secure or contribute to securing actual water for in-stream tributary flows.
   - The water rights to be secured are valid, verifiable, and have sufficient seniority to enable water to be transferred to the applicable state trust water system or equivalent for protection in-stream.
   - The quantity to be transferred has been determined by the applicable state agency or properly estimated.
   - Steps have been taken to effect transfer of the water with the applicable state agency.
   - Planning, permitting, and landowner/irrigation district agreements are signed or the steps to final transaction completion are identifiable, manageable and timely.

[33] NFWF may evaluate and prioritize water transaction proposals for funding based on the extent to which the proposals submitted by the Qualified Local Entities satisfy the following criteria. To qualify for funding, a proposal need not meet all the criteria below, with the exception of the administrative and accountability criteria.

4. The proposed project fully explores the innovative components:
    - The proposal will develop a new transactional strategy or uses an existing innovative method to increase tributary flow.
    - The proposal demonstrates collaborative efforts with other entities.
    - The proposal considers synergistic effects with other mitigation actions in the area.
    - The proposal is based upon or will develop a strategic analysis of water acquisition priorities in a specific, targeted watershed.
    - The proposal is based upon or will develop standardized appraisal and valuation methods.
5. The proposed project satisfies one or more of the following biological components:
    - ESA listed species or other depressed native fish stocks benefit from the program when implemented.
    - Improvement of tributary flows.
    - Improvement of water quality due to increased quantity.
    - Flow restoration will occur in an area where low flows are a limiting factor to fish survival.
6. The proposed project satisfies the accountability components:
    - Provisions for effective long-term monitoring.
    - Documentation and assurance of tributary flow improvements in the short term and the long term.
    - The local entity agrees to update the water transaction checklist and forward a final version to NFWF upon completion of a water transaction.

<u>Conservation Measures</u>. Because no adverse effects are anticipated from this fee-title or easement acquisition, cooperative agreements, and/or leasing of land and/or water activity, BPA does not propose any conservation measures.

1.2.5 Small Scale Instream Habitat Actions

1.2.5.1 Streambank Protection using Bioengineering Methods

<u>Purpose</u>. To protect and repair eroding streambanks, thereby reducing sediment loading in streams and promoting more stable stream courses.

<u>Description</u>. All actions intended for streambank protection will provide the greatest degree of natural stream and floodplain function achievable through application of an integrated, ecological approach by requiring the selection of protection measures to be constrained by an analysis of the mechanisms and causes of streambank failure, reach conditions, and habitat impacts (NOAA Fisheries 2003b). The following bank protection techniques are proposed for use either individually or in combination:

- Woody plantings and variations (*e.g.,* live stakes, brush layering, facines, brush mattresses).
- Herbaceous cover, where analysis of available records (*e.g.,* historical accounts and photographs) shows that trees or shrubs did not exist on the site within historic times, primarily for use on small streams or adjacent wetlands.

- Deformable soil reinforcement, consisting of soil layers or lifts strengthened with fabric and vegetation that are mobile ('deformable') at approximately two- to five-year recurrence flows.
- Coir logs (long bundles of coconut fiber), straw bales and straw logs used individually or in stacks to trap sediment and provide growth medium for riparian plants.
- Bank reshaping and slope grading, when used to reduce a bank slope angle without changing the location of its toe, increase roughness and cross-section, and provide more favorable planting surfaces.
- Floodplain roughness, *e.g.,* floodplain tree and large woody debris rows, live siltation fences, brush traverses, brush rows and live brush sills; used to reduce the likelihood of avulsion[34] in areas where natural floodplain roughness is poorly developed or has been removed.
- Floodplain flow spreaders, consisting of one or more rows of trees and accumulated debris used to spread flow across the floodplain.
- Flow-redirection structures known as barbs, vanes, or bendway weirs, when designed as follows, unless otherwise approved in writing by NOAA Fisheries.
    1. No part of the flow-redirection structure will exceed bank full elevation, including all rock buried in the bank key.
    2. Build the flow-redirection structure primarily of wood or otherwise incorporate large wood at a suitable elevation in an exposed portion of the structure or the bank key. Placing the large woody debris near streambanks in the depositional area between flow-direction structures to satisfy this requirement is not included, unless those areas are likely to be greater than one meter in depth, sufficient for salmon rearing habitats.
    3. Fill the trench excavated for the bank key above bankfull elevation with soil and top with native vegetation.
    4. The maximum flow-redirection structure length will not exceed 1/4 of the bankfull channel width.
    5. Place rock individually without end dumping.
    6. If two or more flow-redirection structures are built in a series, place the flow-redirection structure farthest upstream within 150 feet or 2.5 bankfull channel widths, from the flow-redirection structure farthest downstream.
    7. Include woody riparian planting as a project component.

No other types of streambank protection are included in this Opinion. Work may require the use of heavy equipment, power tools, and/or hand crews.

Conservation Measures. In addition to the general conservation measures and those for construction activities described above, BPA proposes the following conservation measures for streambank erosion control activities (all below from NOAA Fisheries 2003b):

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[34] 'Avulsion' means a significant and abrupt change in channel alignment resulting in a river moving into a new channel across the floodplain. It is usually associated with large flood events, and may be caused by either natural events or actions such as straightening or moving channels by building dikes or levees, or building deep, floodplain gravel pits too near the river.

- Use of large wood and rock. Whenever possible, use large wood as an integral component of all streambank protection treatments.[35] Avoid or minimize the use of rock, stone and similar materials.
    1. Large wood will be intact, hard, and undecayed to partly decaying with untrimmed root wads to provide functional refugia habitat for fish. Use of decayed or fragmented wood found laying on the ground or partially sunken in the ground is not acceptable.
    2. Rock may be used instead of wood for the following purposes and structures. The rock will be class 350 metric, or larger, wherever feasible, but may not impair natural stream flows into or out of secondary channels or riparian wetlands. Rock will be used:
        - As ballast to anchor or stabilize large woody debris components of an approved bank treatment.
        - To fill scour holes, as necessary to protect the integrity of the project, if the rock is limited to the depth of the scour hole and does not extend above the channel bed.
        - To construct a footing, facing, head wall, or other protection necessary to prevent scouring or downcutting of an existing flow control structure (*e.g.,* a culvert or bridge support).
        - To construct a flow-redirection structure as described above.

1.2.5.2 Install Habitat-Forming Natural Material Instream Structures (Large Wood and Boulders)

Purpose. To provide instream spawning, rearing and resting habitat for salmonids; provide high flow refugia; increase interstitial spaces for benthic organisms and juvenile salmonids; increase in-stream structural complexity and diversity; promote natural vegetation composition and diversity; reduce embeddedness in spawning gravels; reduce siltation in pools; reduce the width/depth ratio of the stream; mimic natural input of large woody debris in aquatic systems that have been altered by channelization and land use practices; restore historic hydrologic regimes; decrease flow velocities; and deflect flows into adjoining floodplain areas.

Description. All activities intended for installing habitat-forming instream structures will provide the greatest degree of natural stream and floodplain function achievable through application of an integrated, ecological approach (NOAA Fisheries 2003b). Instream structures capable of enhancing habitat-forming processes and migratory corridors will be installed within previously degraded stream reaches. These structures include engineered log jams and other cover structures designed with large woody debris and/or boulder materials. Structures will be installed only in streambed gradients of 6% or less. Structure placement activities will be limited to areas where structures are, or would be, naturally present. This may include structure types

[35] See, *e.g.,* Washington Department of Fish and Wildlife, Washington Department of Transportation, and Washington Department of Ecology, *Integrated Streambank Protection Guidelines*, Appendix I: Anchoring and placement of large woody debris (June 2002) (http://www.wa.gov/wdfw/hab/ahg/ispgdoc.htm); Oregon Department of Forestry and Oregon Department of Fish and Wildlife, *A Guide to Placing Large Wood in Streams*, May 1995 http://www.odf.state.or.us/divisions/protection/forest_practices/RefsList.asp

that are designed to lower a stream's width to depth ratio while providing habitat and migratory corridors capable of connecting existing habitats and promoting a naturally functioning channel. Large woody debris structures will be designed to minimize the need for anchoring. However, dependent on site location and design criteria, some structures may be anchored. If anchored, a variety of methods may be used. These include buttressing the wood between riparian trees, cabling the structure to existing structures, and/or anchoring with boulders, concrete blocks or new log wedges. Biodegradable manila/sisal rope may be used to temporarily stabilize structures. Work may require the use of heavy equipment, power tools, and/or hand crews.

Placement of large wood will occur in channels with an intact, well-vegetated riparian buffer area that is not mature enough to provide large wood, or in conjunction with riparian rehabilitation and/or management. Wood placement will also be limited to areas where the absence of large wood has been identified as a limiting factor for fish habitat using survey data.

The placement of large boulders will be restricted to streams where boulders naturally occur but are currently lacking. Boulder placement projects will rely on the size of boulder for stability, not on any artificial cabling or other devices. Total length of a placement project will be limited to 250 feet. Boulders will be placed in random patterns replicating natural conditions without substantially modifying stream hydraulics. The use of boulders to construct weirs or other channel-spanning structures is not included under this action (see section 1.2.5.1 above for activities included in this Opinion where boulders may be used). Permanently anchored structures, engineered structures and deflectors, debris jam structures relying on large rock, rebar and cable, and other similar habitat construction activities are not included in this Opinion.

Some of the instream habitat improvement projects may involve pulling or felling trees into streams. Although trees would be sacrificed and maneuvered within the riparian zone and stream channel, in these projects, no trees would be harvested or removed from riparian reserves. In addition, the projects would extend over substantial distances and stocking levels of remaining trees would remain high, so BPA does not believe that riparian indicators would be degraded. In projects where logs would be hauled to the site, the logs would be obtained from upland areas or would be salvaged and hauled by the project sponsor after having been cut in the course of highway repair.

Conservation Measure. In addition to the general conservation measures and those for construction activities described above, BPA proposes the following conservation measure for installing habitat-forming natural material instream structures:

- Installation of LWD will comply with the size requirements outlined in A Guide to Placing Large Wood in Streams (ODFW/ODF 1995) and placement guidance in the Oregon Aquatic Habitat Restoration and Enhancement Guide (ODFW/ODF 1999) (NMFS 2001f), or Appendix I of the Integrated Streambank Protection Guidelines[36] (WDFW et al. 2003). The wood length requirement is at least two times the bankfull

[36] See Washington Department of Fish and Wildlife, Washington Department of Transportation, and Washington Department of Ecology, *Integrated Streambank Protection Guidelines*, April 2003, Appendix I, Anchoring and Placement of Large Woody Debris (http://www.wa.gov/wdfw/hab/ahg/ispgdoc.htm).

stream width (1.5 times the bankfull width for wood with rootwad attached) (ODFW/ODF 1999). The minimum diameter size requirements are based on the bankfull width of the stream as follows (ODFW/ODF 1995):

Bankfull Width (feet)	Minimum Diameter (inches)
0 to 10	10
10 to 20	16
20 to 30	18
Over 30	22

1.2.5.3 Improve Secondary Channel Habitats

Purpose. To increase area available for rearing habitat; improve access to rearing habitat; increase hydrologic capacity of side channels; increase channel diversity and complexity; provide resting areas for fish and wildlife species at various levels of inundation; reduce flow velocities; and provide protective cover for fish and other aquatic species.

Description. Actions include removing or modifying sediment bars or terraces that block fish passage and removing channel and bank sediments to open the channel or increase the channel area. All activities intended for improving secondary channel habitats will provide the greatest degree of natural stream and floodplain function achievable through application of an integrated, ecological approach (NOAA Fisheries 2003b). Activities that will alter streambank or channel conditions are not included in this consultation except for the following:

- Removal of trash and other artificial debris dams that block fish passage.
- Removal of sediment bars or terraces that block fish passage within 50 feet of a tributary mouth.
- Streambed grading within 50 feet of the mouth of a stream.

Work may entail use of heavy equipment, power tools, and/or hand crews.

Conservation Measures. In addition to the general conservation measures and those for construction activities described above, BPA proposes the following conservation measures for improving secondary channel habitats:

- Projects will be designed to provide fish passage in accordance with NOAA Fisheries "Anadromous Salmonid Passage Facility Guidelines and Criteria" (NOAA Fisheries 2003).
- For removal of sediment bars or terraces, no more than 25 cubic yards of sediment may be removed from within 50 feet of the mouth of the stream.
- Adequate precautions will be taken to prevent post-construction stranding of juvenile or adult fish.

1.2.5.4 Riparian and Wetland Habitat Creation, Rehabilitation, and Enhancement

Purpose. To reestablish a hydrologic regime that has been disrupted by human activities, including functions such as water depth, seasonal fluctuations, flooding periodicity, and connectivity; increase area available for rearing habitat; improve access to rearing habitat; increase hydrologic capacity of side channels; increase channel diversity and complexity; provide resting areas for fish and wildlife species at various levels of inundation; reduce flow velocities; provide protective cover for fish and other aquatic species; and improve or reestablish wetland processes and functions which have been disrupted by human activities, such as provision of fish and wildlife habitat, flood water attenuation, nutrient and sediment storage, support of native plant communities and removal of pollutants.

Description. For purposes of this consultation, the riparian and wetland habitat creation, rehabilitation,[37] and enhancement activity is limited to the following list. No other projects that would alter streambank or channel conditions are included in this proposed action.

- Removal of levees, dikes, berms, weirs or other water control structures (NOAA Fisheries 2003b).
- Set back of levees, dikes and berms (NOAA Fisheries 2003b).
- Reshaping of streambanks as necessary to reestablish vegetation (NOAA Fisheries 2003b).
- Excavation and removal of artificial fill materials from former wetlands (NMFS 2002).
- Developing berms or impoundments in upland areas with or without installing water control structures, to create a geomorphic depression in conjunction with a water source.
- Reintroducing beavers in areas where they have been removed.
- Excavating pools and ponds to groundwater to create wetlands in uplands.
- Removing structural bank protections, and other engineered or created structures that do not meet the description and conservation measures under Section 1.2.5.1 “Streambank Protection Using Bioengineering Methods.”
- Recontouring off stream areas that have been leveled.

All activities intended for riparian and wetland habitat creation, rehabilitation, and enhancement will also provide the greatest degree of natural stream and floodplain function achievable through application of an integrated, ecological approach (NOAA Fisheries 2003b). This work will involve careful design to retain or reclaim natural conditions and the functions of the natural, active floodplain. The design will consider data and results from current and historic aerial photos, maps, hydraulic models, original plans, local knowledge of historic conditions and recent literature. Projects will be designed to mimic natural conditions for gradient, width, sinuosity and other hydraulic parameters. Bioengineering methods will be employed to help stabilize the banks and floodplains as the new features perform minor self-adjustment during bankfull (and larger) flood events.

Common practices for riparian or wetland creation include the use of heavy equipment, such as excavators, backhoes, and graders. Power tools and crews with hand tools may also be used. Soil may be moved out of or brought onto a site, depending on the specific characteristics of the site. Hydric soils may be salvaged to provide appropriate substrate and/or seed source for hydrophytic plant community development. Hydric soils will only be obtained from wetland salvage sites.

[37] "Rehabilitation project" means a habitat rehabilitation activity whose primary purpose is to restore natural aquatic or riparian habitat process or conditions, which would not be undertaken but for its rehabilitation purpose.

Conservation Measures. In addition to the general conservation measures and those for construction activities described above, BPA has proposed the following conservation measures for riparian and wetland habitat creation, rehabilitation, and enhancement:

- Adequate precautions will be taken to prevent stranding of juvenile or adult fish (NOAA Fisheries 2003b).
- All passage will be designed in accordance with NOAA Fisheries "Anadromous Salmonid Passage Facility Guidelines and Criteria" (NOAA Fisheries 2003).

1.2.5.5 Fish Passage Activities

Purpose. To facilitate fish passage past obstacles in streams.

Description. Fish passage will be improved by:

- Removal of trash and other artificial debris dams that block fish passage.
- Removal of permanent or intermittent dams, if fish cannot readily pass at any streamflow where either adult or juvenile upstream migrants are present.
- Removal of tide gates that block fish passage to estuarine habitat.
- Modification of a dam apron with shallow depth (less than 10 inches), or high flow velocity to provide depths and velocities passable to upstream migrants.
- Modification of a diffused or braided flow that impedes approach to the impediment.
- Re-engineering of improperly designed fish passage or fish collection facilities.
- Periodic maintenance of fish passage or fish collection facilities to ensure proper functioning, *e.g.,* cleaning debris buildup, replacement of parts.

Conservation Measures. In addition to the general conservation measures and those for construction activities described above, BPA proposes the following conservation measures for fish passage activities:

- Preliminary designs for modifying upstream passage facilities will be developed in an interactive process with NOAA Fisheries, in accordance with "Anadromous Salmonid Passage Facility Guidelines and Criteria" (NOAA Fisheries 2003). The preliminary design will be developed on the basis of synthesis of the required site and biological information listed in NOAA Fisheries 2003. NOAA Fisheries will review fish passage facility designs in the context of how the required site and biological information was integrated into the design. Submittal of all information discussed in the document may not be required in writing for NOAA Fisheries review, however, BPA and the project sponsor will be prepared to describe how the biological and site information listed in the document was included in the development of the preliminary design. NOAA Fisheries will be available to discuss these criteria in general or in the context of a specific site. BPA and the project sponsor will initiate coordination with NOAA Fisheries fish passage specialists early in the development of the preliminary design to allow an iterative, interactive, and cooperative process (NOAA Fisheries 2003).

- NOAA Fisheries staff will conduct post-construction evaluations to assure the intended results are accomplished, and that mistakes are not repeated elsewhere. There are three parts to this evaluation: (1) Verification that the fish passage facility is installed in accordance with proper design and construction procedures; (2) measurement of hydraulic conditions to assure that the facility meets these guidelines; and (3) biological evaluations to confirm the hydraulic conditions are resulting in successful passage. Step 1 is always required; steps 2 and 3 are may be waived on a project-by-project basis if it is clear that the hydraulic conditions are being met (usually applies to smaller facilities). NOAA Fisheries technical staff may assist in developing a hydraulic or biological evaluation plan to fit site-specific conditions and species. These evaluations are not intended to cause extensive retrofits of any given project unless the as-built installation does not reasonably conform to the design guidelines, or an obvious fish passage problem continues to exist (NOAA Fisheries 2003).
- Operation and maintenance of fish passage structures will be conducted in accordance with the operation and maintenance plan outlined in Section 7 of Form 1 in Appendix A.

1.2.6 Livestock Impact Reduction

1.2.6.1 Construct Fencing for Grazing Control

Purpose. To eliminate or reduce livestock degradation of streams, streambanks, lakeshores, riparian/wetland vegetation, and unstable upland slopes; reduce soil compaction and erosion; reduce fecal input to streams and wetlands; thereby improving riparian habitat function.

Description. Permanent or temporary livestock exclusion fences and cross-fences will be installed to manage grazing. Individual fence posts will be pounded or dug using hand tools or augers on backhoes or similar equipment. Fence posts will be set in the holes, backfilled, and fence wire strung or wooden rails placed. Installation may involve the removal of native or non-native vegetation along the proposed fence line. Occasionally rustic wood X-shaped fencing that does not require setting posts will be used.

Conservation Measures. In addition to the general conservation measures and those for construction activities described above, BPA proposes the following conservation measure for constructing fencing for grazing control:

- Fenced enclosures and exclosures will be implemented in conjunction with a prescribed grazing plan that minimizes the impact to riparian areas. The prescribed management plan will follow the criteria, specifications, and operation and maintenance protocols of the National Resource Conservation Service (NRCS) Conservation Practice Standard 528a for prescribed grazing (NRCS 2000g).
- Modify grazing practices, such as the season and amount of use, that prevent attainment of salmon habitat quality indicators, as described above. In particular, insure that grazing use does not cause bank instability for more than 5% lineal bank distance (including both banks), or exceed more than 30% or the current year's growth of woody vegetation. Pasture moves will occur before these annual thresholds are reached.

- Manage the timing and distribution of livestock to ensure that they do not enter the specific stream reaches used by ESA-listed salmon or steelhead for spawning during times when reproductive adults, eggs, or pre-emergent fry are expected to be present.

1.2.6.2 Install Off-Channel Watering Facilities

Purpose. To install off-channel watering facilities to preclude or limit the need for cattle to access a creek or wetland for drinking water. Implementation of this activity will eliminate or reduce livestock degradation of streams, streambanks, lakeshores, and riparian/wetland vegetation; reduce soil compaction and erosion; reduce fecal input to streams and wetlands; thereby improving riparian habitat function.

Description. Watering facilities will consist of various low volume pumping or gravity feed systems to move the water to a trough or pond at an upland site. Either above ground or underground piping will be installed between the troughs or ponds and the water source. Water sources will include springs and seeps, streams, or groundwater wells. Off-channel watering facility projects involving instream diversions from fish-bearing streams will be accomplished in accordance with Section 1.2.8.5, "Remove, Consolidate, or Improve Diversion Dams." Pipes will generally range from 0.5 to 4 inches, but may exceed 12 inches in diameter. Placement of the pipes in the ground will typically involve minor trenching using a backhoe or similar equipment.

Conservation Measures. In addition to the general conservation measures and those for construction activities described above, BPA proposes the following conservation measures for installation of watering facilities:

- Off-channel livestock watering facilities will be located to minimize compaction and/or damage to sensitive soils, slopes, vegetation, or fish spawning habitat due to congregating livestock (NMFS 2002).
- Wherever feasible, place new livestock water developments and move existing water developments at least 0.5 miles away from riparian areas, unless livestock movement is otherwise limited by terrain.
- Ensure that each watering development has a float valve, fenced overflow area, return flow system, or other means, as necessary, to minimize water withdrawal and potential runoff and erosion.
- All intake screening projects will be consistent with NOAA Fisheries' Pump Intake Screen Guidelines[38] (NMFS 2002).
- Withdrawals from all new wells or other stock watering sources installed under this activity will not exceed 1 cfs and will be permitted by the appropriate state agency. Project biologists will verify clearance with agency contacts (NMFS 2002).

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[38] NMFS *Addendum: Juvenile Fish Screen Criteria for Pump Intakes* (May 9, 1996) at (http://www.nwr.noaa.gov/1hydrop/hydroweb/ferc.htm). NOTE: new criteria are currently being drafted by NOAA Fisheries (2002).

1.2.6.3 Harden Fords for Livestock Crossings of Streams

Purpose. To eliminate or reduce livestock degradation of streams and streambanks; to reduce soil compaction and erosion.

Description. Livestock stream crossings will be installed to allow access to pastures and watering sources where livestock and other farm animals access and cross a stream channel on a somewhat infrequent basis. Culverts or bridges will be installed for frequent crossing locations in accordance with Section 1.2.10.2, "Bridge, Culvert, and Ford Maintenance, Removal, and Replacement." Hardening stream crossings will involve the placement of river rock along the stream bottom. Work will entail the use of heavy equipment, power tools, and/or hand crews. Additional use of fences will reduce straying off fords or watering areas into spawning gravels or large rearing pools.

Conservation Measures. In addition to the general conservation measures and those for construction activities described above, BPA proposes the following conservation measures for hardening of fords for livestock crossing of streams:

- Minimize the number of crossings.
- Locate crossings to minimize compaction and/or damage to sensitive soils, slopes, or vegetation. Place fords on bedrock or stable substrates whenever possible (NMFS 2002).
- Do not place crossings in areas where ESA-listed salmon or steelhead spawn or are suspected of spawning, or within 300 feet upstream of such areas if spawning areas may be disturbed.
- Design and construct or improve essential crossings to accommodate reasonably foreseeable flood risks, including associated bedload and debris, and to prevent the diversion of streamflow out of the channel and down the trail if the crossing fails (NMFS 1999).
- Stabilize bank cuts, if any, with vegetation and protect approaches and crossings with river rock (not crushed rock) when necessary to prevent erosion (NMFS 1999).
- Ensure that livestock crossings in and of themselves do not create barriers to the passage of adult and juvenile fish (NMFS 1999).
- Manage livestock to minimize time spent in the crossing or riparian area.

1.2.7 Control of Soil Erosion from Upland Farming

1.2.7.1 Implement Upland Conservation Buffers

Purpose. To reduce sediment and nutrient pollution from upland agricultural lands to streams; to provide a contributing mechanism for farmers and ranchers to meet the water quality requirements established under Federal and state laws.

Description. Field borders of perennial vegetation will be created along edges of fields, consisting of shrub and/or herbaceous cover. Close-growing ground cover species will be planted to encircle areas that may serve as a source of sediment to prevent contamination of streams, rivers and lakes. Grassed waterways will be constructed with a swale cross-section to assure bank stability and retain vegetation, with vegetation suitable for conveyance of runoff. The criteria, plans and specifications, and operation and maintenance protocols of the following NRCS conservation practice standards will be followed:

- 332 Contour Buffer Strip (NRCS 1999)
- 380 Windbreak/Shelterbelt Establishment (NRCS 2002a)
- 386 Field Border (NRCS 1999d)
- 393 Filter Strip (NRCS 1999b)
- 412 Grassed Waterway (NRCS 2000b)
- 601 Vegetative Barriers (NRCS 2001)

Conservation Measure. In addition to the general conservation measures, BPA proposes the following conservation measure for implementing upland conservation buffers:

- Implement these activities in combination with a riparian forest buffer (NRCS measure 391) (NRCS 2000e) wherever trees and/or shrubs can grow, or a riparian herbaceous cover (NRCS measure 390) (NRCS 1998) where analysis of available information (*e.g.,* historical accounts, photographs, USDA Plant Association Groups) indicates that no trees or shrubs, including willow (*Salix spp.*), existed on the site within historic times. Installation and management of the full range of field and landscape buffers will be encouraged by BPA as necessary to address small but unavoidable pollutant discharges associated with active agricultural operations, catastrophic pollution-associated episodic storm events, and other landscape-level concerns.

1.2.7.2 Implement Conservation Cropping Systems

Purpose. To reduce sediment and nutrient pollution from upland agricultural lands to streams; to provide a contributing mechanism for farmers and ranchers to meet the water quality requirements established under Federal and state laws.

Description. Conservation tillage and no-till direct seeding methods will be used to minimize tilling of agricultural fields. Crops will be arranged so that close-growing crops or grasses alternate with bands of clean-tilled crops. The contour of the land will be followed during all preparation, planting, and cultivation of crops. Slopes will be altered to create a stair-step or inclining ridge and swale appearance. Green manure crops and grasses and legumes will be planted in rotation to increase organic matter in the soil and reduce the need for synthetic fertilizers. The following NRCS Conservation Practice Standards will be followed:

- 329a Residue Management, No-till and Strip Till (NRCS 2000c)
- 329b Residue Management – Mulch Till (NRCS 1999a)
- 328 Conservation Crop Rotation (NRCS 2000f)
- 330 Contour Farming (NRCS 2000a)

- 585 Contour Strip Cropping (NRCS 2000)
- 590 Nutrient Management (NRCS 1999e)
- 777 Residue Management Direct Seed (NRCS 2000h)
- 586 Stripcropping (NRCS 2002b)

Conservation Measures. In addition to the general conservation measures, BPA proposes the following conservation measures for implementing conservation cropping systems:

- Employ conservation tillage and residue management practices that leave 30% or more of the previous crop residue on the soil surface after planting, as feasible, to reduce erosion potential.
- Employ nutrient management practices to increase the efficiency of fertilizer inputs and decrease the transport of nutrients to ground and surface water. Nutrients will be applied at an agronomic rate.[39]
- Employ vegetation management practices, including nonchemical vegetation control measures that will reduce losses dues to herbicide contamination during transport, handling, and use, and nonpoint pollution losses after use.[40]
- Implement these activities in combination with a riparian forest buffer (NRCS measure 391) (NRCS 2000e) wherever trees and/or shrubs can grow, or a riparian herbaceous cover (NRCS measure 390) (NRCS 1998) where analysis of available information (*e.g.,* historical accounts, photographs, or USDA Plant Association Groups) indicates that no trees or shrubs, including willow (Salix spp.), existed on the site within historic times. Installation and management of the full range of field and landscape buffers will be encouraged by BPA as necessary to address small but unavoidable pollutant discharges associated with active agricultural operations, catastrophic pollution-associated episodic storm events, and other landscape level concerns.

1.2.7.3 Soil Stabilization *via* Planting and Seeding

Purpose. To reduce sediment pollution from upland agricultural lands to streams; to provide a contributing mechanism for farmers and ranchers to meet the water quality requirements established under Federal and state laws.

Description. Pastures and rangelands will be planted or seeded with native or adapted perennial and biannual vegetation. The ground will be scarified as necessary to promote seed germination. In areas with severe erosion or high erosion potential, trees, shrubs, vines, grasses, and legumes will be planted to stabilize soils. Since noxious weeds, nonnative invasive plants, and aggressive, weedy species can take over disturbed lands and degrade range values, vegetation will be controlled through the use of herbicide applications, mechanical removal, hand pulling,

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[39] "Agronomic rate" means a quantity and timing of total nutrient application that does not exceed the requirements of the crop production and harvest or grazing system, as opposed to a nutrient application rate based on production goals that are difficult to define and variable. Calculation of the agronomic rate should take into account the total nitrogen or phosphorus resources for plant nutrition, and any retention of phosphorus in the soil and losses of nitrogen through dentrification and ammonia volatilization.

[40] Take of ESA-listed species caused by any aspect of pesticide use is not included in this Opinion and must be evaluated in an individual consultation if it is funded by BPA.

and prescribed burning. Vegetation control activities will be conducted in accordance with the descriptions and conservation measures in Section 1.2.9, “Native Plant Community Establishment and Protection" below.

Planting and seeding will be accomplished, as appropriate, in accordance with:

- the applicable best management practices outlined in the NRCS Conservation Practice Standards in sections 1.2.7.1 and 1.2.7.2 above; and
- Sloping Agricultural Land Technology (SALT) to reduce erosion and soil loss on sloping lands (Escano and Tababa 1998).

Conservation Measure. In addition to the general conservation measures, BPA proposes the following conservation measure for soil stabilization by planting and seeding:

- Implement the applicable conservation measures in sections 1.2.7.1 and 1.2.7.2 above.

1.2.7.4 Implement Erosion Control Practices

Purpose. To trap and contain water and sediment from uplands prior to it entering streams; to prevent sediment from entering fish-bearing streams and retain runoff for release during low streamflow periods in late summer and fall.

Description. Small impoundments with water retention and release capabilities will be created in natural swales in uplands. Water will be released from the top of water column so that sediment is retained. This practice will be applied where physical conditions or land ownership preclude treatment of a sediment source by the installation of erosion-control measures to keep soil and other material in place, or where a sediment basin offers the most practical solution to the problem. The criteria, plans and specifications, and operation and maintenance protocols of the following NRCS conservation practice standards will be employed:

- 342 Critical Area Planting (NRCS 2002)
- 350 Sediment Basin (NRCS 1978)
- 362 Diversion (NRCS 2001a)
- 410 Grade Stabilization Structure (NRCS 1985a)
- 683 Water and Sediment Control Basins (NRCS 1985)

Conservation Measure. In addition to the general conservation measures and those for construction activities described above, BPA proposes the following conservation measure for implementing erosion control practice:

- Implement these activities in combination with a riparian forest buffer (NRCS measure 391) (NRCS 2000e) wherever trees and/or shrubs can grow, or a riparian herbaceous cover (NRCS measure 390) (NRCS 1998) where analysis of available information (e.g., historical accounts, photographs, or USDA Plant Association Groups) indicates that no trees or shrubs, including willow (Salix spp.), existed on the site within historic times. Installation and management of the full range of field and landscape buffers will be encouraged by BPA as necessary to address small but unavoidable pollutant discharges associated with active agricultural operations, catastrophic pollution-associated episodic storm events, and other landscape level concerns.

1.2.8 Irrigation and Water Delivery/Management Actions

1.2.8.1 Convert Delivery System to Drip or Sprinkler Irrigation

Purpose. To increase the amount of in-stream flow for fish; to increase riparian functions.

Description. Flood or other inefficient irrigation systems will be converted to drip or sprinkler irrigation; education will be provided to irrigators on ways to make their systems more efficient. This proposed activity will involve the installation of pipe, possibly trenched and buried into the ground, and possibly pumps to pressurize the system. The criteria, plans and specifications, and operation and maintenance protocols of the NRCS conservation practice standards for Irrigation System, Sprinkler (NRCS 1987) will be employed.

Conservation Measure. In addition to the general conservation measures and those for construction activities described above, BPA proposes the following conservation measure for converting delivery systems to drip or sprinkler irrigation:

- None beyond the general and applicable construction measures (Sections 1.2.2 and 1.2.3, respectively).

1.2.8.2 Convert Water Conveyance from Open Ditch to Pipeline or Line Leaking Ditches and Canals

Purpose. To increase the amount of instream flow for fish; to increase riparian functions.

Description. Open ditch irrigation water conveyance systems will be replaced with pipelines to reduce evaporation and transpiration losses. Leaking irrigation ditches and canals will be converted to pipeline or lined with concrete, bentonite, or appropriate lining materials. The criteria, plans and specifications, and operation and maintenance protocols of the NRCS conservation practice standards for irrigation water conveyance dealing with galvanized steel ditch and canal lining (NRCS 1977); flexible membrane ditch and canal lining (NRCS, 1980), nonreinforced concrete ditch and canal lining (NRCS 1985b); aluminum tubing pipeline (NRCS 1988); asbestos-cement pipeline (NRCS 1988a); and high-pressure, underground, plastic pipeline (NRCS 1988b); will be employed.

Conservation Measure. In addition to the general conservation measures and those for construction activities described above, BPA proposes the following conservation measure for converting water conveyance from open ditch to pipeline or line leaking ditches and canals:

- None beyond the general and applicable construction measures (Sections 1.2.2 and 1.2.3, respectively).

1.2.8.3 Convert from Instream Diversions to Groundwater Wells for Primary Water Source

Purpose. To increase the amount of instream flow for fish; to increase riparian functions.

Description. Wells will be drilled as an alternative water source to surface water withdrawals. Water from the wells will be pumped into ponds or troughs for livestock, or used to irrigate agricultural fields. Instream diversion infrastructure will be removed or downsized, if feasible. The criteria, plans and specifications, and operation and maintenance protocols of the Natural Resources Conservation Service (NRCS) conservation practice standards for waterwell code (NRCS 1999c) will be employed.

Conservation Measure. In addition to the general conservation measures and those for construction activities described above, BPA proposes the following conservation measure for conversion from instream diversion to groundwater wells:

- All new wells installed under this activity will obtain applicable permits from the appropriate state agency (NMFS 2002).

1.2.8.4 Install New or Upgrade/Maintain Existing Fish Screens

Purpose. To reduce losses of juvenile fish and food organisms from entrainment into inadequately screened or unscreened diversions.

Description. Irrigation diversion intake and return points will be designed or replaced to prevent salmonids of all life stages from swimming or being entrained into the irrigation system. Intake pipes or discharges will be screened with mesh sizes small enough to prevent access to the withdrawal and outlet structures. Salmonids will be prevented from becoming entrained or impinged by improperly designed screens. Periodic maintenance of fish screens will be conducted to ensure their proper functioning, *e.g.,* cleaning debris buildup, and replacement of parts.

Conservation Measures. In addition to the general conservation measures and those for construction activities described above, BPA proposes the following conservation measures for installing new or upgrading/maintaining existing fish screens:

- All fish screening projects will be consistent with NOAA Fisheries' Juvenile Fish Screen Criteria (NMFS 1995b), and all intake screening projects will be consistent with NOAA Fisheries' Pump Intake Screen Guidelines[41] (NMFS 1996) (NMFS 2002).

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[41] NMFS (National Marine Fisheries Service), *Juvenile Fish Screen Criteria* (revised February 16, 1995) and *Addendum: Juvenile Fish Screen Criteria for Pump Intakes* (May 9, 1996) (guidelines and criteria for migrant fish passage facilities, and new pump intakes and existing inadequate pump intake screens) (http://www.nwr.noaa.gov/1hydrop/hydroweb/ferc.htm). NOTE: new criteria are currently being drafted by NOAA Fisheries (2002).

- All passage will be designed in accordance with NOAA Fisheries "Anadromous Salmonid Passage Facility Guidelines and Criteria" (NOAA Fisheries 2003), including the described interactive design process with NOAA Fisheries Engineering staff.
- All fish screens will be sized to match the owner's documented or estimated historic water use.
- Operation and maintenance of fish passage structures will be conducted in accordance with the operation and maintenance plan outlined on Form 1 in Appendix A.

1.2.8.5 Remove, Consolidate, or Improve Irrigation Diversion Dams

Purpose. To reduce the number of diversions (*e.g.,* push-up dams) on streams and thereby conserve water and improve habitat for fish; to improve the design of diversions to allow for fish passage and adequate screening; and/or to reduce the annual instream construction of push-up dams.

Description. Push-up dams will be replaced with permanent structures or pumping stations that improve fish passage and habitat. The installation of in-stream infiltration galleries is not included under this consultation at this time. Multiple diversions may be replaced with one permanent diversion or pumping station. Diversion dams will be removed or improved where they are barriers to fish passage, have created unacceptable habitat modifications, or are causing sediment concerns through deposition behind the dam or downstream scour. They will also be removed where they are abandoned, in need of repair, or are considered unnecessary to meet demand. Projects will be supported by watershed-based analyses with the involvement of multiple owners and users. Coordination with appropriate local governments, irrigation districts, and state and Federal agencies will be required. Periodic maintenance of irrigation diversions will be conducted to ensure their proper functioning, *e.g.,* cleaning debris buildup, and replacement of parts. Work will entail use of heavy equipment, power tools and/or crew.

Conservation Measures. In addition to the general conservation measures and those for construction activities described above, BPA proposes the following conservation measures for removing, consolidating, or replacing irrigation diversion dams:

- The design of the proposed irrigation diversion structure will enable the irrigators to comply with all appropriate state water right agency rules and regulations. No new or replacement diversion structure will be sized to exceed the amount of the irrigators' documented or estimated historic water use (NOAA Fisheries 2002a).
- Project design will include the installation of a totalizing flow meter device on all diversion structures for which installation of this device is possible (NOAA Fisheries 2002a).
- Diversion structures will be designed and screened to meet NOAA Fisheries' criteria[42] (NMFS 1995b, 1996 and "Anadromous Salmonid Passage Facility Guidelines and Criteria" NOAA Fisheries 2003), including the described interactive design process with NOAA Fisheries Engineering staff.

Operation and maintenance of irrigation diversion structures will be conducted in accordance with the operation and maintenance plan outlined on Form 1 in Appendix A

[42] ibid

1.2.8.6 Install or Replace Return Flow Cooling Systems

Purpose. To reduce temperatures of return flows from irrigation systems, and possibly to reduce in-stream temperatures in localized areas.

Description. Above ground pipes and open ditches that return tailwater from flood-irrigated fields back to the river will be replaced. Return flow cooling systems will be constructed by trenching and burying a network of perforated PVC pipes that will collect irrigation tailwater below ground, eliminating pools of standing water in the fields and exposure of the water to direct solar heating. No instream work is involved except for installing the drain pipe outfall; most work will be in uplands or in riparian buffer areas that are already plowed or grazed.

Conservation Measure. In addition to the general conservation measures and those for construction activities described above, BPA proposes the following conservation measure for installing or replacing return flow cooling systems:

- None beyond the general and applicable construction measures (Sections 1.2.2 and 1.2.3, respectively).

1.2.9 Native Plant Community Establishment and Protection

BPA's goal for native plant communities under BPA's Fish and Wildlife Program is to establish and protect self-sustaining communities that provide habitat for fish and wildlife and help control erosion and sedimentation. In order to reach this goal, it is necessary to plant new, native vegetation, as well as to manage existing vegetation, some of which may consist of noxious weeds. Federal or state law designates plant species that harm crops, livestock, public health, and/or property as noxious weeds. BPA and the project sponsors will work with local and state weed control districts and boards to control noxious weed infestations by preventing and eradicating new invaders, and by controlling established infestations. These entities each have their own lists of designated noxious weeds, which vary from location to location throughout the Columbia River Basin. Common noxious weeds being addressed by control programs include tansy ragwort, Canada thistle, yellow starthistle, leafy spurge, bull thistle, dalmatian toadflax, diffuse knapweed, gorse, scotch broom, and musk thistle. The proposed vegetation management activities may consist of one or a combination of approaches including vegetation planting, and physical and herbicidal methods to control noxious weeds.

BPA will use the following factors to determine the type of control method(s), and when and how often they will be applied: (1) Physical growth characteristics of target weeds (rhizomatous vs. tap-rooted, *etc.*); (2) seed longevity and germination; (3) infestation size; (4) relationship of the site to other infestations; (5) relationship of the site to listed and/or proposed species; (6) distance to surface water; (7) accessibility to site for equipment; (8) type and amount of use of the area by people; (9) effectiveness of treatment on the target weed; and (10) cost. Due to these various factors, one or several treatment methods may be needed in a given area.

For all treatment methods, repeat treatments may be needed for many years to eradicate or control the populations. Treatment may occur several times within a season or for many seasons for a maximum of five years. At a minimum, at the end of five years of treatments, BPA will assess the control methods to determine the effectiveness of controlling or eradicating the populations and whether treatments under this assessment would still be applicable.

BPA will use physical treatments to the extent practicable. However, vegetation management by physical means tends to be less effective and more costly than herbicidal methods for control of noxious weeds. Physical treatments have limited effectiveness because such methods often fail to remove noxious weed roots. Physical treatment of noxious weeds is costly and only feasible in small areas. Herbicidal controls are the less expensive than physical control methods, and more effective at controlling noxious weeds. In many instances, herbicidal controls are the only mechanisms to halt the spread of noxious weeds. Therefore, BPA needs to include herbicidal controls as one of its noxious weed management tools. The following sections detail the proposed action for native vegetation planting and for vegetation management by physical control and herbicide use.

1.2.9.1 Vegetation Planting

Purpose. To recover watershed processes and functions associated with native plant communities, such as thermal and microclimate regulation, hydrologic and nutrient cycling, channel formation and sediment storage, soil development and stability, flood energy dissipation and filtering; and to provide feeding, breeding, and sheltering habitat for native wildlife.

Description. Plant trees, shrubs, herbaceous plants, and aquatic macrophytes to help stabilize soils. A vegetation plan will be developed that is responsive to the biological and physical factors at the site. Plant large trees such as cottonwoods and conifers in areas where they historically occurred but are currently either scarce or absent. Obtain plants and seeds from local sources to ensure plants are adapted to local climate and soil chemistry.

Prepare planting sites by cutting, digging, grubbing roots, scalping sod, decompacting soil as needed, and removing existing vegetation. Place woody debris, wood chips, or soil at select locations to alter microsites. Plants will be fertilized, mulched, and stems wrapped to protect from rodent girdling. Buds will be capped to protect plants from herbivores. Work may entail use of heavy equipment, power tools, and/or hand crew.

Conservation Measure. In addition to the general conservation measure, BPA proposes the following conservation measure for vegetation planting:

- Vegetation plans will be prepared that: (1) Require the use of native species; (2) specify seed/plant source, seed/plant mixes, soil preparation, *etc.*, (NPS 2001); (3) include vegetation management strategies that are consistent with local native succession and disturbance regimes (USFWS 1999); (4) address the abiotic factors contributing to the sites' succession, *i.e.,* weather and disturbance patterns, nutrient cycling, and hydrologic condition; and (5) specify only certified noxious weed-free seed, hay, straw, mulch, or other vegetation material for site stability and revegetation projects.

1.2.9.2 Vegetation Management by Physical Control

Purpose. To control or eliminate non-native, invasive plant species that compete with or displace native plant communities, in order to maximize habitat processes and functions associated with native vegetation diversity, form, structure, and decomposition; recover watershed processes and functions associated with native plant communities, such as thermal and microclimate regulation, hydrologic and nutrient cycling, channel formation and sediment storage, soil development and stability, flood energy dissipation and filtering; and provide feeding, breeding, and sheltering habitat for native wildlife.

Description. BPA proposes to use the following two mechanisms for vegetation management by physical control:

- Manual. Manual control includes hand pulling and grubbing with hand tools; bagging plant residue for burning or other proper disposal; mulching with organic materials; shading or covering unwanted vegetation; controlling brush and pruning using hand and power tools such as chain saws and machetes; using grazing goats.
- Mechanical. Mechanical control includes techniques such as mowing, tilling, disking, or plowing. Cables and chains attached between vehicles may also be used to clear vegetation. Mechanical control may be carried out over large areas or be confined to smaller areas (known as scalping).

Conservation Measures. In addition to the general conservation measures, BPA proposes the following conservation measures for vegetation management by physical control:

- For mechanical control that will disturb the soil, an untreated or modified treatment area will be maintained within the immediate riparian buffer area to prevent any potential adverse effects to stream channel or water quality conditions. The width of the untreated riparian buffer area will vary depending on site-specific conditions and type of treatment (NMFS 2001g).
- Ground-disturbing mechanical activity will be restricted in established buffer zones (USDA 1997) adjacent to streams, lakes, ponds, wetlands and other identified sensitive habitats based on percent slope. For slopes less than 20%, a buffer width of 35 feet will be used. For slopes over 20% no ground-disturbing mechanical equipment will be used (BPA 2000).
- When possible, manual control (*e.g.,* hand pulling, grubbing, cutting) will be used in sensitive areas to avoid adverse effects to listed species or water quality (PNF 2001e).
- All noxious weed material will be disposal of in a manner that will prevent its spread. Noxious weeds that have developed seeds will be bagged and burned (PNF 2001e).

1.2.9.3 Vegetation Management by Herbicide Use

Purpose. To recover watershed processes and functions associated with native plant communities, such as thermal and microclimate regulation, hydrologic and nutrient cycling, channel formation and sediment storage, soil development and stability, flood energy dissipation and filtering; to control or eliminate non-native, invasive plant species that compete with or displace native plant communities, in order to maximize habitat processes and functions associated with native vegetation diversity, form, outputs, structure, and decomposition; and to provide feeding, breeding, and sheltering habitat for native wildlife.

Description. Apply herbicides in liquid or granular form through the use of wand or broom sprayers mounted on or towed by trucks, backpack equipment containing a pressurized container with an agitation device, injection, hand wicking cut surfaces, and ground application of granular formulas. Herbicides will be mixed with water as a carrier (no oil-based carriers will be used) and may also contain a variety of additives (see adjuvant paragraph below) to promote saturation and adherence, to stabilize, or to enhance chemical reactions.

During 2003, BPA sponsors plan to treat about 2880 acres of upland properties and about 975 acres of riparian properties. Of these, approximately 780 acres of upland properties and about 395 acres of riparian properties occur in watersheds with anadromous fish. Table 1-4 shows the BPA-funded project proposals for 2003 that would occur in watersheds with anadromous fish. These projects are mainly for noxious weed control of wildlife mitigation and management areas; however, some of the projects include reestablishment of native vegetation. A more detailed description of the proposed projects, including 6th field HUC locations, is attached in Appendix C.

For the Opinion, BPA proposes to use only the products evaluated in risk assessments by the US Forest Service (http://www.fs.fed.us/foresthealth/pesticide/risk). BPA addressed the use and effects of the proposed herbicides in its Final Transmission System Vegetation Management EIS (BPA 2000). BPA proposes the use of the following herbicides and adjuvants (see Table 1-5 and Table 1-6) for vegetation management:

- **2,4-D Amine Formulations -** 2,4-D amine is the most commonly used and most widely studied herbicide in the United States. It is labeled for a wide range of uses and is an active ingredient in many products offered for home use. 2,4-D acts as a growth-regulating hormone on broad leaf plants, being absorbed by leaves, stems and roots, and accumulating in a plant's growing tips. 2,4-D exhibits good control of most undesirable plants at application rates of 0.5 to 1.5 pounds per acre. Some hardier plants require repeat applications.

Table 1-4

BPA Funded Projects - FY 2003 Proposed Herbicide Application

Project Name and Location					Acres Proposed for Treatment		ESA Anadromous Fish ESUs[7] Potentially Affected
Title	Sponsor	Drainage	4th HUC	BPA No.	Upland	Riparian	
Northeast Oregon Wildlife Project	Nez Perce Tribe	Lower Grande Ronde	17060106	1996-080-00	185	6	1, 2, 3
Pine Creek Ranch	CTWSRO[3]	Upper John Day River	17070201	1998-022-00	95	10	7
Yakama Wetlands/Riparian Restoration Project	Yakama Nation	Lower Yakima River	17030003	1992-062-00	39		7
John Day Fish Habitat	ODFW[4]	John Day River	170702xx	1984-021-00		75	7
Umatilla River Basin Enhancement Project	CTUIR[5]	Umatilla River	17070103	1987-100-01	243	258	7
Walla Walla River Basin Enhancement Project	CTUIR[5]	Walla Walla River	17070102	1996-046-01	91	23	7
North Fork John Day Enhancement Project	CTUIR[5]	N. Fork John Day	17070202	2000-031-00	120		7
Tualatin River National Wildlife Refuge	USFWS[6]	Tualatin River	17090010	2000-016-00	6		11, 12
Burlington Bottoms Wildlife Mitigation Project	ODFW[4]	Lower Willamette River	17090012	1991-078-00		5	4, 5, 6
Umatilla Basin Fish Facilities	Westland Irrigation District	Umatilla River	17070103	1983-436-00		12	7
Yakima Phase II Screens (O&M)	WDFW	Yakima River	1703xxxx	1992-009-00		1	7
Burlingame Screens and Ladder	Gardena Irrigation District 13	Walla Walla River	17070102	1996-011-00		3	7
Total Acres					**780**	**395**	

[1] Washington State Department of Fish and Wildlife
[2] Idaho State Department of Fish and Game
[3] Confederated Tribes of the Warm Springs Reservation of Oregon
[4] Oregon Department of Fish and Wildlife
[5] Confederated Tribes of the Umatilla Indian Reservation
[6] USDOI-Fish and Wildlife Service
[7] * NOAA Fisheries Listed Fish ESU Key:

1 = Snake River chinook fall run	4 = Lower Columbia River chinook	7 = Middle Columbia River steelhead	10 = Snake River sockeye
2 = Snake River chinook spring/summer run	5 = Columbia River chum	8 = Upper Columbia River steelhead	11 = Upper Willamette River chinook
3 = Snake River Basin steelhead	6 = Lower Columbia River steelhead	9 = Upper Columbia River chinook spring run	12 = Upper Willamette River steelhead

- **Chlorsulfuron -** Chlorsulfuron is used for the control of broadleaf weeds and some annual grasses on noncrop lands. It is applied to young, actively growing weeds and works by preventing the production of an essential amino acid. This in turn inhibits cell division in root tips and shoots. The registered application rate is 0.25 to 3.0 ounces of active ingredient per acre.
- **Clopyralid -** Clopyralid is a relatively new and very selective herbicide. It is toxic to some members of only three plant families: the composites (Compositae), the legumes (Fabaceae), and the buckwheats (Polygonaceae). Clopyralid is very effective against knapweeds, hawkweeds and Canada thistle at applications rates of 0.10 to 0.375 pounds per acre. Its selectivity makes it an attractive alternate herbicide on sites with non-target species that are sensitive to other herbicides.
- **Dicamba -** Dicamba is used to control broadleaf weeds, brush and vines. Dicamba is absorbed by leaves and roots, and moves throughout the plant, although in some plants, it may accumulate in the tips of leaves. Dicamba acts as a growth regulator. Some plants can metabolize or break down dicamba. Dicamba can be applied by ground broadcast, band treatment, basal bark treatment, cut surface treatment, spot treatment, or wiper methods at use rates of 0.25 to 8 pounds per acre.
- **Glyphosate -** Glyphosate is a non-selective, broad-spectrum herbicide that is labeled for a wide variety of uses, including home use. It is absorbed by leaves and translocated throughout the plant, and disrupts the photosynthetic process. The herbicide affects a wide variety of plants, including grasses and many broadleaf species, and has the potential to eliminate desirable as well as undesirable vegetation. Some plant selectivity can be achieved by using a wick applicator to directly apply glyphosate to the target plant, thereby avoiding desirable vegetation.

  (For the purpose of this Opinion glyphosate is being proposed and analyzed as two distinct factory-formulated types. The first type (I) is glyphosate factory-formulated without an identified surfactant. The second type (II) is glyphosate factory-formulated with an identified or implied surfactant. The reason for this is due to the increased aquatic toxicity resulting from the surfactant formulation. See Appendix D for a current listing of Glyphosate product brands, selective characteristics, and types.)
- **Metsulfuron methyl -** Metsulfuron methyl is used for the control of brush and certain woody plants, annual and perennial broadleaf weeds, and annual grasses. Metsulfuron methyl is absorbed through the roots and foliage and inhibits cell division in the roots and shoots, so it should be applied before or during active growth periods at a rate of 0.33 to 2.0 ounces per acre.
- **Picloram -** Picloram is a restricted-use herbicide labeled for non-cropland forestry, rangeland, right-of-way and roadside weed control. The herbicide acts as a growth inhibitor and is used to control a variety of broadleaf weed species. It is absorbed through the leaves and roots, is easily translocated through the plant, and accumulates in new growth, causing leaves to cup and curl. Picloram is generally applied at rates of 0.25 to 0.50 pound per acre for non-rhizomatous weeds.

- **Sulfometuron methyl -** Sulfometuron methyl is a non-selective herbicide used primarily to control broadleaf weeds and grasses. Its primary use is for noxious weed control. Application rates for most plants range from 0.023 to 0.38 ounces per acre.
- **Triclopyr -** Triclopyr is found in two formulations. Triclopyr TEA, or the acid formulation labeled as Garlon 3A/Tahoe 3A, is being proposed in this consultation. Triclopyr BEE, or the ester formulation labeled as Garlon 4, will not be used. Triclopyr acts by mimicking the activity of auxin, a natural plant growth hormone. Backpack (selective) foliar, hack and squirt, basal stem, and boom spray or roadside hydraulic spraying are the most common methods for applying triclopyr. The typical application rate used is 1 lb active ingredient/acre, and few applications will exceed 2.5 lbs active ingredient/acre.
- **Herbicide Mixes -** Combinations of herbicides may be the most appropriate treatment where several species of noxious weeds occur together, where the herbicides affect weeds differently, or where herbicide resistance is occurring. For example, a mixture of picloram and 2,4-D, which are both broadleaf-selective herbicides, is used for many broadleaf weed species. 2,4-D generally has a shorter half-life compared to the more persistent picloram, and when used with picloram may provide more effective weed control than either chemical used alone. By itself, picloram is generally the most persistent of the herbicides described above and therefore requires fewer repeat applications, is more effective against many weed species, and when applied according to label specifications, is not likely to affect non-target plants. By comparison, glyphosate or 2,4-D labeled for use near water might be the only or most appropriate chemicals allowed in the treatment of weeds that occur largely in moist habitats or near water. In contrast, picloram may be used more often to treat weeds that typically occur in dry sites. Chemical treatment can also be used in conjunction with, or proceeding, non-chemical weed control treatments, depending on weed species composition, infestation level, and environmental setting.

Table 1-5. Herbicides Proposed for Use by BPA

Common Name	Trade Name	Typical Application Rates (ai/ac)	Maximum Label Application Rate (ai/ac)	General Geographic Application Areas	Aquatic Level of Concern (See Table F-2 in Appendix F)
2,4-D (amines)	Many	0.5-1.5 lb	4.0 lb	Upland and Riparian	Low[1]
Chlorsulfuron	Telar®	0.25-1.33 oz	3.0 oz	Upland	Low
Clopyralid	Transline®	0.1-0.375 lb	0.5 lb	Upland and Riparian	Low
Dicamba	Banvel®	0.25-7.0 lb	8.0 lb	Upland and Riparian	Moderate
Glyphosate 1 Glyphosate 2	Many Many	0.5-2.0 lb 0.5-2.0 lb	3.75 lb 3.75 lb	Upland and Riparian Upland	Low[1] Moderate
Metsulfuron methyl	Escort®	0.33-2.0 oz	4.0 oz	Upland	Low
Picloram	Tordon®	0.125-0.50 lb	1 lb	Upland	Moderate
Sulfometuron methyl	Oust®	0.023-0.38 oz	2.25 oz	Upland	Low
Triclopyr (TEA)	Garlon 3A®	1.0-2.5 lb	9.0 lb	Upland and Riparian	Low[1]

[1] USEPA Registered for aquatic use.

- **Adjuvants: Marker Colorants/Dyes, Surfactants, and Drift Retardants -** Spray additives can be included in formulated herbicides, or, can be added to the spray mixture to improve the effectiveness of the spray solution. Adjuvants are classified by their uses rather than their chemistry, although chemical properties determine their suitability for use with different herbicides. Adjuvants include surfactants, antifoaming agents, compatibility agents, crop oil or crop oil concentrates, activators, and drift retardants, and marker colorants/dyes. Adjuvants BPA proposes to use in this consultation are listed in Table 1-6. The use areas and amount of colorants, surfactants, and drift retardants will be in accord with Table 1-6. Dyes would usually be added to herbicides to identify areas that have been sprayed, to warn the general public, to regulate application rates, reduce drift, and reduce risk of spraying non-target species. The dyes proposed for use with herbicides are water-soluble, break down in sunlight and wash away easily with water. Surfactants are specialized additives, formulated to improve the emulsifying, spreading, sticking, and absorbing properties of herbicides to aid in uptake by the target plant. The type of surfactant used depends on the target plant, the selected herbicide, and environmental condition. Drift is primarily a function of droplet size and wind. Droplets with diameters of 100 microns (0.1 mm) or less contribute the bulk of the drift off site from the treated fields. Drift control adjuvants increase the viscosity and the "tensile" strength of water and decrease the proportion of smaller drops in a spray system. They will also increase the average drop size resulting in fewer drops per square inch of leaf surface, but it will still be the same rate of deposit of herbicide in pounds per acre.

Table 1-6. Adjuvants Proposed for Use by BPA

Type Adjuvant	Trade Name	Labeled Mixing Rates per Gallon of Application Mix	General Geographic Application Areas	Aquatic Level of Concern (See Table F-4 in Appendix F)
Colorants	Dynamark™ U.V. (red)	0.1 fl oz	Riparian	Low (Food Grade)
	Dynamark™ U.V. (yel)	0.1 fl oz	Riparian	Low (Food Grade)
	Dynamark™ U.V. (blu)	0.5 fl oz	Upland	Moderate (Non-Crop Use)
	Hi-Light® (blu)	0.5 fl oz	UpLand	Moderate (Non-Crop Use)
Surfactants	Activator 90®	0.16 – 0.64 fl oz	Upland	Moderate[1]
	Agri-Dex®	0.16 – 0.48 fl oz	Riparian	Low[1]
	Entry II®	0.16 – 0.64 fl oz	Upland	High
	Hasten®	0.16 – 0.48 fl oz	Riparian	Low[1,2]
	LI 700®	0.16 – 0.48 fl oz	Riparian	Moderate [1,2]
	R-11®	0.16 – 1.28 fl oz	Riparian	Moderate[1]
	Super Spread®	0.16 – 0.32 fl oz	Riparian	Low
	Syl-Tac®	0.16 – 0.48 fl oz	Upland	Moderate
	Generic POEA	Pre-formulated	Upland	High
Drift Retardants	41-A®	0.03 – 0.06 fl oz	Riparian	Low
	Valid®	0.16 fl oz	Upland	Moderate

[1] USEPA Registered for aquatic use in California.
[2] USEPA Registered for aquatic use in Washington.

Application Methods. Liquid or granular forms of herbicides would be applied either with machinery or by hand. Mechanized application would be done with vehicle-mounted (pick-up, 4-wheeler, or tractor) fixed-booms, or spray guns. Hand application methods to be used are: (1) Spot-spraying with hand-held spray nozzles either mounted on a vehicle or attached to a backpack system; (2) hand-spreading granular formulations; and (3) wicking, wiping, dripping, painting, or injecting target weeds. Except as described in Tables 1-7, 1-8, and 1-9, all application methods may be used for each herbicide and herbicide combination.

Conservation Measures. In addition to the general conservation measures described above in section 1.2.2, BPA proposes the following conservation measures for vegetation management by herbicide use: [Note: Water, waters, or surface water by definition, refers to perennial, intermittent, ephemeral stream channels, lakes, reservoirs, ponds, meadows, springs, seeps, bogs, and irrigation conveyances.]

General Herbicide Conservation Measures. The measures listed below are for terrestrial application of chemicals only, and are designed to prevent chemicals from entering any surface waters. *Aquatic application of chemicals is not covered under this Opinion*. Applicators will only use the herbicides and adjuvants as proposed in this Opinion as follows:

- BPA will use the following factors to determine whether to use herbicides instead of or in combination with other types of vegetation control method(s), and when and how often they will be applied: (1) Physical growth characteristics of target weeds (rhizomatous vs. tap-rooted, *etc.*); (2) seed longevity and germination; (3) infestation size; (4) relationship of the site to other infestations; (5) relationship of the site to listed and/or proposed species; (6) distance to surface water; (7) accessibility to site for equipment; (8) type and amount of use of the area by people; (9) effectiveness of treatment on the target weed; and (10) cost.
- Within the buffers identified in Tables 1-7, 1-8, and 1-9, applicators will time all vegetation management activities described in this Opinion to occur when aquatic ESA species are not likely to be present during spawning and/or sensitive life stages.
- Product label directions will be followed as required by the Federal Insecticide, Fungicide, and Rodenticide Act, including "mandatory" statements (such as registered uses, maximum use rates, application restrictions, worker safety standards, restricted entry intervals, environmental hazards, weather restrictions, and equipment cleaning) (BPA 2000).
- All product label "precautionary" statements such as environmental hazards, physical or chemical hazards, soil and climate application restrictions, wildlife warnings, and threatened and endangered species warnings will be followed (BPA 2000 [modified] and EPA Label Review Manual, 1995 as revised **http://www.epa.gov/oppfead1/labeling/lrm/**).
- Herbicides will only be applied by a licensed applicator (valid for the state where the work is located) and only in accordance with EPA labeling or the restrictions identified in the Opinion, whichever are more restrictive. Applicators will use the herbicide

specifically targeted for a particular weed species that will cause the least impact to non-target vegetation (BPA 2000).

- Applicators will keep records of each application, the active ingredient, formulation, application rate, date, time, location, etc. Records will be available to state and Federal inspectors, and will be supplied to applicable regulatory agencies and land managers as requested (*e.g.,* USDA Forest Service and Washington Department of Natural Resources) (BPA 2000).
- Applicators will also supply application information to BPA for the annual NOAA Fisheries reporting and monitoring requirements described in the Reporting, Monitoring, Evaluation, and Adaptive Management portion of this section.
- Applicators will never leave herbicides or equipment unattended in unrestricted access areas (BPA 2000).
- Only the minimum area necessary for the control of noxious weeds will be treated (NMFS 2002a).
- *Before application*, applicators will thoroughly review the site to identify and mark, if necessary, the buffer requirements (see Tables 1-7, 1-8, and 1-9) (BPA 2000). The most restrictive buffer for the conditions at the site will apply.
- Applicators will observe restricted entry intervals specified by the herbicide label (BPA 2000).
- No 2,4-D ester formulations of any kind will be used (NMFS 2002a).
- Only glyphosate that is factory-formulated *without* a surfactant will be used within 100 feet of any surface waters. See Appendix D for listing of acceptable glyphosate formulations.
- Tank mixing of surfactants or other additives to glyphosate without factory-formulated surfactants for use within 100 feet of any surface waters will be in strict accordance with all tables in this chapter.
- Only triclopyr TEA (acid) (Garlon 3A/Tahoe 3A) formulations of triclopyr will be used. No triclopyr BEE (ester) (Garlon 4) formulations of any kind will be used (NMFS 2002a).
- Only surfactants listed in Table 1-6 will be used for any project within the buffer specified in Tables 1-7, 1-8, and 1-9, specifically: only *surfactants registered and approved for aquatic use* as shown on Table 1-6 will used within 15 feet of any surface waters.
- No carrier other than water will be used for tank mixing (NMFS 2002a).

<u>Drift and Leach Reduction Conservation Measures.</u>

- Applicators will use drift reduction agents, as appropriate and as identified in this Opinion, to reduce the drift hazard when applying herbicides as broadcast or localized foliar treatments (BPA 2000).
- Colorants will be used to the extent practicable to ensure proper coverage and targeting.

- Herbicides/adjuvants with a groundwater or surface water label advisory will not be used within 100 feet of any surface water.
- For basal bark/stem and stump applications, applicators will directly spray the root collar area, sides of the stump, and/or the outer portion of the cut surface, including the cambium, until thoroughly wet, but not to the point of runoff, in order to avoid or minimize deposition to surrounding surfaces. A marker colorant/dye is recommended to establish coverage and prevent plant runoff.
- Treatment will be delayed if precipitation is forecasted to occur within 24 hours, except for pellet application. (NMFS 2002a).
- Weather Considerations/Restrictions - Tables 1-7, 1-8, and 1-9 identify BPA's proposed minimum weather and wind speed restrictions (to be used in the absence of more stringent label instructions and restrictions). During application, applicators will monitor weather conditions hourly at sites where spray methods are being used (BPA 2000, NMFS 2002a).

Mixing Conservation Measures.

- Applicators will prepare spray mixtures in accordance with the label(s) instructions and will not exceed the amount of herbicide per acre specified on the label (BPA 2000).
- Applicators will perform mixing at suitable locations with respect to buffer zones and recommended buffer widths (see Table 1-7 re: buffers) (BPA 2000).
- Except as indicated by Table 1-7, applicators will mix and load herbicides at least 100 feet from any surface waters and only in locations where accidental spills cannot flow into waters, or contaminate groundwater (BPA 2000, NMFS 2002a).

Spills and Misapplication Conservation Measures.

- Applicators will conduct regular testing on field calibration and calculations to prevent gross application errors (BPA 2000, NMFS 2002a).
- The applicator will develop a Spill Containment and Control Plan (SCCP) prior to herbicide application. The plan will contain notification procedures, specific clean up and disposal instructions for different products, quick response containment and clean up measures that will be available on site, proposed methods for disposal of spilled materials, and employee training for spill containment. All individuals involved, including any contracted applicators, will be instructed on the plan (NMFS 2002a).
- In addition to an applicator's SCCP, applicators will report spills and misapplications to EPA in accordance with the BPA's Government Agency Plan (GAP) (See Appendix E). Applicators will report spills and misapplications and clean up according to Federal and applicable state laws and regulations. At a minimum:
    - Notify BPA within 24 hours of any spill or misapplication;
    - Contain spill or leak, or halt misapplication;
    - Isolate area and request help as appropriate;

- As soon as possible, notify the owner of the land and any other potentially affected parties;
- Clean up the spill;
- Clean up equipment and vehicles;
- Dispose of cleanup materials properly, and;
- Follow up with appropriate cleanup documentation (BPA 2000).
- Upon notification of a spill or misapplication by an applicator, BPA will immediately notify the nearest NOAA Fisheries field office and provide copies of all subsequent relevant information generated from the event.

Handling Conservation Measures.

- During transportation, applicators will secure herbicide containers to prevent movement within the vehicle or loss from the vehicle during the operation of the vehicle (BPA 2000).
- When spray equipment is not being used, applicators will ensure that all valves and tank covers will be closed during any movement of the vehicle (BPA 2000).
- Applicators will firmly secure any portable tanks used for herbicide application to the frame of the vehicle (BPA 2000).

Storage of Herbicides, Containers, and Equipment Conservation Measures.

- Applicators will follow label requirements for storage (BPA 2000).
- Storage of herbicides will be in strict compliance with the relevant regulations of the State in which the herbicides are being stored.
- Applicators will inspect storage areas frequently for leakage and clean up spill areas immediately, (BPA 2000).
- Applicators will store only minimum amounts of chemicals at field and temporary locations, and will order out no more chemicals than necessary (BPA 2000).
- Applicators will dispose of unwanted or unusable products promptly and correctly (BPA 2000).
- In temporary storage locations, such as the field, applicators will store all chemicals in buildings or vehicles that can be locked up (BPA 2000) and no closer than 300 feet from any surface water.

Disposal Conservation Measures.

- Applicators will use water-soluble packaging (WSP) when available, to eliminate the need for container disposal (BPA 2000).
- Applicators will not burn paper and carton-type containers unless stated as permissible on the label (BPA 2000).
- Applicators will dispose of containers or cartons in one of three ways:

- Triple rinse containers of liquid herbicides before disposal. The rinse solution will be poured into the mix-tank and used for treatment. Each rinse solution will be equal to at least 10% of the container volume. Dispose of the empty containers as non-contaminated waste, at any legal landfill dump.
    - Use a rinsing nozzle (instead of triple rinsing). A rinsing nozzle has a sharp point that can puncture a plastic or metal empty herbicide container and flush the container's contents into the mix tank.
    - Return returnable "mini-bulk" type containers to the distributor for refill (BPA 2000).
- Applicators will observe the applicable buffers (see Table 1-7) when washing or rinsing spray tanks near waters (BPA 2000, NMFS 2002a).
- Applicators will dispose of unwanted or unusable herbicide products as contaminated waste at an approved waste facility (BPA 2000).
- Applicators will dispose of contaminated materials (including contaminated soil) resulting from cleanup procedures according to EPA directives (BPA 2000).
- Applicators will place any contaminated materials to be transported in watertight containers (BPA 2000).

Table 1-7. Conservation Buffers to Minimize Impacts on Non-Target Resources

Activity	Minimum Buffers for Non-Target Resources Needing Protection						
	Aquatic Species Spawning Seasons/Rearing Areas	Soils		Agricultural Resources			Other T&E Species Not Covered in this BA.
		Slopes >10% <20%	Slopes >20%	Food/Feed Crops	Grazing	Irrigation	
Chemical Application including mixing/loading/cleaning	Follow Timing and Distance Guidelines for instream work[1] where applicable, otherwise 300 ft.	NA	Do not apply any herbicide with a groundwater/surfacewater advisory. Do not apply any granulated herbicide.	Apply only chemicals in this Opinion labeled for crop use.	Observe all labeled grazing restrictions.	Do not apply unless dry and allowed by the label.	Requires NOAA/USFWS consultation.
Motorized Activities	Follow Timing and Distance Guidelines for instream work[1] where applicable, otherwise 300 ft	Do not enter within 35 feet of any surface water	Do not enter within 300 feet of any surface water	NA	NA	NA	Requires NOAA/USFWS consultation.
Manual Activities	Follow Timing and Distance Guidelines for instream work[1] where applicable, otherwise 100 ft	NA	NA	NA	NA	NA	Requires NOAA/USFWS consultation.

Activity	Minimum Buffers for Non-Target Resources Needing Protection						
	Water Resources[3]			Weather			
	Domestic/Public/Wildlife Drinking Water Well	Domestic/Public/Wildlife Drinking Drinking Water Intake/Spring	Sole Source Aquifers	Rain	Wind	Temperature[2] at >30% Humidity	
						Air	Soil
Chemical Application including mixing/loading/cleaning	50m (164 ft.) radius for any herbicide having a ground/surface water advisory* 15m (50 ft.) radius for any other herbicide	For slopes <10% 50-m (164- ft.) radius for any herbicide having a ground/surface water advisory* 15-m (50-ft.) radius for any other herbicide For Slopes >10% <30% 150-m (492-ft.) radius for any herbicide having a ground/surface water advisory* 50-m (164-ft.) radius for any other herbicide For slopes >30% 300-m (984-ft.) radius for any herbicide having a ground/surface water advisory* 100-m (328-ft.) radius for any other herbicide	As per local aquifer management plan	Do not apply if rain is likely to occur within 24 hours (does not apply to granular herbicides)	See Tables 2-6 and 2-7	<85ºF >50ºF	>32ºF <85ºF

[1] Contact appropriate state or federal agency for timing restrictions based on location – see footnote 12 for more detail.
[2] Represents optimum range when labels are lacking in specific instructions.
[3] BPA 2000

Table 1-8. Herbicide Buffer Widths to Minimize Impacts on Non-Target Resources

Herbicide	Broadcast Application[1]		Backpack Sprayer/Bottle[2] Spot Spray Foliar/Basal		Hand Application[3] Wicking/Wiping/Injection
	Minimum Buffer (ft)	Maximum/Minimum Wind Speed[4,5] (mph)	Minimum Buffer (ft)	Maximum/Minimum Wind Speed[4,5] (mph)	Minimum Buffer (Wind speed not a factor.)
2,4-D (amine)	100	10/2	15	5/2	Up to waters edge for aquatic labeled formulations
Chlorsulfuron	100	10/2	15	5/2	Up to high water mark[6]
Clopyralid	100	10/2	15	5/2	Up to high water mark[6]
Dicamba	100	10/2	15	5/2	Up to high water mark[6]
Glyphosate 1	100	10/2	15	5/2	Up to waters edge for aquatic labeled formulations
Glyphosate 2	100	10/2	100	5/2	100 feet
Metsulfuron			15	5/2	Up to high water mark[6]
Picloram	100	8/2	100	5/2	Do not use within 100 feet of any surface water
Sulfometuron	100	10/2	15	5/2	Up to high water mark[6]
Triclopyr (TEA) (acid)	100	10/2	15	5/2	Up to waters edge for aquatic labeled formulations
Herbicide Mixtures	100	10/2 for mixtures without picloram 8/2 for mixtures with picloram	15	5/2	The widest buffer listed above for the herbicides in the mixture

[1] Ground-based only broadcast application methods via truck/ATV with motorized low-pressure, high-volume sprayers using spray guns, broadcast nozzles, or booms.
[2] Spot and localized foliar and basal/stump applications using a hand-pump backpack sprayer or field-mixed or pre-mixed hand-operated spray bottle.
[3] Hand applications to a specific portion of the target plant using wicking, wiping or injection techniques. This technique implies that herbicides do not touch the soil during the application process.
[4] Unless more conservative wind speed restrictions are required by the product label.
[5] The maximum and minimum wind speeds are designed to reduce the likelihood of spray/dust drift. Winds of 2 mph or less are indicative of air inversions. The applicator must confirm (using smoke or equivalent) the absence of an inversion before proceeding with the application whenever the wind speed is 2 mph or less.
[6] Bank full or mean high tide mark.

Table 1-9. Adjuvant Buffer Widths to Minimize Impacts on Non-Target Resources

Adjuvant	Broadcast Application[1]		Backpack Sprayer/Bottle[2] Spot Spray Foliar/Basal		Hand Application[3] Wicking/Wiping/Injection
	Minimum Buffer (ft)	Maximum/Minimum Wind Speed[4,5] (mph)	Minimum Buffer (ft)	Maximum/Minimum Wind Speed[4,5] (mph)	Minimum Buffer (ft) (Wind speed not a factor.)
Dynamark (red)	100	Herbicide Dependent from Table 2-3	15	Herbicide Dependent from Table 2-3	Up to waters edge when using herbicides labeled for aquatic uses
Dynamark (yel)	100	Herbicide Dependent from Table 2-3	15	Herbicide Dependent from Table 2-3	Up to waters edge when using herbicides labeled for aquatic uses
Dynamark (blu)	100	Herbicide Dependent from Table 2-3	<50 >50	Do not use Herbicide Dependent from Table 2-3	<50 Do not use >50 Herbicide Dependent from Table 2-3
Hi-Light (blu)	100	Herbicide Dependent from Table 2-3	<50 >50	Do not use. Herbicide Dependent from Table 2-3	<50 Do not use >50 Herbicide Dependent from Table 2-3
Activator 90®	100	Herbicide Dependent from Table 2-3	15	Herbicide Dependent from Table 2-3	Up to waters edge for aquatic labeled formulations
Agri-Dex	100	Herbicide Dependent from Table 2-3	15	Herbicide Dependent from Table 2-3	Up to waters edge for aquatic labeled formulations
Entry II	100	Herbicide Dependent from Table 2-3	<100	Do not use	<100 Do not use
Hasten	100	Herbicide Dependent from Table 2-3	15	Herbicide Dependent from Table 2-3	Up to waters edge for aquatic labeled formulations
LI 700	100	Herbicide Dependent from Table 2-3	15	Herbicide Dependent from Table 2-3	Up to waters edge for aquatic labeled formulations
Preference®	100	Herbicide Dependent from Table 2-3	15	Herbicide Dependent from Table 2-3	Up to waters edge for aquatic labeled formulations
Super Spread	100	Herbicide Dependent from Table 2-3	15	Herbicide Dependent from Table 2-3	Up to waters edge for aquatic labeled formulations
Syl-Tac	100	Herbicide Dependent from Table 2-3	<50	Do not use	<50 Do not use
Unspecified POEA	100	Herbicide Dependent from Table 2-3	<100	Do not use	<100 Do not use
41-A	100	Herbicide Dependent from Table 2-3	15	Herbicide Dependent from Table 2-3	Up to waters edge when using herbicides labeled for aquatic uses
Valid	100	Herbicide Dependent from Table 2-3	50	Herbicide Dependent from Table 2-3	<50 Do not use

[1] Ground-based only broadcast application methods via truck/ATV with motorized low-pressure, high-volume sprayers using spray guns, broadcast nozzles, or booms.
[2] Spot and localized foliar and basal applications using a hand-pump backpack sprayer or field-mixed or pre-mixed hand-operated spray bottle.
[3] Hand applications to a specific portion of the target plant using wicking, wiping or injection techniques. This technique implies that herbicides do not touch the soil during the application process.
[4] Unless more conservative wind speed restrictions are required by the product label.
[5] The maximum and minimum wind speeds are designed to reduce the likelihood of spray/dust drift. Winds of 2 mph or less are indicative of air inversions. The applicator must confirm (using smoke or equivalent) the absence of an inversion before proceeding with the application whenever the wind speed is 2 mph or less.
[6] Bank full or mean high tide mark.

Herbicide Reporting Conservation Measures.

- For the 2002/2003 program years, BPA will prepare and deliver a summary of the previous year's activities on July 15, 2003. For subsequent years, the previous year's report will be prepared and delivered to NOAA Fisheries on March 1. Table 1-10 illustrates the proposed schedule.
- The summary of the previous year's activities will, at a minimum, include a table showing: (1) The drainage name/code and description; (2) 6th level hydrologic unit code; (3) upland acres treated; (4) riparian acres treated; (5) accomplished treatment (previous year); (6) proposed treatment (subsequent year); (7) herbicide product name (including mixtures); (8) active ingredient(s) (a.i.) and percent a.i.; (9) type and percent of each adjuvant used; (10) application rate; (11) application method(s); (12) date(s) of treatment; (13) treatment for noxious weeds only; (14) treatment for weed control plus restoration/revegetation; and (15) fish and wildlife species and life stages potentially affected. A copy of the table sent to project sponsors is attached in Appendix C, "BPA-Funded Projects FY2002/03 Herbicide Applications."
- BPA will also prepare an annual update report of the BA. The update will identify in separate sections: (1) any new literature findings brought to the attention of the BPA on the herbicides in use, indicating adverse effects (especially sub-lethal effects) of the use of the herbicides on listed fish or critical habitat; (2) a discussion of the ways adverse effects could be minimized further through modification of the proposed activity, or through additional activities; (3) a description of any changes in the environmental baseline; and (4) recommended remedies to address the problems identified through monitoring or literature findings.
- By October 1, 2003, and each subsequent year, BPA will present the proposed program for NOAA Fisheries approval of work for the upcoming year that includes the proposed sites, methods of treatment, and site specific information about baseline conditions of the proposed treatment areas (when available), adjustments to the program resulting from the monitoring results of the previous year, and planned monitoring (the 2003 proposed program is included in this Opinion in Table 1-4 and Appendix C). The program of work will be reported in the format described above and by the form in Appendix C along with a written report that will also include the upcoming year's proposed monitoring plan, as described below.

Table 1-10. Proposed Schedule of Reporting, Monitoring and Evaluation

For the Year	Reporting		Monitoring and Evaluation		
	Previous Year	Upcoming Year	Develop Plan	Interim Monitoring*	Full Monitoring
2003	July 15, 2003	May 15, 2003	X	X	
2004	March 1, 2004	October 1, 2003	X	X	
2005	March 1, 2005	October 1, 2004			X
2006	March 1, 2006	October 1, 2005			X
2007	March 1, 2007	October 1, 2006			X
2008	March 1, 2008	October 1, 2007			X
2009	March 1, 2009	October 1, 2008			X
2010	March 1, 2010	October 1, 2009			X

*Interim monitoring would consist of visual sampling coupled with applicable literature research relevant to biological and technological vegetative management methods and their potential effects on ESA and non-target species.

Herbicide Monitoring and Evaluation Conservation Measures.

- BPA will monitor and evaluate the effectiveness of the noxious weed/vegetation restoration program on both a site-specific treatment level and on a landscape level.

- Site-specific treatment level monitoring will involve assessing the effectiveness of the treatment agent or control method on a specific patch of noxious weeds. Follow-up treatments will occur as staffing and funding allow. Monitoring of physical, cultural, and chemical control methods will be conducted on randomly selected sites within one to two months of treatment through visual observation of target species' relative abundance/site dominance compared to pre-treatment conditions. Non-target plant mortality will also be monitored in riparian areas to determine if mortality of non-target plants is affecting riparian functions in NOAA Fisheries' Matrix of Pathways and Indicators (NMFS 1996a). Also during 2003/4, in consultation with NOAA Fisheries, BPA will develop a monitoring plan that includes the efforts described above plus a standardized sampling and analytical protocol for the purpose of monitoring potential herbicidal effects on applicable non-target resources as a result of atmospheric drift and deposition, and, lateral and/or vertical movement of the applied chemicals through water and soil. Subsequent results will be used in determining the continuation, modification, and/or termination of a particular weed control/vegetation restoration method. The target year for implementing such a plan would be 2005. Table 1-10 illustrates the proposal for both reporting and monitoring.

- Landscape level effectiveness monitoring will be accomplished through the Research, Monitoring and Evaluation (RME) Program being developed for the Federal Columbia River Power System (FCRPS) 2000 Biological Opinion (NOAA Fisheries and Action

Agencies 2003). While little detail can be provided at this point, the FCRPS RME, when finalized, will provide a consistent approach for the monitoring and evaluation of the processes currently underway for the protection and restoration of ESA species within the Columbia River basin.

Herbicide Adaptive Management Conservation Measures.

- The habitat improvement program is a long-term endeavor that includes control of noxious weeds, removal of unwanted vegetation, and revegetation where and when practicable. However, because there are areas of scientific and management uncertainty, management actions may require refinement or change over time as data from specific effectiveness monitoring is analyzed. With the likely development of new control methods and technology, changes in existing or use of new noxious weed treatments and/or vegetation restoration methods may be authorized and warranted. Any changes to the proposed action, as described in this Opinion, would be analyzed for impacts to listed/proposed species and critical habitat, and consultation would be reinitiated as appropriate.

1.2.10 Road Actions

1.2.10.1 Road Maintenance

Purpose. To eliminate or reduce erosion and mass-wasting hazards and thereby the sedimentation potential to down slope habitats; and to eliminate or reduce human access and use/disturbance associated impacts, such as: Timber theft, disturbance to wildlife, road density, poaching, illegal dumping of waste, erosion of soils, and sedimentation of aquatic habitats, particularly in sensitive areas such as riparian habitats or geologically unstable zones.

Description. In general, road maintenance will involve minor construction efforts, typically using a small work crew equipped with one or two vehicles. This category also addresses road maintenance activities using heavy equipment, including:

- Creating barriers to human access: gates, fences, boulders, logs, tank traps, vegetative buffers, and signs .
- Surface maintenance, such as building and compacting the road prism, grading, and spreading rock or surfacing material
- Drainage maintenance and repair of inboard ditch lines, water bars, sediment traps.
- Removing and hauling or stabilizing pre-existing cut and fill material or slide material.
- Snowplowing.
- Dust abatement.
- Relocating portions of roads and trails to less sensitive areas outside of riparian buffer areas.

Interrelated actions addressed elsewhere in this consultation are:

- Native Plant Community Establishment and Protection (see section 1.2.9)
- Bridge, Culvert, and Ford Maintenance, Removal, and Replacement (see section 1.2.10.2).

Exclusions. The proposed activity does not include new construction or relocation of any permanent road inside a riparian buffer area except for a bridge approach in accordance with Section 1.2.10.2, "Bridge, Culvert, and Ford Maintenance, Removal, and Replacement." The activity also does not include a new bridge pier or abutment below the bankfull elevation, a new bridge approach within the Federal Emergency Management Agency (FEMA) designated floodway that will require embankment fills that significantly impair floodplain function, or a baffled culvert or fishway. Extensive asphalt resurfacing (as opposed to localized asphalt patching) also is not included.

Conservation Measures. In addition to the general conservation measures and those for construction activities described above, BPA proposes the following conservation measures for road maintenance:

- Road maintenance will comply with ODOT (1999) practices or the most current version of the Regional Road Maintenance Endangered Species Act Program Guidelines.[43] (NOAA Fisheries 2003b)
- All fill-associated wood will be removed during sidecast removal (NMFS 2002).
- Waste material generated from road maintenance activities and slides will be disposed of in stable, non-floodplain sites approved by a geotechnical engineer or other qualified personnel (NMFS 2001g).
- Soil-disturbing maintenance activities will be conducted during dry conditions to the greatest extent practical. Road maintenance work in riparian areas will follow the appropriate state agency In-Water Work Timing guidelines, where relevant, except where the potential for greater damage to water quality and fish habitat exists if the emergency road maintenance is not performed as soon as possible (NMFS 2001g).
- Disturbance of existing vegetation in ditches and at stream crossings will be minimized to the greatest extent possible (NMFS 2001g).
- Ditches and culverts will be promptly cleaned of materials resulting from slides or other debris (NMFS 1999c).
- Dust-abatement additives and stabilization chemicals (typically magnesium chloride or calcium chloride salts) will not be applied within 25 feet of water or a stream channel and

[43] Oregon Department of Transportation, *Routine Road Maintenance: Water Quality and Habitat Guide, Best Management Practices*, 21 pp. + appendices (July 1999) (providing guidance on routine road maintenance activity only) (http://www.odot.state.or.us/eshtm/images/4dman.pdf) or, see, Regional Road Maintenance Endangered Species Act Program Guidelines (March 2002) (http://www.metrokc.gov/roadcon/bmp/pdfguide.htm)

will be applied so as to minimize the likelihood that they will enter streams. Application will be avoided during or just before wet weather and at stream crossings or other locations that could result in direct delivery to a waterbody (typically within 25 feet of a waterbody or stream channel). Spill containment equipment will be available during chemical dust abatement application (NMFS 2001g).

- Berms will not be left along the outside edge of roads, unless an outside berm was specifically designed to be a part of the road, and low-energy drainage is provided (PNF 2001, PNF 2001a-e).
- Roads will be graded and shaped to conserve existing surface material. Road grading and shaping will maintain, not destroy, the designed drainage of the road, unless modification is necessary to improve drainage problems that were not anticipated during the design phase (PNF 2001, PNF 2001a-e).
- Ditch back slopes will not be undercut to avoid slope destabilization and erosion acceleration (PNF 2001, PNF 2001a-e).
- When blading and shaping roads, excess material will not be side cast onto the fill. All excess material that cannot be bladed into the surface will be end hauled to an appropriate site. End haul and prohibition of side casting will not be required for organic material like trees, needles, branches, and clean sod; however, fine organics like sod and grass will not be cast into water. Slides and rock failures including fine material of more than approximately ½ yard at one site will be hauled to disposal sites. Fine materials (1-inch minus) from slides, ditch maintenance, or blading may be worked into the road. Scattered clean rocks (1-inch plus) may be raked or bladed off the road except within 300 feet of perennial or 100feet of intermittent streams (PNF 2001, PNF 2001a-e).
- Road grading material will not be side cast along roads within one-quarter mile of perennial streams and from roads onto fill slopes having a slope greater than 45% (PNF 2001, PNF 2001a-e).
- Road maintenance will not be attempted when surface material is saturated with water and erosion problems could result (PNF 2001, PNF 2001a-e).
- Large woody debris (LWD > 9 m in length and >50 cm in diameter) present on roads will be moved intact to down slope of the road, subject to site-specific considerations. Movement down-slope will be subject to the guidance of a fisheries biologist (PNF 2001, PNF 2001a-e).
- Unsurfaced roads will be managed to avoid delivery of sediment to streams (*e.g.,* closing during the wet season, surfacing, adding drainage). See http://www.dnr.wa.gov/forestpractices/board/manual/ for guidance.
- Water drafting/pumping (for dust suppression or other needs) will maintain a continuous surface flow of the stream, without altering the original wetted width. Pumping will follow the NOAA Fisheries guidelines for screening pump intakes (NMFS 1996). No dams or channel alterations will be made for pumping in streams occupied by listed fish species (USDI/USDA 2002).

1.2.10.2 Bridge, Culvert, and Ford Maintenance, Removal, and Replacement

Purpose. To improve fish passage, prevent streambank and roadbed erosion, facilitate natural sediment and wood movement, and eliminate or reduce excess sediment loading and dynamic changes in stream flow that cause streambank erosion, undermining of roadbeds, and the washout of culverts.

Description. BPA proposes the following bridge, culvert, and ford activities:

- Culvert removal, where possible, and natural channel cross section reestablishment.
- Replacement of undersized culverts that present a barrier to fish movement with appropriately sized culverts or bridges.
- Lowering of perched culverts to meet the natural bed of the stream.
- Excavation and realignment of misaligned culverts.
- Modification of culverts by means such as installing step-and-pool weirs at culvert outlets, trash/debris racks, or erosion protection structures at culvert outlets or inlets where replacement or lowering is not feasible.
- Redesign of stream crossings determined to be inappropriate for culvert installations to steel/concrete reinforced bridge installations or fords.
- Removal or lowering of artificial structures that impede fish passage.
- Repair, upgrade or replacement of bridges and culverts, except that bridge replacements will be full-span, *i.e.,* no bents, piers, or other support structures below bankfull elevation.

New or replacement culverts and bridges will be designed using an interdisciplinary stream simulation approach involving team members with skills in engineering, hydrology/fluvial geomorphology, and fisheries biology. Culverts and bridges will be designed mimic the natural stream processes and allow for fish passage, sediment transport, and flood and debris conveyance. Culvert installations will be designed to avoid upstream headcutting.

These proposed activities will entail use of heavy equipment, power tools, and/or crews. Restoring fish passage at existing culvert crossing sites implies that road access is available and that the need for new road construction and the associated impacts can be largely avoided. In the case of large fills, or dependent on the engineered solution, some constructed road access may be required to gain access to the culvert structure itself (NMFS 2002).

Exclusions. The following types of bridge and culvert maintenance removal and replacement are not included under this Opinion:

- Culverts with widths less than bankfull width.
- Culverts with widths less than 6 feet in fish-bearing streams.
- Embedded culverts in a slope greater than 6%.
- Modifying an existing culvert in place.

- A new or replacement bridge pier or abutment below the bankfull elevation, or in an active channel migration zone.[44]
- A new bridge approach within the Federal Emergency Management Agency (FEMA) designated floodway that will require embankment fills that significantly impair floodplain function.
- A baffled culvert or fishway.

Conservation Measures. In addition to the general conservation measures and those for construction activities described above, BPA proposes the following conservation measures for bridge and culvert maintenance, removal, and replacement:

- All fish passage will be designed in accordance with NOAA Fisheries "Anadromous Salmonid Passage Facility Guidelines and Criteria" (NOAA Fisheries 2003), including the described interactive design process with NOAA Fisheries Engineering staff.
- Design permanent stream crossings in the following priority[45](NOAA Fisheries 2003b). Explain why a particular design was chosen.
  1. Nothing –realign road to avoid crossing the stream
  2. Bridge – new bridges will span the stream to allow for long-term dynamic channel stability, *i.e.,* no bents, piers or other support structures below bankfull elevation.
  3. Streambed simulation – bottomless arch, embedded culvert, or ford.
  4. No-slope design culvert[46]– limit new culverts to 0% slopes.
     - New culvert widths will meet or exceed bankfull width.
     - To provide for upstream passage of juvenile salmonids, the maximum average water velocity[47] will not exceed 1 foot per second.

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[44] "Bankfull elevation" means the bank height inundated by an approximately 1.2 to 1.5 year (maximum) average recurrence interval and may be estimated by morphological features such as the following: (1) A topographic break from vertical bank to flat floodplain; (2) a topographic break from steep slope to gentle slope; (3) a change in vegetation from bare to grass, moss to grass, grass to sage, grass to trees, or from no trees to trees; (4) a textural change of depositional sediment; (5) the elevation below which no fine debris (e.g., needles, leaves, cones, seeds) occurs; and (6) a textural change of matrix material between cobbles or rocks (Castro and Jackson, 2001). "Channel migration zone" means the area defined by the lateral extent of likely movement along a stream reach where there is evidence of active stream channel movement over the past 100 years, e.g., alluvial fans or floodplains formed where the channel gradient decreases, the valley abruptly widens, or at the confluence of larger streams.

[45] For a discussion of crossing design types, see, National Marine Fisheries Service, Southwest Region, *Guidelines for Salmonid Passage at Stream Crossings* (September 2001) (http://swr.nmfs.noaa.gov/hcd/NMFSSCG.pdf) and Washington Department of Fish and Wildlife, *Fish Passage Design at Road Culverts: A Design Manual for Fish Passage at Road Crossings* (March 3, 1999) (http://www.wa.gov/wdfw/hab/engineer/cm/toc.htm).

[46] "No-slope design culvert" means a culvert that is sufficiently large and installed flat to allow the natural movement of bedload to form a stable bed inside the culvert. See, WDFW (Washington Department of Fish and Wildlife), *Design of Road culverts for Fish Passage* (2003)
http://www.wa.gov/wdfw/hab/engineer/cm/

[47] "Maximum average water velocity" means the average of water velocity within the barrel of the culvert calculated using the 10% annual exceedance of the daily average flow.

    - Include suitable grade controls to prevent culvert failure caused by changes in stream elevation.
- If the crossing will occur near an active spawning area, only full-span bridges or streambed simulation will be used (NOAA Fisheries 2003b).
- Limit fill width to the minimum necessary to complete the crossing, and do not reduce existing stream width (NOAA Fisheries 2003b).
- Clean culverts by working from the top of the bank, unless culvert access using work area isolation would result in less habitat disturbance. Remove only the minimum amount of wood, sediment and other natural debris necessary to maintain culvert function without disturbing spawning gravel (NOAA Fisheries 2003b.
    - Place all large wood, cobbles, and gravels recovered during cleaning downstream of the culvert.
    - Do all routine work in the dry, using work area isolation if necessary.
- Culverts or bridge abutments will not be filled with vegetation, debris, or mud. Abutments will be properly protected (e.g., rock armored) to prevent future scouring actions and erosion hazards (NMFS 2002).
- Maintenance schedules will be developed for culvert installations to ensure the culverts remain in proper functioning condition (NMFS 2002).

1.2.10.3 Road Decommissioning

Purpose. To eliminate or reduce erosion and mass-wasting hazards and thereby their sedimentation hazards to down-slope habitats; to reduce the impact of roads on the hydrology of watersheds; to eliminate or reduce human access and use/disturbance associated impacts, such as: timber theft, disturbance to wildlife, road density, poaching, illegal dumping of waste, erosion of soils, and sedimentation of aquatic habitats, particularly in sensitive areas such as riparian habitats or geologically unstable zones.

Description. BPA proposes to decommission and obliterate roads that are no longer needed, *e.g.,* logging roads. Water bars will be installed, road surfaces will be insloped or outsloped, asphalt and gravel will be removed from road surfaces, culverts and bridges will be altered or removed, streambanks will be recontoured at stream crossings, cross drains installed, fill or sidecast will be removed, road prism reshaped, sediment catch basins created, all surfaces will be revegetated to reduce surface erosion of bare soils, surface drainage patterns will be recreated, and dissipaters, chutes or rock will be placed at remaining culvert outlets.

Conservation Measures. In addition to the general conservation measures and those for construction activities described above, BPA proposes the following conservation measures for road decommissioning:

- All fill-associated wood will be removed during sidecast removal (NMFS 2002).
- A fisheries biologist and/or hydrologist will be involved in the design and implementation of each road decommissioning project (NMFS 2000b).

- Slide and waste material will be disposed in stable, non-floodplain sites. Disposal of slide and waste material within the existing road prism or on adjacent hillslopes will be allowed to restore natural or near-natural contours, if approved by a geotechnical engineer or other qualified personnel (NMFS 2000b).
- Disturbance of existing vegetation in ditches and at stream crossings will be minimized to the extent necessary to restore hydrologic functions (NMFS 2000b).
- Culvert removal will be designed to restore the natural drainage pattern (NMFS 1999a).

1.2.11 Special Actions

1.2.11.1 Install/Develop Wildlife Structures

Purpose. To enhance terrestrial habitats until native plant communities or other natural habitat features become established; to augment, not replace, natural habitat features and processes

Description. This activity involves the installation or development of a variety of structures that mimic natural features and provide support for wildlife foraging, breeding, and or resting/refuge. These can include bat roosting/breeding structures, avian nest boxes, hardwood snags, brush/cover piles, coarse woody debris, and raptor perches. Work may entail use of power tools and/or crew.

Conservation Measures. Because no adverse effects are anticipated from this activity, BPA does not propose any conservation measures.

1.2.12 Applicable Federal, Tribal, and State Regulations and Permits

Federal, Tribal, and state regulations and permits may apply to many activities proposed in this consultation. Section 1.3 includes a discussion of commonly required regulations, permits, and approvals for activities addressed in this Opinion. Impact avoidance measures for aquatic resources are often part of such permits and approvals. For activities proposed in this consultation, impact avoidance measures associated with permits and approvals will be implemented at the time of the action as applicable. These measures are therefore part of the proposed action. This discussion is not exhaustive, and project proponents will need to contact local offices of Federal, Tribal, state, and local agencies and obtain all required permits approvals are obtained.

1.2.12.1 Federal Regulations

Clean Water Act (CWA)

The primary purpose of the CWA is to help protect the nation's water resources, including wetland, river, estuarine, and marine habitats, from being polluted, filled, developed, or otherwise negatively impacted. Section 401 of the CWA requires water quality certification from the applicable state agency for a Federal license or permit to conduct any activity that may result in a discharge into surface waters. This includes erosion and sedimentation from construction activities. The state in which the discharge will originate provides the Federal agency granting the permit or license a certification that the discharge complies with the requirements of the CWA and state water quality standards. Section 401 allows states to waive a certification, deny the certification, grant the certification, or grant the certification with conditions. If a state denies a certification, the Federal agency cannot issue the Federal license or permit. Pursuant to Section 401(d), a certification may include any limitations and monitoring requirements necessary to ensure that the applicant for the Federal permit will comply with applicable sections of the CWA and state water quality standards. Any such conditions become a condition on the Federal license or permit. EPA has delegated the Section 401 water quality certification process to the Department of Ecology in Washington, the Department of Environmental Quality in Oregon, and the Division of Environmental Quality in Idaho.

Section 404 of the CWA requires a permit from the U.S. Army Corps of Engineers (COE) to place fill in waters of the United States, including adjacent wetlands. Permit conditions may require: (1) Avoidance of impact; (2) minimization and/or restoration of impact; and (3) if the impact is not adequately avoided, compensatory replacement. Three to five years of monitoring is generally required to ensure compliance with identified performance standards in a compensatory mitigation plan.

Proposed activities to which the CWA may apply:

- All small-scale instream habitat actions
- Installation of off-channel watering facilities
- Hardening fords for livestock crossings of streams
- Construction of retention/detention basins
- Converting from instream diversions to groundwater wells for primary water source
- Installing new or upgrade/maintain existing fish screens
- Removing, consolidating, or improving irrigation diversion dams
- Installing or replacing return flow cooling systems
- Bridge, culvert, and ford maintenance, removal or replacement

Coastal Zone Management Act (CZMA)

The CZMA encourages states to preserve, protect, develop, and, where possible, restore or enhance valuable natural coastal resources such as wetlands, floodplains, estuaries, beaches, dunes, and barrier islands, as well as the fish and wildlife using those habitats. CZMA participation by states is voluntary. To encourage states to participate, the act makes Federal financial assistance available to any coastal state or territory that is willing to develop and implement a comprehensive coastal management program. The U.S. Department of Commerce, Office of Coastal Zone Management, certifies each state’s coastal zone management program. Under law, states with approved plans have the right to review Federal activities (including private activities that require Federal permits) to determine whether they are consistent with the policies of the state's coastal zone management program. Federal actions must consistent to "the maximum extent practicable" with state programs approved under the CZMA.

In the State of Oregon, the Department of Land Conservation and Development is the state's designated coastal management agency responsible for reviewing projects for consistency with the Oregon Ocean-Coastal Management Program and issuing coastal management decisions. In the State of Washington, the Department of Ecology's Shorelands and Environmental Assistance Program is responsible for implementing Washington's Coastal Zone Management Program. The CZMA does not apply to the state of Idaho.

Proposed activities to which CZMA may apply:

- All small scale instream habitat action
- Hardening fords for livestock crossings of streams
- Converting from instream diversions to groundwater wells for primary water source
- Installing new or upgrade/maintain existing fish screens
- Removing, consolidating, or improving irrigation diversion dams
- Installing or replacing return flow cooling systems
- Bridge, culvert, and ford maintenance, removal or replacement

Rivers and Harbors Act of 1899, Section 10

Section 10 of the Rivers and Harbors Act (RHA) authorizes the U.S. Army Corps of Engineers to regulate the construction of any structure or work within navigable waters of the United States. Activities include the construction of such diverse activities as: (1) Breakwaters or jetties; (2) bank protection or stabilization projects; (3) permanent mooring structures or marinas; (4) intake or outfall pipes; canals; (5) boat ramps; and (6) any other modifications affecting the course, location, condition, or capacity of navigable waters. The RHA restricts U.S. Army Corps of Engineers jurisdiction to "navigable waters," or waters subject to the ebb and flow of the tide shoreward to the mean high water mark that may be used to transport interstate or foreign commerce. The definition of navigable waters under RHA is substantially more limited than the definition under Section 404 of the Clean Water Act, which extends to inland wetlands. Permit conditions require impact avoidance and conservation measures similar to those discussed above for the CWA. It is unlikely this law would apply to HIP actions unless work is conducted in a large river.

Proposed activities to which the RHA Section 10 may apply:

- All small scale instream habitat actions
- Installing new or upgrade/maintain existing fish screens
- Removing, consolidating, or improving irrigation diversion dams
- Bridge, culvert, and ford maintenance, removal or replacement

National Environmental Policy Act (NEPA)

All Federal agencies are required to comply with NEPA for Federally-funded, authorized or implemented activities. The law is intended to promote efforts to prevent or eliminate damage to the environment, and to promote understanding of the ecological systems and natural resources of the nation. Compliance requires that a document be prepared that assesses the potential impacts of an action. For activities addressed under this consultation, BPA has prepared a Programmatic Environmental Impact Statement (EIS). BPA requires project sponsors to prepare a detailed checklist, available from BPA, which addresses the site-specific impacts and issues associated with a project. BPA staff review the checklist and determine whether the project can be covered under the Programmatic EIS, or whether individual environmental documentation is required.

Proposed activities to which NEPA may apply:

- All activities proposed in this consultation.

Resource Conservation and Recovery Act (RCRA)

RCRA gives the Environmental Protection Agency (EPA) the authority to control hazardous waste from "cradle-to-grave," including the generation, transportation, treatment, storage, and disposal of hazardous waste. RCRA also sets forth a framework for the management of non-hazardous wastes. The 1986 amendments to RCRA enabled EPA to address environmental problems that could result from underground tanks storing petroleum and other hazardous substances. RCRA focuses only on active and future facilities and does not address abandoned or historical sites (which are regulated under the Comprehensive Environmental Response, Compensation, and Liability Act or Superfund).

In accordance with RCRA, BPA requires that actions that will disturb soil be reviewed through an environmental land audit to determine whether or not hazardous wastes are present or may be present prior to commencement of work. If hazardous wastes are suspected, sampling and further investigation may be required. BPA may elect not to fund projects that involve hazardous wastes generated through historic actions due to the liability issues.

Proposed activities to which RCRA may apply:

- Any activity proposed in this consultation where hazardous waste is generated (*e.g.,* herbicides or other chemicals) or may be disturbed through movement of soil during construction.

1.2.12.2 Tribal Regulations

Each Indian tribe has laws and regulations that parallel many Federal, state, and local laws and ordinances, but also have provisions that are unique to the individual Indian tribes. These laws and regulations apply only to actions occurring on the respective Indian tribes' reservation lands.

Proposed activities to which Tribal regulations may apply:

- All activities proposed in this consultation that occur on Tribal lands.

1.2.12.3 State of Washington Laws and Regulations

State Environmental Policy Act (SEPA) - Chapter 43.21C RCW

SEPA requires Washington governmental agencies to give proper consideration of environmental matters in making decisions on actions that may affect the environment. Actions include new and continuing activities (including projects and programs) entirely or partly financed, assisted, conducted, regulated, licensed, or approved by agencies. Certain actions are exempt from SEPA because they are of the size or type to be unlikely to cause a significant adverse environmental impact. In accordance with SEPA, the environmental consequences of a proposal are evaluated by a lead agency to determine whether the proposal is likely to have any "significant adverse environmental impact." The determination made by the lead agency is documented in either a determination of nonsignificance (DNS), or a determination of significance (DS) and subsequent preparation of an environmental impact statement (EIS). A mitigated DNS contains mitigation actions or conditions that reduce likely significant adverse environmental impacts to a nonsignificant level. Impact avoidance measures for potential significant adverse impacts on fish and wildlife and their habitats are part of an EIS and a mitigated DNS under SEPA. In many cases, NEPA and SEPA regulations can be covered in a combined process, or a state agency can adopt a NEPA document or vice versa.

Proposed activities to which SEPA may apply (any action that requires a state or local authorization or permit in Washington):

- Fee-title or easement acquisition, cooperative agreements, and/or leasing of land and/or water
- All small scale instream habitat actions
- Installation of off-channel watering facilities
- Hardening fords for livestock crossings of streams
- Construction of retention/detention basins
- All irrigation and water delivery/management actions
- All road actions

Shorelines Management Act (SMA) - Chapter 90.58 RCW

The Washington Shorelines Management Act applies throughout the state, to all marine waters, submerged tidelands, lakes over 20 acres, and all streams with a mean annual flow greater than 20 cubic feet per second. The SMA also includes marshes, bogs, and swamps associated with the lakes, streams, and marine waters, and a 200-foot wide shoreline area landward from the water's edge. The primary intent of the SMA is to protect the quality of water and the environment and to preserve and enhance public access to shorelines.

SMA regulates activities through local shoreline master programs. Master programs are based on state guidelines but tailored to the specific needs of the local community. Local governments write these programs with policy guidance from the Department of Ecology (DOE). Each local master program is a combined planning and regulatory document that includes goals, objectives, and policy statements, combined with specific land use regulations. Each local government has established a system of permitting for shoreline development. Substantial Development permits are required for projects costing over $2,500, or those that materially interfere with the public's use of the waters. Local governments may also issue Conditional Use or Variance permits to allow flexibility and give consideration to special circumstances. DOE reviews all local government permits and decisions.

Proposed activities to which SMA may apply:

- All small scale instream habitat activities
- Installation of off-channel watering facilities
- Hardening fords for livestock crossings of streams
- Installing new or upgrade/maintain existing fish screens
- Removing, consolidating, or improving irrigation diversion dams
- Installing or replacing return flow cooling systems
- All native plant community protection and establishment actions
- Bridge, culvert, and ford maintenance, removal or replacement

Hydraulic Project Approvals (HPA) – Chapter 75.20 RCW

Any form of work that uses, diverts, obstructs, or changes the natural flow or bed of any fresh water or saltwater of the state requires a hydraulic project approval from the Washington Department of Fish and Wildlife. A complete application package for an HPA must include a completed Joint Aquatic Resource Permit Application (JARPA) form, general plans for the overall project, and complete plans and specifications of the proposed work within fresh or saltwater of the state. The application also needs to include complete plans and specifications for the protection of fish life.

Proposed activities to which the Hydraulic Project Approval may apply:

- All small scale instream habitat actions
- Installation of off-channel watering facilities
- Hardening fords for livestock crossings of streams
- Converting from instream diversions to groundwater wells for primary water source
- Installing new or upgrade/maintain existing fish screens
- Removing, consolidating, or improving irrigation diversion dams
- Installing or replacing return flow cooling systems
- Bridge, culvert, and ford maintenance, removal or replacement

Washington Pesticide Application Act - Chapter 17.21 RCW

The Washington Pesticide Application Act authorizes the Department of Agriculture (WSDA) to regulate pesticide application and use, formulation, distribution, storage, and disposal. The law requires individuals involved in the pesticide industry to obtain at least one of nine different pesticide licenses issued by the WSDA. Licensees may only perform the technical activities (agricultural weed control, aquatic weed control, structural pest control, etc.) for which they have been certified. A person becomes certified by passing the exam(s) required by WSDA. The Department of Ecology will require a permit (Water Quality Modification) before pesticides are used in or near water. Some cities and counties also have special requirements related to pesticide use in sensitive areas (wetlands, surface waters, groundwater recharge areas, etc.).

Proposed activities to which this chapter may apply:

- Vegetation management by herbicide use

Water Pollution - Chapter 90.48 RCW

The state's surface water quality standards set limits on pollution in lakes, rivers and marine waters in order to protect water quality. The Clean Water Act requires that the water quality standards protect beneficial uses, such as swimming, fishing, aquatic life habitat, and agricultural and drinking water supplies. The Water Pollution regulation requires a Short-Term Modification of Water Quality Standards permit from Washington Department of Ecology for projects that change turbidity, pH, and other parameters that do not meet state standards, as well as the use of aquatic herbicides or pesticides, including herbicides used to control noxious and non-noxious aquatic plants (RCW 90.48.445) and for fishery enhancement projects that involve the use of rotenone. A Short-Term Modification of Water Quality Standards permit cannot be issued if the proposed action interferes with, or becomes injurious to, existing water uses or causes long-term harm to the environment. A Short-Term Modification of Water Quality Standards permit would only apply to activities addressed in this Opinion when an HPA from Washington DOE is not required (Jeff Lewis, WA DOE, personal communication 12/02/02).

Proposed activities to which the Water Pollution regulation may apply:

- Vegetation management by herbicide use

Dam Safety Construction Permit - Chapters 90.03 and 43.21a RCW

Chapters 90.03 and 43.21a RCW requires a Dam Safety Construction Permit be issued before constructing, modifying, or repairing any dam or controlling works for storage of 10 or more acre-feet of water, liquid waste, or mine tailings. This requirement may apply to dams and storage lagoons for: (1) Flood control; (2) domestic or irrigation water; (3) domestic, industrial, or agricultural wastes (including animal waste); and (4) mine tailings. The applicant must submit plans and specifications prepared by a qualified professional engineer and carrying the engineer's signature and seal to the Washington Department of Ecology for review and approval. The Washington Department of Ecology also inspects the construction of all dams to reasonably secure safety of life and property.

Proposed activities to which Dam Safety Construction Permit may apply:

- Constructing retention/detention basins
- Removing, consolidating, or improving irrigation diversion dams

Water Right Permit/Certificate – Chapters 18.104; 43.27A; 90.03; 90.14; 90.16; 90.99; 90.44; 90.54 RCW

The Washington Department of Ecology regulates the withdrawal of water from surface and ground sources. The Water Right Permit/Certificate regulations require a permit for such withdrawals unless the water withdrawn from a ground water source will be used to irrigate a lawn or non-commercial garden of up to one-half acre of land or less, and/or the withdrawal is less than 5,000 gallons per day for industrial or domestic use, or for stock watering. Public notice is required for permit applications. To the extent that water is used under the terms of the permit, a water right is perfected and a Certificate of Water Right is issued to document the water right. The Washington Department of Ecology must also review and approve changes of existing water rights/claims (Chapters 90.03 and 90.44 RCW).

Proposed activities to which Water Rights laws and regulations may apply:

- Fee-title or easement acquisition, cooperative agreements, and/or leasing of land and/or water
- Installation of off-channel watering facilities
- Converting a delivery system to drip or sprinkler irrigation
- Converting a water conveyance from open ditch to pipeline or line leaking ditches and canals
- Converting from instream diversion to groundwater wells for primary water source
- Removing, consolidating, or improving irrigation diversion dams
- Installing or replacing return flow cooling systems

1.2.12.4 State of Oregon Laws and Regulations

Oregon Removal-Fill Law - ORS 196.795-990

Under the Oregon Removal-Fill Law, the Division of State Lands (DSL) issues permits for activities involving fill or excavation of waters of the state. The law defines "waters of the state" as natural waterways including all tidal and nontidal bays, intermittent streams, constantly flowing streams, lakes, wetlands and other bodies of water in this state, navigable and nonnavigable, including that portion of the Pacific Ocean that is within the boundaries of this state. DSL's jurisdiction extends to the ordinary high water line or to the line of non-aquatic vegetation – whichever is higher. A permit is not required for filling and excavation involving less than 50 cubic yards of material with the exception of activities in streams designated as essential salmon habitat or scenic waterways (no minimum applies in these waters). Activities are required to take place during the inwater work periods identified by Oregon Department of Fish and Wildlife to protect fish and wildlife. Best management practices are also required to be followed. Most activities requiring a removal-fill permit also require a Section 404 or Section 10 permit from the U.S. Army Corps of Engineers (see CWA above). DSL and the Corps have a joint application and work closely in implementing their respective regulations.

Proposed activities to which the Removal-Fill Law may apply:

- All small scale instream habitat activities.
- Installation of off-channel watering facilities.

- Hardening fords for livestock crossings of streams.
- Constructing retention/detention basins.
- Converting from instream diversions to groundwater wells for primary water source.
- Installing new or upgrade/maintain existing fish screens.
- Removing, consolidating, or improving irrigation diversion dams.
- Installing or replacing return flow cooling systems.
- Bridge, culvert, and ford maintenance, removal or replacement.

Oregon Water Rights - ORS 537

The Oregon Water Rights regulation requires the Oregon Water Resources Department to issue Water Use Permit for a new water right. The Water Resources Department also issues approvals for modifications and transfers of water rights under existing permits. A change in an existing permit is only allowed if it will not cause injury to other water rights, either upstream or downstream.

Proposed activities to which Oregon Water Rights may apply:

- Fee-title or easement acquisition, cooperative agreements, and/or leasing of land and/or water
- Installation of off-channel watering facilities
- Converting a delivery system to drip or sprinkler irrigation
- Converting water conveyance from open ditch to pipeline or line leaking ditches and canals
- Converting from instream diversion to groundwater wells for primary water source
- Removing, consolidating, or improving irrigation diversion dams
- Installing or replacing return flow cooling systems

Water Storage Permit - ORS 537

The construction of a reservoir or pond of any size to store water requires a permit from Oregon Water Resources Department (OWRD). Reservoirs with a dam of 10 feet or higher and which store 9.2 acre-feet or more of water must submit engineering plans and specifications for approval to OWRD before the reservoir is constructed. Smaller reservoirs and dams do not require OWRD's approval of designs and plans. However, dam builders are highly encouraged to seek OWRD's technical review of plans before beginning construction to help ensure the protection of downstream property owners.

Proposed activities to which a Water Storage Permit may apply:

- Constructing retention/detention basins
- Removing, consolidating, or improving irrigation diversion dams

State Pesticide Control Act – OAR 634

The purpose of the Oregon State Pesticide Control Act, enforced by the State Department of Agriculture, is to regulate in the public interest the formulation, distribution, storage, transportation, application and use of pesticides. The act requires individuals involved in the pesticide industry to obtain a pesticide licenses issued by the Department of Agriculture. A licensee may only perform the technical activities (agricultural weed control, aquatic weed control, structural pest control, *etc.*) for which they have been certified. A person becomes certified by passing the exam(s) required by the Department of Agriculture.

Proposed activities to which this chapter may apply:

- Vegetation management by herbicide use

1.2.12.5 State of Idaho Laws and Regulations

Stream Channel Protection Act – IDAPA 37.03.07

The Stream Channel Protection Act requires a permit from the Idaho Department of Water Resources (IDWR) before initiating any type of alteration work inside the ordinary high water marks of a continuously flowing stream. Stream channel alteration is defined as any activity that will obstruct, diminish, destroy, alter, modify, relocate, or change the natural existing shape or direction of water flow of a stream channel. This includes taking material out of the channel or placing material or structures in or across the channel where the potential exists to affect flow in the channel. If the stream is navigable, a permit from the Idaho Department of Lands is required because the state owns the streambed. This permit would usually be coordinated with an IDWR permit. A joint agency stream channel alteration permit application is available.

Proposed activities to which the Stream Channel Protection Act may apply:

- All small scale instream habitat actions
- Installation of off-channel watering facilities
- Hardening fords for livestock crossings of streams
- Converting from instream diversions to groundwater wells for primary water source
- Installing new or upgrade/maintain existing fish screens
- Removing, consolidating, or improving irrigation diversion dams
- Installing or replacing return flow cooling systems
- Bridge, culvert, and ford maintenance, removal or replacement

Idaho Water Appropriation Rules – IDAPA 37.03.08

Idaho water right law requires a permit from the Idaho Department of Water Resources for a new water right. The Department of Water Resources also issues approvals for modifications and transfers of water rights under existing permits. The point of diversion, place of use, period of use or nature of use of a water right may be changed so long as the change does not result in injury to the rights of other water users, does not constitute an enlargement of the original water right, and is in the local public interest.

Proposed activities to which Idaho Water Appropriation Rules may apply:

- Fee-title or easement acquisition, cooperative agreements, and/or leasing of land and/or water
- Installation of off-channel watering facilities

- Converting a delivery system to drip or sprinkler irrigation
- Converting water conveyance from open ditch to pipeline or line leaking ditches and canals
- Converting from instream diversion to groundwater wells for primary water source
- Removing, consolidating, or improving irrigation diversion dams
- Installing or replacing return flow cooling systems

Safety of Dams Rules - IDAPA 37.03.06
The Idaho Safety of Dams Rules establish acceptable standards for dam construction and provide guidelines for safety evaluation of new or existing dams. The rules apply to all new dams, to existing dams to be enlarged, altered or repaired, and maintenance of certain existing dams. The Idaho Department of Water Resources enforces the rules. The rules require submission of plans, drawings and specifications prepared by an engineer for the proposed work. The Idaho Department of Water Resources reviews the plans and provides written approval to the applicant.

Proposed activities to which Safety of Dams Rules may apply:

- Constructing retention/detention basins
- Removing, consolidating, or improving irrigation diversion dams

Pesticide and Chemigation Use and Application Rules - IDAPA 02.03.03
The Idaho State Department of Agriculture (ISDA) regulates the use and application of pesticides, licensing of pesticide applicators, and registration of pesticides for use in Idaho. Individuals involved in the pesticide industry are required to obtain a pesticide licenses issued by the ISDA. A licensee may only perform the technical activities (agricultural weed control, aquatic weed control, structural pest control, *etc.*) for which they have been certified. A person becomes certified by passing the exam(s) requirements established by ISDA.

Proposed activities to which Pesticide Rules may apply:

- Vegetation management by herbicide use

1.3 Action Area

An action area is defined by NOAA Fisheries regulations (50 CFR Part 402) as "all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action." The action area for this consultation, as illustrated in Figure 1-1, is the Columbia River Basin within the contiguous United States that is also within the range of ESA-listed salmon and steelhead and their designated critical habitats; and EFH-designated under the MSA. The action area relative to both juvenile and adult Columbia Basin anadromous salmonids is that part of their in-water and riparian habitat and associated uplands that would be affected by the habitat actions described in Section 1.2 above. The area is best defined as the farthest upstream point at which smolts enter (or adults exit) the Snake and Upper Columbia rivers and their tributaries to the farthest downstream point at which they exit (or adults enter) the migration corridor. In the Snake River, the area translates to immediately below Hells Canyon Dam (or wherever a tributary stream meets the Snake River below Hells Canyon Dam) to the confluence of the Snake and Columbia rivers. In the Columbia River, the action area begins immediately below Chief Joseph Dam (or wherever a tributary stream meets the Columbia River below Chief Joseph Dam). Although the actual upstream extent of the action area varies among ESUs, in all cases the action area extends downstream to the farthest point (the Columbia River estuary and nearshore ocean environment) at which listed salmonids would be influenced by the proposed actions under the Opinion. This area serves as a migratory corridor for juveniles and adults, spawning, rearing, and growth and development to adulthood for EFH and the salmonid ESUs listed in Table 2-2 below.

1.4 Relationship of Proposed Actions to Tribal Resources and/or Interests

The 13 Indian tribes in the Columbia River basin are sovereigns with governmental rights over their lands and people, and with rights over natural resources that are reserved by or protected in treaties, executive orders, and Federal statutes. The U.S. has a trust obligation toward Indian tribes to preserve and protect these rights and authorities (NWPPC 2000). BPA and NOAA Fisheries do not intend, through this consultation, to affect or modify any trust or treaty right of an Indian tribe.

The proposed actions will be of high interest to Indian tribes that have rights to natural resources within the action area. These actions will directly and indirectly affect resources and interests of Indian tribes in the Columbia Basin. Salmonid and other fisheries are an extremely important resource for the Indian tribes. Since the proposed activities will improve habitat functions that have been lost or degraded, these actions will contribute to the improvement of Tribal fisheries resources. The Indian tribes are co-managers of the resources the Columbia River basin within the U.S. Interaction and collaboration with the Indian tribes will occur during the implementation of this program, as they will be the sponsors of, and will implement some of the proposed actions included in this consultation.

2. ENDANGERED SPECIES ACT - BIOLOGICAL OPINION

The objective of this Opinion is to determine whether the BPA Habitat Improvement Program is likely to jeopardize the continued existence of the 12 Columbia River ESUs of anadromous fish or destroy or adversely modify their designated critical habitat.

2.1 Evaluating the Effects of the Proposed Action

The standards for determining jeopardy and destruction or adverse modification of critical habitat are set forth in section 7(a)(2) of the ESA. In conducting analyses of habitat-altering actions under section 7 of the ESA, NOAA Fisheries uses the following steps of the consultation regulations and combines them with The Habitat Approach (NMFS 1996a): (1) Consider the biological requirements and status of the listed species; (2) evaluate the relevance of the environmental baseline in the action area to the species' current status; (3) determine the effects of the proposed or continuing action on the species, and whether the action is consistent with any available recovery strategy; and (4) determine whether the species can be expected to survive with an adequate potential for recovery under the effects of the proposed or continuing action, the effects of the environmental baseline, and any cumulative effects, and considering measures for survival and recovery specific to other life stages. In completing this step of the analysis, NOAA Fisheries determines whether the action under consultation, together with all cumulative effects when added to the environmental baseline, is likely to jeopardize the ESA-listed species or result in the destruction or adverse modification of critical habitat. If jeopardy or adverse modification are found, NOAA Fisheries may identify reasonable and prudent alternatives for the action that avoid jeopardy and/or destruction or adverse modification of critical habitat.

The fourth step above (jeopardy/adverse modification analysis) requires a two-part analysis. The first part focuses on the action area and defines the proposed action's effects in terms of the species' biological requirements in that area (*i.e.,* effects on essential features). The second part focuses on the species itself. It describes the action's effects on individual fish, populations, or both–and places that impact in the context of the ESU as a whole. Ultimately, the analysis seeks to determine whether the proposed action is likely to jeopardize a listed species' continued existence or destroy or adversely modify its critical habitat.

2.1.1 Biological Requirements

The first step NOAA Fisheries uses when applying ESA section 7(a)(2) to the listed ESUs considered in this Opinion includes defining the species' biological requirements within the action area. Biological requirements are population characteristics necessary for the listed ESUs to survive and recover to naturally-reproducing population sizes, at which time protection under the ESA would become unnecessary. This will occur when populations are large enough and habitat is of sufficient quantity and quality to safeguard the genetic diversity of the listed ESUs, enhance their capacity to adapt to various environmental conditions, and allow them to become self-sustaining in the natural environment (see Appendix G - McElhany *et al.* 2000).

The listed species' biological requirements may be described as characteristics of the habitat, population or both. Population characteristics may be expressed as a ratio of recruits to spawners, a survival rate for a given life stage (or set of life stages), a positive population trend, a threshold population size, spatial structure, and life-history diversity (McElhany *et al.* 2000). Essential habitat features can be expressed in terms of physical, chemical, and biological parameters. The manner in which these requirements are described varies according to the nature of the action under consultation and its likely effects on the species or its critical habitat.

Relationships between human activities in watersheds and population responses of Pacific salmon can be difficult to quantify and synthesize. Also, the survival and recovery of Pacific salmon species will depend on their ability to persist through periods of low natural survival. During these periods, relatively high freshwater survival is particularly important since sufficient smolts must be produced to ensure that enough adults will survive to complete their oceanic migration, return to spawn, and perpetuate the species. For these reasons, NOAA Fisheries often relies on analysis of expected habitat changes as a surrogate for changes in the survival of life stages using that habitat. By examining the effects of a given action on the habitat portion of a species' biological requirements, NOAA Fisheries can gauge how that action would affect the population variables that constitute the rest of a species' biological requirements, and ultimately how the action would affect the species' potential for survival and recovery.

For actions that affect freshwater habitat, NOAA Fisheries usually describes the habitat portion of a species' biological requirements in terms of a concept called properly functioning condition (PFC). PFC is defined as the sustained presence of natural,[48] habitat-forming processes in a watershed that are necessary for the long-term survival of the species through the full range of environmental variation (NMFS 1996a). PFC, then, constitutes the habitat component of a species' biological requirements.

Although NOAA Fisheries is not required to use a particular procedure to describe biological requirements, it typically considers the status of habitat variables in a matrix of pathways and indicators (MPI, found in Table 1 of NOAA Fisheries [1996]) that were developed to describe PFC in forested montane watersheds. In the PFC framework, baseline environmental conditions are described as "properly functioning," "at risk," or "not properly functioning." NOAA Fisheries relies on these pathways and indicators because they are supported in the scientific literature as being affected by land management activities, and are relevant to the survival and recovery of the fresh-water life stages of Pacific salmon. NOAA Fisheries uses this information to determine how current habitat conditions compare to the biological requirements of the listed species and are affecting the species' status in the action area.

[48] The word "natural" in this definition is not intended to imply "pristine," nor does the best available science lead us to believe that only pristine wilderness will support salmon.

Whether species' biological requirements are expressed in terms of population variables or habitat components, a strong causal link exists between the two. Actions that affect habitat have the potential to effect population abundance, productivity and diversity, and these impacts can be particularly acute when populations are at low levels. The importance of this relationship is highlighted by the fact that freshwater habitat degradation is identified as a factor for decline in every salmon listing on the West Coast. With respect to the analysis of Federal actions on listed species, by analyzing the effects of a given action on the habitat portion of a species biological requirements, NOAA Fisheries is able to gauge how that action will affect the population variables that constitute the rest of a species' biological requirements, and ultimately, how the action will affect the species' current and future health.

The Habitat Improvement Program would occur within designated critical habitat for three of the 12 Columbia River Pacific salmon ESU(s). Freshwater critical habitat can include all waterways, substrates, and adjacent riparian areas[49] below longstanding, natural impassable barriers (*i.e.,* natural waterfalls in existence for at least several hundred years) and dams that block access to former habitat (see citations in Table 2-2).

Essential features of habitat for the affected listed species are: (1) Substrate, (2) water quality, (3) water quantity, (4) water temperature, (5) water velocity, (6) cover/shelter, (7) food (juvenile only), (8) riparian vegetation, (9) space, and (10) safe passage conditions (50 CFR 226). Together, these factors determine the biotic composition, structure, function, and stability of aquatic and riparian ecosystems and their ability to support the biological requirements of the species (Spence *et al.* 1996). Table 2-1 summarizes the species habitat-related biological requirements and lists the conditions that have adversely affected those habitat requirements through the action area. The activities proposed in this consultation are designed to address most of the identified habitat concerns.

[49] Riparian areas adjacent to a stream provide the following functions: shade, sediment delivery/filtering, nutrient or chemical regulation, streambank stability, and input of large woody debris and fine organic matter.

Table 2-1. Summary of Major Habitat Requirements for the Freshwater Portion of the Life Cycle of Salmon and Steelhead (modified after PFMC 1999)

HABITAT REQUIREMENTS	HABITAT CONCERNS
Adult Migration Pathways Adult salmon leave the ocean, enter estuaries and rivers, and migrate upstream to spawn in the stream of their birth.	Passage blockage (*e.g.,* culverts, dams) Water quality (high temperatures, pollutants) Competition with exotic species High flows/low flows/water diversions Channel modification/simplification Reduced frequency of holding pools Lack of cover, reduced depth of holding pools Reduced cold-water refugia Increased predation resulting from habitat modifications
Spawning and Incubation Salmon lay their eggs in gravel or cobble nests called redds. To survive, eggs (and the alevins that hatch and remain in the gravel) must receive sufficient water and oxygen flow within the gravel.	Availability of spawning gravel of suitable size Siltation of spawning gravels Redd scour caused by high flows Redd de-watering Temperature/water quality problems Redd disturbance from trampling (human, animal).
Stream Rearing Habitat Juvenile salmon may remain in freshwater streams over a year. They must find adequate food, shelter, and water quality conditions to survive, avoid predators, and grow. They must be able to migrate upstream and downstream within their stream and into the estuary to find these conditions and to escape high water or unfavorable temperature conditions.	Diminished pool frequency, area, or depth Diminished channel complexity, cover Temperature/water quality problems Blockage of access to habitat (upstream and down) Loss of off-channel areas, wetlands Low water flows/high water flows Predation caused by habitat simplification or loss of cover Nutrient availability Diminished prey/competition for prey Stranding due to water level fluctuations Competition with exotic species
Smolt Migration Pathways Smolts swim and drift through the streams and rivers, and must reach the estuary or ocean when there are adequate prey and water quality conditions and must find adequate cover to escape predators as they migrate.	Water quality Low water flows/high water flows Altered timing/quantity of water flows Passage blockage/diversion away from stream Increased predation resulting from habitat simplification or modification Stranding due to water level fluctuations Competition with exotic species
Estuarine Habitat Estuaries provide a protected and food-rich environment for juvenile salmon growth and allow the transition for both juveniles and adults between the fresh and salt water environments. Adults also may hold and feed in estuaries before beginning their upstream migration.	Water quality Altered timing/quantity of fresh water in-flow Loss of habitat resulting from diking dredging, filling Diminished habitat complexity Loss of channels, eel grass beds, woody debris Increased predation resulting from habitat simplification Diminished prey/competition for prey Reduction/elimination of periodic flooding Competition with exotic species

2.1.2 Status of the Species and Critical Habitat Under the Environmental Baseline

In this step, NOAA Fisheries also considers the current status of the listed species within the action area, taking into account population size, trends, distribution, and genetic diversity. To assess the current status of the listed species, NOAA Fisheries starts with the determinations made in its decision to list the species and also considers any new data that is relevant to the species' status.

Over the past year, NOAA Fisheries has been working with state, Tribal and other Federal biologists to develop the updated information and analyses needed to re-evaluate the status of the 27 ESUs of Pacific salmon and steelhead, including the 14 ESUs that occur in the proposed action area. The NOAA Fisheries' Biological Review Team (BRT) for Pacific salmon and steelhead met recently to review this updated information, and to draw preliminary findings about the status of each ESU (NOAA Fisheries 2003a).

As in the past, the BRT used a risk-matrix method to quantify risks in different categories within each ESU. In the current report, the method was modified to reflect the four major criteria identified in the NMFS Viable Salmonid Populations (VSP) document: abundance, growth rate/productivity, spatial structure, and diversity. These criteria are being used as a framework for approaching formal ESA recovery planning for salmon and steelhead. Tabulating mean risk scores for each element allowed the BRT to identify the most important concerns for each ESU and make comparisons of relative risk across ESUs and species. These data and other information were considered by the BRT in making their overall risk assessments. Based on provisions in the draft revised NOAA Fisheries policy on consideration of artificial propagation in salmon listing determinations, the risk analyses presented to the BRT focused on the viability of populations sustained by natural production.

The status review updates were undertaken to allow consideration of new data that have accumulated since the last updates and to address issues raised in recent court cases regarding the ESA status of hatchery fish and resident (nonanadromous) populations. The draft BRT conclusions in this report should be considered preliminary for two reasons. First, the BRT will not make final status recommendations until state, Tribal, and other Federal co-managers have had an opportunity to review and comment on the draft report. Second, some policy issues regarding the treatment of hatchery fish and resident fish in ESU determinations and risk analyses are not resolved at this time.

For the following ESUs considered in this Opinion, the majority BRT conclusion was "in danger of extinction": UCR spring-run chinook, UCR steelhead, and SR sockeye. For the following ESUs, the majority BRT conclusion was "likely to become endangered in the foreseeable future": SR fall-run chinook, SR spring/summer-run chinook, LCR chinook, UWR chinook, SR steelhead, MCR steelhead, LCR steelhead, UWR steelhead, and CR chum.

In some ESUs, adult returns over the last 1-3 years have been significantly higher than have been observed in the recent past, at least in some populations. The BRT found these results, which affected the overall BRT conclusions for some ESUs, to be encouraging. For example, the majority BRT conclusion for SR fall chinook salmon was "likely to become endangered," whereas the BRT concluded at the time of the original status review that this ESU was "in danger of extinction". This change reflects the larger adult returns over the past several years, which nevertheless remain well below preliminary targets for ESA recovery. In the UCR, the majority BRT conclusions for spring chinook salmon and steelhead were still "in danger of extinction", but a substantial minority of the votes fell in the "likely to become endangered" category. The votes favoring the less severe risk category reflect the fact that recent increases in escapement have temporarily alleviated the immediate concerns for persistence of individual populations, many of which fell to critically low levels in the mid 1990s.

Overall, although recent increases in escapement were considered a favorable sign by the BRT, the response was uneven across ESUs and, sometimes, across populations within ESUs. Furthermore, most of these recent increases have not yet been sustained for even a full salmon/steelhead generation. The causes for the increases are not well understood. Many (perhaps most) cases may be due primarily to unusually favorable conditions in the marine environment rather than more permanent alleviations in the factors that led to widespread declines in abundance over the past century. Overall, the BRT felt that ESUs and populations would have to maintain themselves for a longer time at levels considered viable before it could be concluded that they are not at significant continuing risk.

These preliminary findings focus solely on the naturally-spawning portion of each ESU, and do not take into account the future effects of ongoing salmon conservation and recovery efforts. These findings do not represent any determination by NOAA Fisheries regarding whether particular ESUs should remain listed under the ESA. Following this review and technical discussions with co-managers, the panel will prepare a revised Part 1 report.

When completed, this draft report would represent the first major step in the agency's efforts to review and update the listing determinations for all listed ESUs of salmon and steelhead. By statute, ESA listing determinations must take into consideration not only the best scientific information available, but also those efforts being made to protect the species. After receiving the final BRT report and after considering the conservation benefits of such efforts, NOAA Fisheries will determine what changes, if any, to propose to the listing status of the affected ESUs. Appendix H is a discussion of the general life history of each species and current status, including distribution and population trends, summarized from the BRT report (NOAA Fisheries 2003a).

The BPA found that the Habitat Improvement Program is likely to adversely affect the ESA-listed species and designated critical habitat identified below in Table 2-2. Based on the life histories of these ESUs, the BPA determined that it is likely that incubating egg, juvenile, smolt, and adult life stages of these listed species would present in part of the proposed action area where activities authorized by this Opinion may be carried out.

Table 2-2. References for Additional Background on the Listing Status, Critical Habitat, Protective Regulations, and Biological Information for All Species Addressed in this Consultation

Species	Listing Status	Critical Habitat	Protective Regulations	Biological Information/ Population Trends
Lower Columbia River chinook	Threatened 03/24/99 64 FR 14308	02/16/00 65 FR 7764*	07/10/00 65 FR 42423	Myers *et al.* 1998; Healey 1991; ODFW and WDFW 1998
Upper Willamette River chinook	Threatened 3/24/99 64 FR 14308	02/16/00 65 FR 7764*	07/10/00 65 FR 42423	Myers *et al.* 1998; Healey 1991; ODFW and WDFW 1998
Snake River Fall-Run chinook	Threatened 4/22/92 57 FR 14653	12/28/93 58 FR 68543	07/22/1992 57 FR 14653	Waples *et al.* 1991a; Healey 1991; ODFW and WDFW 1998
Snake River Spring/Summer-Run chinook	Threatened 04/22/92 57 FR 14653	12/28/93 58 FR 68543 and 10/25/99 64 FR 57399	04/22/1992 57 FR 14653	Matthews and Waples 1991; Healey 1991; ODFW and WDFW 1998
Upper Columbia River Spring-Run chinook	Endangered 03/24/99 64 FR 14308	02/16/00 65 FR 7764*	ESA prohibition on take applies	Myers *et al.* 1998; Healey 1991; ODFW and WDFW 1998
Columbia River chum	Threatened 03/25/99 64 FR 14508	02/16/00 65 FR 7764*	07/10/00 65 FR 42423	Johnson *et al.* 1997; Salo 1991; ODFW and WDFW 1998
Snake River sockeye	11/20/91 56 FR 58619 Endangered	12/28/93 58 FR 68543	ESA prohibition on take applies	Waples *et al.* 1991; Burgner 1991; ODFW and WDFW 1998
Lower Columbia River steelhead	03/19/98 63 FR 13347 Threatened	02/16/00 65 FR 7764*	07/10/00 65 FR 42423	Busby *et al.* 1995; Busby *et al.* 1996; ODFW and WDFW 1998
Upper Willamette River steelhead	03/25/99 64 FR 14517 Threatened	02/16/00 65 FR 7764*	07/10/00 65 FR 42423	Busby *et al.* 1995; Busby *et al.* 1996; ODFW and WDFW 1998
Middle Columbia River steelhead	03/25/99 64 FR 14517 Threatened	02/16/00 65 FR 7764*	07/10/00 65 FR 42422	Busby *et al.* 1995; Busby *et al.* 1996; ODFW and WDFW 1998
Snake River Basin steelhead	08/18/97 62 FR 43937 Threatened	02/16/00 65 FR 7764*	07/10/00 65 FR 42423	Busby *et al.* 1995; Busby *et al.* 1996; ODFW and WDFW 1998
Upper Columbia River steelhead	08/18/97 62 FR 43937 Endangered	02/16/00 65 FR 7764*	ESA prohibition on take applies	Busby *et al.* 1995; Busby *et al.* 1996; ODFW and WDFW 1998

* On April 30, 2002, the United States District Court for the District of Columbia adopted a consent decree resolving the claims in the National Association of Homebuilders, *et al.* v. Evans, Civil Action No. 00-2799 (CKK) (D. D.C., April 30, 2002). Pursuant to that consent decree, the court issued an order vacating critical habitat designations for a number of listed salmonid species.

2.1.3 Factors Affecting the Environmental Baseline in the Action Area

The environmental baseline is defined as: "the past and present impacts of all Federal, state, or private actions and other human activities in the action area, including the anticipated impacts of all proposed Federal projects in the action area that have undergone section 7 consultation and the impacts of state and private actions that are contemporaneous with the consultation in progress" (50 CFR 402.02). In step 2, NOAA Fisheries' evaluates the relevance of the environmental baseline in the action area to the species' current status. In describing the environmental baseline, NOAA Fisheries evaluates essential features of designated critical habitat and the listed Pacific salmon ESUs affected by the proposed action. The environmental baseline for this Opinion is therefore the result of the impacts a great many activities have had on survival and recovery of the 12 listed ESUs under discussion. Put another way (and as touched upon previously), the baseline is the culmination of the effects that multiple activities have had on the species' biological requirements and, by examining those individual effects, it is possible to derive the species' status in the action area.

The Columbia River basin occupies approximately 220,000 square miles in seven states: Washington, Oregon, Idaho, Montana, Wyoming, Utah, and Nevada. The river and its tributaries are the primary hydrologic features in the Pacific and inland northwest. The Columbia River runs for more than 1,200 miles from its origin at Columbia Lake in British Columbia to its estuary on the Oregon-Washington coast. The largest major tributary of the Columbia is the Snake River, which is 1,036 miles long. Average annual runoff at the mouth of the Columbia River is approximately 198 million acre-feet.

As discussed in Section 1.1.3, "Analytical Approach," the entire Columbia River basin is too large and variable to describe its baseline conditions as a whole. However, the factors influencing the baseline conditions in the varied provinces and subbasins of the Columbia River basin are similar throughout the basin, and can be discussed for the basin as a whole. Many of the biological requirements for the 12 listed ESUs in the action area can best be expressed in terms of the essential features of their critical habitat (see Section 2.1.2 above). The best scientific information presently available demonstrates that a multitude of factors, past and present, have contributed to the decline of west coast salmonids by adversely affecting these essential habitat features. NOAA Fisheries reviewed much of that information in its Consultation on Operation of the Federal Columbia River Power System (NMFS 2000e). That review is summarized in the sections below.

The following discussion concentrates on the effects of the various factors for decline on those species where data are available. More studies have been done on how the various factors for decline affect species listed further in the past (*e.g.,* Snake River spring/summer chinook, listed in 1992, as opposed to MCR steelhead, by comparison, which was listed fairly recently). It should be further noted that the discussion below is simply a solid overview, rather than an exhaustive treatment, of the environmental factors affecting the 12 listed ESUs currently addressed in this Opinion. For greater detail, please see Busby *et al.* (1996) and NMFS (1991).

2.1.3.1 Mainstem Hydropower System

Hydropower development on the Columbia River has dramatically affected anadromous salmonids in the basin. Storage dams have eliminated spawning and rearing habitat and altered the natural hydrograph of the Snake and Columbia Rivers—decreasing spring and summer flows and increasing fall and winter flows. Power operations cause flow levels and river elevations to fluctuate—slowing fish movement through reservoirs, altering riparian ecology, and stranding fish in shallow areas. The 13 dams in the Snake and Columbia River migration corridors kill smolts and adults and alter their migrations. The dams have also converted the once-swift river into a series of slow-moving reservoirs—slowing the smolts' journey to the ocean and creating habitat for predators. Because most of the listed salmon and steelhead must navigate at least one, and up to nine major hydroelectric projects during their up- and downstream migrations (and experience the effects of other dam operations occurring upstream from their ESU boundary), they feel the influence of all the impacts listed above.

However, ongoing consultations between NOAA Fisheries and BPA, the U.S. Army Corps of Engineers (Corps), USFWS, and the Bureau of Reclamation (BOR) have brought about numerous beneficial changes in the operation and configuration of the Columbia River hydropower system. For example, in most years increased spill at the dams allows smolts to avoid both turbine intakes and bypass systems; increased flow in the mainstem Snake and Columbia Rivers provides better in river conditions for smolts; and better smolt transportation (through the addition of new barges and by modifying existing barges) helps the young salmonids make their way down to the ocean.

It is possible to quantify the survival benefits accruing from many of these strategies for each of the listed salmonid ESUs. To give an example, for Snake River spring/summer chinook salmon smolts migrating in river, the estimated survival through the hydropower system is now between 40% and 60%, compared with an estimated survival rate during the 1970s of 5 to 40%. Snake River steelhead have probably received a similar benefit because their life history and run timing are similar to those of spring/summer chinook salmon (NMFS 2000b). It is more difficult to obtain direct data and compare survival improvements for fish transported from the Snake River, but there have been survival improvements for transported fish as well. However, even though there have been a number of improvements, more are needed because the Federal hydropower system continues to kill a significant number of fish from some ESUs.

Several non-federal projects licensed by the Federal Energy Regulating Commission (FERC) also affect MCR steelhead. Operations of the Wells, Rocky Reach, Rock Island, Wanapum, and Priest Rapids Dams are currently governed by existing FERC license requirements and settlement agreements. Each of these license requirements and settlement agreements specify actions intended to reduce the effects of project operations on anadromous salmonids. For example, a spring flow objective of 135 thousand cubic feet per second at Priest Rapids Dam was established for the Mid Columbia River in the 1998 FCRPS Supplemental Biological Opinion (NMFS 1998). It is hoped that this and other actions will improve salmon survival, but much remains to be done to offset the effects of hydropower development, and for now the net impact of the hydropower system on the 12 listed ESUs' survival is still unequivocally negative. This was especially true for the 2001 juvenile salmon and steelhead outmigration because the severe drought conditions at that time made it impossible to meet flow targets in the Columbia River system. As a result, many salmonids had to be transported down river rather than allowed to migrate naturally. It will take some years before it can be determined what effect this had on salmonid survival in the Columbia Basin.

2.1.3.2 Human-induced Habitat Degradation

The quality and quantity of fresh water habitat in much of the Columbia River basin have declined dramatically in the last 150 years. Forestry, farming, grazing, road construction, hydropower system development, mining, and development have radically changed the historical habitat conditions of the basin. More than 2,500 streams, river segments, and lakes in the Northwest do not meet federally-approved, state, and/or Tribal water quality standards and are now listed as water-quality-limited under Section 303(d) of the Clean Water Act. Tributary water quality problems contribute to poor water quality when sediment and contaminants from the tributaries settle in mainstem reaches and the estuary. Most of the water bodies in Oregon, Washington, and Idaho on the 303(d) list do not meet water quality standards for temperature. High water temperatures adversely affect salmonid metabolism, growth rate, and disease resistance, as well as the timing of adult migrations, fry emergence, and smoltification. Many factors can cause high stream temperatures, but they are primarily related to land-use practices rather than point-source discharges. Some common actions that cause high stream temperatures are the removal of trees or shrubs that directly shade streams, water withdrawals for irrigation or other purposes, and warm irrigation return flows. Loss of wetlands and increases in groundwater withdrawals contribute to lower base-stream flows that, in turn, contribute to temperature increases. Activities that create shallower streams (*e.g.,* channel widening) also cause temperature increases.

Many waterways in the Columbia River basin fail to meet Clean Water Act (CWA) and Safe Drinking Water Act (SDWA) water quality standards due to the presence of pesticides, heavy metals, dioxins and other pollutants. These pollutants originate from both point- (industrial and municipal waste) and nonpoint (agriculture, forestry, urban activities, *etc.*) sources. The types and amounts of compounds found in runoff are often correlated with land use patterns: Fertilizers and pesticides are found frequently in agricultural and urban settings, and nutrients are found in areas with human and animal waste. People contribute to chemical pollution in the basin, but natural and seasonal factors also influence pollution levels in various ways. Nutrient and pesticide concentrations vary considerably from season to season, as well as among regions with different geographic and hydrological conditions. Natural features (such as geology and soils) and land-management practices (such as storm water drains, tile drainage and irrigation) can influence the movement of chemicals over both land and water. Salmon and steelhead require clean water and gravel for successful spawning, egg incubation, and fry emergence. Fine sediments clog the spaces between gravel and restrict the flow of oxygen-rich water to the incubating eggs. Pollutants, excess nutrients, low levels of dissolved oxygen, heavy metals, and changes in pH also directly affect the water quality for salmon and steelhead.

Water quantity problems are also a significant cause of habitat degradation and reduced fish production. Millions of acres in the Columbia River basin are irrigated. Although some of the water withdrawn from streams eventually returns as agricultural runoff or groundwater recharge, crops consume a large proportion of it. Withdrawals affect seasonal flow patterns by removing water from streams in the summer (mostly May through September) and restoring it to surface streams and groundwater in ways that are difficult to measure. Withdrawing water for irrigation, urban consumption, and other uses increases temperatures, smolt travel time, and sedimentation. Return water from irrigated fields can introduce nutrients and pesticides into streams and rivers. Deficiencies in water quantity have been a problem in the major production subbasins for some ESUs that have seen major agricultural development over the last century. Water withdrawals (primarily for irrigation) have lowered summer flows in nearly every stream in the basin and thereby profoundly decreased the amount and quality of rearing habitat. In fact, in 1993, fish and wildlife agency, Tribal, and conservation group experts estimated that 80% of 153 Oregon tributaries had low-flow problems, two-thirds of which was caused (at least in part) by irrigation withdrawals (OWRD 1993). The Northwest Power Planning Council (NWPPC 1992) found similar problems in many Idaho, Oregon, and Washington tributaries.

Blockages that stop downstream and upstream fish movement exist at many dams and barriers, whether they are for agricultural, hydropower, municipal/industrial, or flood control purposes. Culverts that are not designed for fish passage also block upstream migration. Being diverted into unscreened or inadequately screened water conveyances or turbines sometimes kills migrating fish. While many fish-passage improvements have been made in recent years, manmade structures continue to block migrations or kill fish throughout the basin.

On the landscape scale, human activities have affected the timing and amount of peak water runoff from rain and snowmelt. Forest and range management practices have changed vegetation types and density that, in turn, affect runoff timing and duration. Many riparian areas, floodplains, and wetlands that once stored water during periods of high runoff have been destroyed by development that paves over or compacts soil—thus increasing runoff and altering natural hydrograph patterns.

Land ownership has also played its part in the region's habitat and land-use changes. Federal lands, which compose 50% of the basin, are generally forested and situated in upstream portions of the watersheds. While there is substantial habitat degradation across all land ownerships, in general, habitat in many headwater stream sections is in better condition than in the largely non-federal lower portions of tributaries (Doppelt *et al.* 1993, Frissell 1993, Henjum *et al.* 1994, Quigley and Arbelbide 1997). In the past, valley bottoms were among the most productive fish habitats in the basin (Stanford and Ward 1992, Spence *et al.* 1996, ISG 1996). Today, agricultural and urban land development and water withdrawals have significantly altered the habitat for fish and wildlife in these valley bottoms. Streams in these areas typically have high water temperatures, sedimentation problems, low flows, simplified stream channels, and reduced riparian vegetation.

At the same time some habitats were being destroyed by water withdrawals in the Columbia basin, water impoundments in other areas dramatically reduced habitat by inundating large amounts of spawning and rearing habitat and reducing migration corridors, for the most part, to a single channel. Floodplains have been reduced in size, off-channel habitat features have been lost or disconnected from the main channel, and the amount of large woody debris (large snags/log structures) in rivers has been reduced. Most of the remaining habitats are affected by flow fluctuations associated with reservoir management.

The Columbia River estuary, through which all the basin's anadromous species must pass, has also been changed by human activities. Historically, the downstream half of the estuary was a dynamic environment of multiple channels, extensive wetlands, sandbars, and shallow areas. Historically, the mouth of the Columbia River was about four miles wide; today it is two miles wide. Previously, winter and spring floods, low flows in late summer, large woody debris floating downstream, and a shallow bar at the mouth of the Columbia River kept the environment dynamic. Today, navigation channels have been dredged, deepened, and maintained; jetties and pile-dike fields have been constructed to stabilize and concentrate flow in navigation channels; marsh and riparian habitats have been filled and diked; and causeways have been constructed across waterways. These actions have decreased the width of the mouth of the Columbia River to two miles and increased the depth of the Columbia River channel at the bar from less than 20 to more than 55 feet.

More than 50% of the original marshes and spruce swamps in the estuary have been converted to industrial, transportation, recreational, agricultural, or urban uses. More than 3,000 acres of intertidal marsh and spruce swamps have been converted by human use since 1948 (LCREP 1999). Many wetlands along the shore in the upper reaches of the estuary have been converted to industrial and agricultural lands after levees and dikes were constructed. Furthermore, water storage and release patterns from reservoirs upstream of the estuary have changed the seasonal pattern and volume of discharge. The peaks of spring/summer floods have been reduced and the amount of water discharged during winter has increased.

Human-caused habitat alterations have also increased the number of predators feeding on salmon and steelhead. For example, a population of terns on Rice Island (16,000 birds in 1997) consumed an estimated 6-25 million outmigrating salmonid smolts during 1997 (Roby *et al.* 1998) and 7-15 million outmigrating smolts during 1998 (Collis *et al.* 1999). Rice Island is a dredged material disposal site in the Columbia River estuary; the Corps created it under its Columbia River Channel Operation and Maintenance Program. As another example, populations of Northern pike minnow (*Ptychocheilus oregonensis*—a voracious predator of salmonids) in the Columbia River have proliferated in the warm, slow-moving reservoirs created by the mainstem dams. Some researchers have estimated the pike minnow population in the John Day pool alone to be more than one million (Bevan *et al.* 1994), and they all consume salmonids if given the opportunity.

To counteract all of the ill effects listed in this section, Federal, state, Tribal, and private entities have—singly and in partnership—begun recovery efforts to help slow and, eventually, reverse the decline of salmon and steelhead populations. Notable efforts within the range of the 12 listed ESUs are the NWPPC's Fish and Wildlife Program, Basinwide Salmon Recovery Strategy (both of which the activities proposed in this Opinion are based on), the Northwest Forest Plan, PACFISH, the Washington Wild Stock Restoration Initiative, the Washington Wild Salmonid Policy, and the Oregon Plan for Salmon and Watersheds. (These are all large and complicated programs; for details on these efforts please see the websites for ODFW, WDFW, the USFS, and the Bonneville Power Administration.) Full discussions of these efforts can be found on the referenced websites and in the Federal Columbia River Power System biological opinion (NMFS 2000e). Despite these efforts, however, much remains to be done to recover salmon and steelhead populations in the Columbia River basin.

2.1.3.3 Hatcheries

For more than 100 years, hatcheries in the Pacific Northwest have been used to: (1) Produce fish for harvest, and (2) replace natural production lost to dam construction and other development—not to protect and rebuild naturally-produced salmonid populations. As a result, most salmonid populations in the region are primarily derived from hatchery fish. In 1987, for example, 95% of the coho salmon, 70% of the spring chinook salmon, 80% of the summer chinook salmon, 50% of the fall chinook salmon, and 70% of the steelhead returning to the Columbia River basin originated in hatcheries (CBFWA 1990). Because hatcheries have traditionally focused on providing fish for harvest and replacing declines in native runs (and generally not carefully examined their own effects on local populations), it is only recently that the substantial effects of hatcheries on native natural populations been documented. For example, the production of hatchery fish, among other factors, has contributed to the 90% reduction in natural coho salmon runs in the lower Columbia River over the past 30 years (Flagg *et al.* 1995).

Hatchery fish can harm naturally-produced salmon and steelhead in four primary ways: (1) Ecological effects, (2) genetic effects, (3) overharvest effects, and (4) masking effects (NMFS 2000c). Ecologically, hatchery fish can predate on, displace, and compete with wild fish. These effects are most likely to occur when young hatchery fish are released in poor condition and do not migrate to marine waters, but rather remain in the streams for extended rearing periods. Hatchery fish also may transmit hatchery-borne diseases, and hatcheries themselves may release disease-carrying effluent into streams. Hatchery fish can affect the genetic composition of native fish by interbreeding with them. Humans taking native fish from one area and using them in a hatchery program in another area can also cause interbreeding. Interbred fish are less adapted to the local habitats where the original native stock evolved and may therefore be less productive there.

In many areas, hatchery fish provide increased fishing opportunities. However, when natural fish mix with hatchery stock in these areas, smaller or weaker natural stocks can be over-harvested. Moreover, when migrating adult hatchery and natural fish mix on the spawning grounds, the health of the natural runs and the habitat's ability to support them can be overestimated because the hatchery fish mask the surveyors' ability to discern actual natural run conditions.

Currently, the role hatcheries are to play in the Columbia basin is being redefined under the Basinwide Salmon Recovery Strategy (Federal Caucus 2000). Under this plan hatcheries are being changed from simple production hatcheries into hatcheries designed to support species recovery ("conservation" hatcheries). The Program contains two primary hatchery initiatives. The first is to reform all existing production and mitigation hatcheries to eliminate or minimize the harm they do to natural fish. The second is to implement projects using various artificial production techniques such as supplementation and captive broodstock programs on an interim basis to avoid extinction while other recovery actions take effect. The artificial propagation efforts will focus on maintaining species diversity and supporting weak stocks. The Program will also have an associated research element designed to clarify interactions between natural and hatchery fish and quantify the effects supplementation has on natural fish. The final facet of the strategy is to use hatcheries to create fishing opportunities that are benign to listed salmonid populations (*e.g.,* terminal area fisheries). For more detail on the use of hatcheries in recovery strategies, please see the Basinwide Salmon Recovery Strategy (Federal Caucus 2000).

2.1.3.4 Harvest

Salmon and steelhead have been harvested in the Columbia basin as long as there have been people there. These harvests were a major food source for the native populations. Commercial fishing developed rapidly with the arrival of European settlers and the advent of canning technologies in the late 1800s. The development of non-Native American fisheries began in about 1830; by 1861, commercial fishing was an important economic activity. The early commercial fisheries used gill nets, seines hauled from shore, traps, and fish wheels. Later, purse seines and trolling (using hook and line) fisheries developed. Recreational (sport fishing) harvest began in the late 1800's and took place primarily in tributary locations (ODFW and WDFW 1998). Salmon and steelhead have formed a major component of recreational fisheries for decades. Conservation concerns for natural salmon and steelhead populations have caused regulations to be put in place in Oregon and Washington that strictly limit the number of fish anglers may catch and the types of gear that may be used in many areas.

Initially, the non-Native American fisheries targeted spring and summer chinook salmon, and these runs dominated the commercial harvest during the 1800's. Eventually the combined ocean and freshwater harvest rates for Columbia River spring and summer chinook salmon exceeded 80% (and sometimes 90%) of the run—accelerating the species' decline (Ricker 1959). From 1938 to 1955, the average harvest rate dropped to about 60% of the total spring chinook salmon run and appeared to have a minimal effect on subsequent returns (NMFS 1991). Until the spring of 2000, when a relatively large run of hatchery spring chinook salmon returned and provided a small commercial tribal fishery, no commercial season for spring chinook salmon had taken place since 1977. Present Columbia River harvest rates are very low compared with those from the late 1930's through the 1960's (NMFS 1991). Although steelhead were never as important a component of the Columbia Basin's fisheries as chinook, net-based fisheries generally do not discriminate among species, so it can fairly be said that harvest has also contributed to declines in all of the 12 ESUs under discussion in this Opinion.

Salmonids' capacity to produce more adults than are needed for spawning offers the potential to sustainably harvest naturally-produced (versus hatchery-produced) fish. This potential can be realized only if two basic management requirements are met: (1) Enough adults return to spawn and perpetuate the run; and (2) the productive capacity of the habitat is maintained. Catches may fluctuate in response to such variables as ocean productivity cycles, periods of drought, and natural disturbance events, but as long as the two management requirements are met, NOAA Fisheries believes that fishing can be sustained indefinitely. However, both prerequisites for sustainable harvest have been violated routinely in the past. The lack of coordinated management across jurisdictions, combined with competitive economic pressures to increase catches or to sustain them in periods of lower production, resulted in harvests that were too high and escapements that were too low. At the same time, habitat has been increasingly degraded, reducing the capacity of the salmon stocks to produce numbers in excess of their spawning escapement requirements.

For years, the response to declining catches was hatchery construction to produce more fish. Because hatcheries require fewer adults to sustain their production, harvest rates in the fisheries were allowed to remain high, or even increase, further exacerbating the effects of overfishing on the naturally-produced (non-hatchery) runs mixed in the same fisheries. More recently, harvest managers have instituted reforms including weak stock, abundance-based, harvest rate, and escapement-goal management. As with improvements being made in other phases of salmon and steelhead life history strategies, it will take some time for these (and future) measures to contribute greatly to the species recovery, but the effort has begun.

Ocean harvest for other species has also affected salmon and steelhead populations, though only incidentally and to an essentially unknown degree. For example, at one point it was estimated that unauthorized high seas drift net fisheries harvested between 2% and 38% of steelhead destined to return to the Pacific Coast of North America (Cooper and Johnson 1992). However, since drift nets were outlawed in 1987, and enforcement has increased, that percentage has certainly decreased greatly. Therefore, it is indeterminable to what degree by-catch affects any of the 12 listed ESUs, but is probably a fairly minor impact in comparison to the effects on these ESUs arising from other anthropogenic sources.

2.1.3.5 Natural Conditions

Natural changes in the freshwater and marine environments play a major role in salmon and steelhead abundance. Recent evidence suggests that marine survival among salmonids fluctuates in response to 20- to 30-year cycles of climatic conditions and ocean productivity (Hare *et al.* 1999). This phenomenon has been referred to as the Pacific Decadal Oscillation. In addition, large-scale climatic regime shifts, such as El Nino, appear to change ocean productivity. During the first part of the 1990s, much of the Pacific Coast was subject to a series of very dry years. More recently, severe flooding has adversely affected some stocks (*e.g.,* the low returns of Lewis River bright fall chinook salmon in 1999).

A key factor affecting many West Coast stocks, including the 12 ESUs under discussion, has been a general 30-year decline in ocean productivity. The mechanism whereby stocks are affected is not well understood, partially because the pattern of response to these changing ocean conditions has differed among stocks, presumably due to differences in their ocean timing and distribution. It is presumed that survival is driven largely by events occurring between ocean entry and recruitment to a subadult life stage. One indicator of early ocean survival can be computed as a ratio of coded-wire tag (CWT) recoveries from subadults relative to the number of CWTs released from that brood year. Time-series of survival rate information for upper Willamette River spring chinook salmon, Lewis River fall chinook salmon, and Skagit fall chinook salmon show highly variable or declining trends in early ocean survival, with very low survival rates in recent years (NMFS 2000a).

Salmon and steelhead are exposed to high rates of natural predation, particularly during freshwater rearing and migration stages. Ocean predation may also contribute to significant natural mortality, although it is not known to what degree. In general, salmonids are prey for pelagic fishes, birds, and marine mammals, including harbor seals, sea lions, and killer whales. There have been recent concerns that the rebound of seal and sea lion populations—following their protection under the Marine Mammal Protection Act of 1972—has caused a substantial number of salmonid deaths. In recent years, for example, sea lions have learned to target upper Willamette River spring chinook salmon in the fish ladder at Willamette Falls.

Finally, it should be noted that the unusual drought conditions in 2001 warrant additional consideration with the available water in the upper Columbia River basin 50 to 60% of normal, resulting in some of the lowest flow conditions on record. These 2001 conditions will have the greatest effect on upriver stocks, but all the 12 listed ESUs will likely feel the effects as well. The juveniles that passed down river during the 2001 spring and summer out-migration will likely be affected and this, in turn, will affect adult returns primarily in 2003 and 2004, depending on the stock and species. At this time, it is impossible to ascertain what those effects will be, but NOAA Fisheries is monitoring the situation and will take the drought condition into account in management decisions, including amending take authorizations and other permit conditions as needed.

2.1.3.6 Summary

NOAA Fisheries concludes that not all of the biological requirements of the species within the action area are being met under current conditions, based on the best available information on the status of the affected species; information regarding population status, trends, and genetics; and the environmental baseline condition within the action area. Significant improvements in habitat conditions over those currently available under the environmental baseline are needed to meet the biological requirements for survival and recovery of these species.

2.2 Analysis of Effects

Effects of the action are defined as "the direct and indirect effects of an action on the species or critical habitat, together with the effects of other activities that are interrelated or interdependent with the action, that will be added to the environmental baseline" (50 CFR 402.02). Direct effects occur at the project site and may extend upstream or downstream based on the potential for impairing the value of habitat for meeting the species' biological requirements or impairing the essential features of critical habitat. Indirect effects are defined in 50 CFR 402.02 as "those that are caused by the proposed action and are later in time, but still are reasonably certain to occur." They include the effects on listed species or critical habitat of future activities that are induced by the proposed action and that occur after the action is completed. "Interrelated actions are those that are part of a larger action and depend on the larger action for their justification" (50 CFR 403.02). "Interdependent actions are those that have no independent utility apart from the action under consideration" (50 CFR 402.02).

2.2.1 Effects of Proposed Action

In step 3 of the jeopardy and adverse modification analysis, NOAA Fisheries evaluates the effects of proposed actions on listed species and seeks to answer the question of whether the species can be expected to survive with an adequate potential for recovery if those actions go forward. In watersheds where critical habitat has been designated, NOAA Fisheries must determine whether the action will result in the destruction or adverse modification of critical habitat (ESA, Section 3(3) and Section 3(5A)).

This Opinion provides an analysis of the effects of the proposed action on the 12 ESUs listed in Table 2-2 and the critical habitat identified in Section 2.1.2. The analysis in this Opinion uses the information provided in the HIP BA to evaluate elements of the proposed action that have the potential to affect the listed fish or essential features of their critical habitat.

2.2.1.1 General Surveying, Construction, Operation, and Maintenance Effects

Most of the proposed activities require some degree of construction, operation, and/or maintenance, often in or beside streams or other waterbodies. The direct physical and chemical effects of the construction, operation, and maintenance associated with the proposed activities begin with surveying, minor vegetation clearing, placement of stakes and flagging guides, and minor movements of machines and personnel over the action area. Subsequent construction of access roads, construction staging areas, and materials storage areas may affect more of the project area and clear vegetation that will allow rainfall to strike the bare land surface. Additional clearing and digging for site preparation and earthwork may remove more vegetation and topsoil, expose deeper soil layers, extend operations into an active stream channel, and reshape stream banks as necessary for successful revegetation. The final stage of general construction is site restoration and consists of activities necessary to restore ecological recovery mechanisms such as soil stability, energy and nutrient distribution, and vegetation succession. Some of the activities will also require ongoing operation and maintenance activities.

To the extent that vegetation is providing habitat function, such as: (1) Delivery of large wood, particulate organic matter, or shade to a riparian area and stream; (2) root strength for slope and bank stability; and (3) sediment filtering and nutrient absorption from runoff, removal of that vegetation for construction will reduce or eliminate those habitat values (Darnell 1976, Spence *et al.* 1996). Denuded areas lose organic matter and dissolved minerals, such as nitrates and phosphates. Microclimate can become drier and warmer with corresponding increases in wind speed and soil and water temperatures. Water tables and spring flow can be reduced. Loose soil can temporarily accumulate in the construction area. In dry weather, this soil can be dispersed as dust. In wet weather, loose soil is transported to streams by erosion and runoff, particularly in steep areas. Erosion and runoff increase the supply of soil to lowland drainage areas and eventually to aquatic habitats where they increase water turbidity and sedimentation. This combination of erosion and mineral loss can reduce soil quality and site fertility in upland and riparian areas. Concurrent in-water work can compact or dislodge channel sediments, thus increasing turbidity and allowing currents to transport sediment downstream where it is eventually redeposited. Continuing construction operations when the construction site is inundated can significantly increase the likelihood of severe erosion and contamination. The following proposed conservation measures will avoid or minimize the adverse effects discussed above:

- Boundaries of clearing limits associated with site access and construction will be marked to avoid or minimize disturbance of riparian vegetation, wetlands and other sensitive sites.
- A pollution and erosion control plan will be prepared and carried out to prevent pollution and erosion related to construction operations. Elements of the plan will address materials storage sites, access roads, stream crossings, construction sites, borrow pit operations, haul roads, and inspection and replacement of erosion controls.
- A supply of emergency erosion control materials will be on hand, and temporary erosion controls will be installed and maintained in place until site restoration is complete.
- Existing roadways or travel paths will be used whenever possible.
- The number of temporary stream crossings will be minimized and roads will be designed to avoid adverse effects.
- Access ways may not be built mid-slope or on slopes greater than 30%.

- Stream crossings will provide for foreseeable risks such as flooding and associated bedload and debris to prevent a stream diversion if the crossing fails.
- Vehicles and machinery will cross riparian areas and streams at right angles whenever possible.
- Earthwork will be completed as quickly as possible.
- The site will be stabilized during any significant break in work.
- If listed fish are present, or the work area is less than 300 feet upstream of a spawning area, any in-water work area will be isolated from flowing waters.
- Project operations will cease under high flow conditions that may inundate the project area, except for efforts to avoid or minimize resource damage.
- Stormwater runoff will be managed.

Use of heavy equipment during construction creates the opportunity for accidental spills of fuel, lubricants, hydraulic fluid and similar contaminants into the riparian zone or water where they can injure or kill aquatic organisms. Discharge of construction water used for vehicle washing, concrete washout, pumping for work area isolation, and other purposes can carry sediments and a variety of contaminants to the riparian area and stream. Similarly, use of treated wood in or over flowing water to build any type of structure at the construction site can introduce toxic compounds directly into the stream during cutting or abrasion, or by leaching (Poston, 2001). In addition to the conservation measures listed above, the BPA proposes the following conservation measures to further minimize or avoid these effects:

- Pollution control elements of the pollution and erosion control plan will address equipment and materials storage sites, fueling operations, staging areas, cement, mortars and bonding agents, hazardous materials, spill containment and notification, and construction debris management.
- Vehicle staging, cleaning, maintenance, refueling, and fuel storage will be 150 feet or more from any stream, water body or wetland.
- All vehicles operated with 150 feet of any water body will be inspected daily for leaks and, if necessary, repaired before leaving the staging area.
- Stationary power equipment operated within 150 feet of any stream or wetland will be diapered to prevent leaks, unless otherwise approved by NOAA Fisheries.
- All equipment operated instream will be cleaned to remove all external grease, dirt, and mud before operations below the bankfull elevation.
- Project operations will cease under high flow conditions that may inundate the project area, except for efforts to avoid or minimize resource damage.
- Construction discharge water will be treated for water quality and discharge velocity, and released away from spawning areas and submerged marine vegetation.
- Treated wood debris and treated wood removed as part of a project will be handled and disposed of as appropriate for this type of hazardous material.
- No new treated wood will be used for any structure that may contact flowing water or that will be placed over water, except pilings installed following NOAA Fisheries' guidelines.

Heavy equipment can cause soil compaction, thus reducing soil permeability and infiltration. Construction of pavement and other permanent soil coverings to build bridges and road upgrades can also reduce site permeability and infiltration. Permeability and infiltration are inversely related to the rate and volume of runoff. During and after wet weather, increased runoff can suspend and transport more sediment to receiving waters. This increases turbidity and stream fertility. Increased runoff also increases the frequency and duration of high stream flows and wetland inundation in construction areas. Higher stream flows increase stream energy that can scour stream bottoms and transport greater sediment loads farther downstream that would otherwise occur. Sediments in the water column reduce light penetration, increase water temperature, and modify water chemistry. Once deposited, sediments can alter the distribution and abundance of important instream habitats, such as pool and riffle areas. During dry weather, the physical effects of increased runoff appear as reduced ground water storage, lowered stream flows, and lowered wetland water levels. The effects of reduced soil permeability and infiltration are most significant in upland areas where runoff processes and the overall storm hydrograph are controlled mainly by groundwater recharge and subsurface flows. These effects are less significant in riparian areas, where saturated soils and high water tables are more common and runoff processes are dominated by direct precipitation and overland flow (Dunn and Leopold 1978). In addition to the conservation measures listed above, the effects of heavy equipment operation will be further minimized or avoided by the following conservation measures:

- Heavy equipment will be limited to that with the least adverse effects on the environment (*e.g.,* minimally-sized, low ground pressure equipment).
- Long-term adverse effects causing unavoidable loss of aquatic habitat or functions will be offset by compensatory mitigation such as planting additional riparian trees and shrubs or restoration of near shore habitats.

The direct physical and chemical effects of post-construction site restoration included as part of the proposed activities are essentially the reverse of the construction activities that go before it. Seeding, planting woody shrubs and trees, and mulching protect bare earth. This immediately dissipates erosive energy associated with precipitation and increases soil infiltration. It also accelerates vegetative succession necessary to restore the delivery of large wood to the riparian area and stream, root strength necessary for slope and bank stability, leaf and other particulate organic matter input, sediment filtering and nutrient absorption from runoff, and shade. Microclimate will become cooler and moister, and wind speed will decrease. In addition to the conservation measures listed above, BPA proposes the following conservation measures to further minimize or avoid the adverse effects of site restoration, and to maximize the beneficial environmental effects:

- All temporary access roads will be obliterated when the project is completed, the soil will be stabilized and the site will be revegetated.
- Temporary roads in wet or flooded areas will be abandoned and restored by the end of the in-water work period.

- Any large wood, native vegetation, weed-free topsoil, and native channel material displaced by construction will be stockpiled for use during site restoration.
- When construction is finished, all streambanks, soils and vegetation will be cleaned up and rehabilitated as necessary to renew ecosystem processes that form and maintain productive fish habitats.
- Any herbicide application will follow the conservation measures listed under Section 1.2.9.3, "Vegetation Management by Herbicide Use."
- Fencing will be installed as necessary to prevent access to revegetated sites by livestock or unauthorized persons.
- Long-term adverse effects causing unavoidable loss of aquatic habitat or functions will be offset by compensatory mitigation such as planting additional riparian trees and shrubs or rehabilitation of near shore habitats.

The direct biological effects of construction included as part of the proposed action are primarily the result of physical and chemical changes in the environment caused by that construction. These effects are complex and vary in magnitude and severity between the individual organism, population, ESU and community scales.

The most lethal biological effects of the proposed activities on individual listed salmon and steelhead will likely be caused by the isolation of in-water areas. Although work area isolation is itself a conservation measure intended to reduce the adverse effects of erosion and runoff on the population, any individual fish present in the work isolation area will be captured and released. Capturing and handling fish causes them stress though they typically recover fairly rapidly from the process and therefore the overall effects of the procedure are generally short-lived (NOAA Fisheries 2003b). The primary contributing factors to stress and death from handling are differences in water temperatures (between the river and wherever the fish are held), dissolved oxygen conditions, the amount of time that fish are held out of the water, and physical trauma. Stress on salmonids increases rapidly from handling if the water temperature exceeds 18^{o}C or dissolved oxygen is below saturation. Fish that are transferred to holding tanks can experience trauma if care is not taken in the transfer process, and fish can experience stress and injury from overcrowding in traps, if the traps are not emptied on a regular basis. Debris buildup at traps can also kill or injure fish if the traps are not monitored and cleared on a regular basis. These biological effects will be minimized or avoiding by the following conservation measures:

- Work below the bankfull elevation will be completed during preferred in-water work windows, when listed fish are least likely to be present in the action area, unless otherwise approved in writing by NOAA Fisheries.
- Fish passage will be provided for any adult or juvenile salmonid species that may be present in the project area during construction and after construction for the life of the project.
- If listed fish are present, or the work area is within 300 feet of a spawning area, the in-water work area will be isolated.

- Any water intakes used for the project, including pumps used to dewater the work isolation area, will have a fish screen installed, operated and maintained according to NOAA Fisheries' fish screen criteria.
- Any listed fish that may be trapped within the isolated work area will be captured and released using methods approved by NOAA Fisheries, including supervision by a fishery biologist experienced with work area isolation and competent to ensure the safe handling of all ESA-listed fish.

Construction activities may also have direct biological effects on individual salmon and steelhead by altering development, bioenergetics, growth, and behavior. Activities that increase flows can disturb gravel in salmon or steelhead redds and can also agitate or dislodge developing young and cause their damage or loss. Similarly, activities that reduce subsurface or surface flows, reduce shade, deposit silt in streams, or otherwise reduce the velocity, temperature, or oxygen concentration of surface water as it cycles through a redd can adversely affect the survival, timing, and size of emerging fry (Warren 1971). Coho salmon that survive the redd but emerge later and smaller than other fry also appear to be weaker, less dominant, and less capable of maintaining their position in the environment (Mason and Chapman 1965). Once adult salmon or steelhead arrive at a spawning area, their successful reproduction is dependent on the same environmental conditions that affect survival of embryos in the redd.

Many environmental conditions can cause incremental differences in feeding, growth, movements, and survival of salmon and steelhead during the juvenile life stage. Construction activities that reduce the input of particulate organic matter to streams, add fine sediment to channels, or disturb shallow-water habitats, can adversely affect the ability of salmon and steelhead to obtain food necessary for growth and maintenance. Salmon and steelhead are generally able to avoid the adverse conditions created by construction if those conditions are limited to areas that are small or local compared to the total habitat area, and if the system can recover before the next disturbance. This means juvenile and adult salmon and steelhead will, to the maximum extent possible, readily move out of a construction area to obtain a more favorable position within their range of tolerance along a complex gradient of temperature, turbidity, flow, noise, contaminants, and other environmental features. The degree and effectiveness of the avoidance response varies with life stage, season and the frequency and duration of exposure to the unfavorable condition, and the ability of the individual to balance other behavioral needs for feeding, growth, migration, and territory. Chronic or unavoidable exposure heightens physiological stress thus increasing maintenance energy demands (Redding *et al.* 1987, Servizi and Martens 1991). This reduces the feeding and growth rates of juveniles and can interfere with juvenile migration, growth to maturity in estuaries, and adult migration. However, with due diligence for the full range of conservation measures outlined above, the threat is negligible that the environmental changes caused by events at any single construction site associated with the proposed activity, or even any likely combination of such construction sites in proximity, could cause chronic or unavoidable exposure over a large habitat area sufficient to cause more than transitory direct affects to individual salmon or steelhead.

At the population level, the effects of the environment are understood to be the integrated response of individual organisms to environmental change. Thus, instantaneous measures of population characteristics, such as population abundance, population spatial structure and population diversity, are the sum of individual characteristics within a particular area, while measures of population change, such as population growth rate, are measured as the productivity of individuals over the entire life cycle (McElhany *et al.* 2000). Lethal take associated with work area isolation, if any, is expected to amount to no more than a few individual juveniles (see Table 2-6). That number is too low to influence population abundance. Similarly, small to intermediate reductions in juvenile population density in the action areas caused by individuals moving out of the construction area to avoid short-term physical and chemical effects of the proposed construction are expected to be transitory and are not expected alter juvenile survival rates. Because adult salmon and steelhead are larger and more mobile than juveniles, it is unlikely that any will be killed during work area isolation, although adults may move laterally or stop briefly during migration to avoid noise or other construction disturbances (Feist *et al.* 1996, Gregory 1988, Servizi and Martens 1991, Sigler 1988). However, with due diligence for the full range of conservation measures outlined above, it is unlikely that physical and chemical changes caused by construction events at any single construction site associated with the proposed activity, or even any likely combination of such construction sites in proximity, will cause delays severe enough to reduce spawning success and alter population growth rate, or cause straying that might alter the spatial structure or genetic diversity of populations. Thus, it is unlikely that the direct biological effects of construction associated with the proposed action will affect the characteristics of salmon or steelhead populations.

At the ESU level, direct biological effects are synonymous with those at the population level or, more likely, are the integrated demographic response of one or more subpopulations (McElhany *et al.* 2000). As described above, it is unlikely that the direct biological effects of construction associated with the proposed action will affect the characteristics of salmon or steelhead populations; therefore it is also unlikely that salmon or steelhead will be affected at the ESU level.

Indirect effects that are reasonably certain to occur after the proposed construction is complete include human activity and ecological recovery in the construction area. The human activity will vary with the type and purpose of the activity completed, and will be discussed below in sections analyzing specific types of activities. "Ecological recovery" means the establishment or restoration of environmental conditions necessary for proper functioning condition in the construction area. The proposed activities will occur in areas where productive habitat functions and recovery mechanisms were absent or degraded before construction took place. These sites are only likely to achieve proper functioning condition if the preconstruction environment retains the ecological potential to function properly[50] (*e.g.,* residual productivity of riparian soils, channel conditions with balanced scour and fill processes). The prospect for ecological recovery will be further limited by ecological and social factors at the watershed and landscape scales, or site capacity. For example, ecological recovery of a project site surrounded by intensive land use and severe upstream disturbance is likely to be less stable and less resilient than the recovery of a site surrounded by wildlands where the headwaters are protected. To some extent, control of undesirable vegetation, limiting anthropogenic disturbance, and other proposed conservation measures described above will help to compensate for low residual ecological potential and accelerate recovery. However, they are unlikely to fully overcome severe site constraints imposed by low site capacity.

The time necessary for recovery of functional habitat attributes will vary by attribute. Recovery mechanisms such as soil stability, sediment filtering and nutrient absorption, and vegetation succession may recover quickly (months, years) after completion of the proposed activity. Recovery of functions related to large wood and microclimate may require decades or longer. Functions related to shading of the riparian area and stream, root strength for bank stabilization, and organic matter input may require intermediate lengths of time. Thus, ecological recovery that includes all important functional habitat attributes, within the limits of site potential and capability, may require many decades although substantial or full recovery of most attributes is likely to occur much sooner. This is well within the 100-year time frame used to evaluate the role of local environmental variation in the long-term survival of salmon and steelhead populations (McElhany *et al.* 2000). Habitat areas associated with new pavement and other new permanent soil cover, if any, will not be part of this recovery trajectory. However, other riparian and in-water areas will be selected for concurrent habitat improvement using quantitative criteria developed for each project as necessary to offset any permanent habitat loss caused by construction.

The indirect biological effects of construction can be understood as the integrated response of individuals and populations of many, interrelated species at the community level. All populations are dependent on the physical and chemical conditions and resources at their locations, and together with these conditions and resources form ecosystems. A persistent change in the environmental conditions or resources of an ecosystem can lead to a change in the abundance of many, if not all, populations in the ecosystem and lead to development of a new community. Differences in riparian and instream habitat quality, including water chemistry, can alter trophic and competitive relationships in ways that support or weaken the populations of salmon and steelhead in relation to other more pollution tolerant species (Wentz *et al.* 1998; Williamson *et al.* 1998). However, with due diligence for the full range of proposed conservation outlined above, it is unlikely that physical and chemical changes due to construction activities

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[50] "Properly functioning," "properly functioning condition," and "properly functioning habitat condition" refers to the habitat component of a species' biological requirements and means the sustained presence of natural habitat-forming processes in a watershed necessary for the long-term survival of the species through the full range of environmental variation. See, NMFS, 1999b The Habitat Approach: Implementation of Section 7 of the ESA for Actions Affecting the Habitat of Pacific Anadromous Salmonids. Northwest Region Habitat Conservation and Protected Resources Divisions, Portland, Oregon. 12 pp. (August 26, 1999).

associated with the proposed action will cause a persistent change in the conditions or resources available relative to the total habitat area. Thus, it is unlikely that the indirect biological effects of construction associated with the proposed action will affect the characteristics of individuals and populations at the biological community level.

2.2.1.2 Planning and Habitat Protection Activities

2.2.1.2.1 Stream Channel, Floodplain, and Uplands Surveys and Installation Stream Monitoring Devices such as Streamflow and Temperature Monitors

The specific activities proposed are:

- Measuring/assessing and recording physical measurements by visual estimates or with survey instruments.
- Manually installing rebar or other markers along transects or at reference points.
- Manually installing piezometers and staff gauges to assess hydrologic conditions.
- Manually installing recording devices for streamflow and temperature.
- Locating and measuring physical features associated with structures on watercourses (such as culverts, bridges, gauges, and dams).
- Visually locating and recording fish presence, redds, or carcasses.
- Conducting snorkel surveys to determine species of fish in streams and observing interactions of fish with their habitats.
- Conducting habitat evaluation procedures, making observations, and walking transects for wildlife habitat assessment.
- Visually locating, identifying, and recording plant presence, frequency, and condition.
- Excavating cultural resource test pits using hand shovel only.
- Inventorying roads for general condition, needed work, and sediment sources.

The use of electroshocking for inventory work is not included (see Section 1.2.4.1). Work may entail use of trucks, survey equipment, hand tools, and crews. BPA is proposing to conduct these activities to collect information about existing on-ground conditions relative to habitat type, condition, and impairment; species presence, abundance, and habitat use; and conservation, protection, and rehabilitation opportunities or effects.

The following potential effects to listed species and their habitats associated with stream channel, floodplain, and upland surveys and installation of stream monitoring devices - disturbance to fish, erosion and sedimentation, compaction and disturbance of streambed sediments - are addressed under the general construction section (2.2.1.1). The stream channel, floodplain, and upland surveys and installation of stream monitoring devices activity will incorporate the conservation measures for general construction as applicable.

Similarly, there is the potential for trampling a negligible amount of vegetation during upland and floodplain surveys, but the vegetation would be expected to recover.

Excavated material from cultural resource testing conducted near streams may contribute sediment to streams and increase turbidity. The amount of soil disturbed would be negligible and would have a minimal effect on instream turbidity.

The following conservation measures will avoid or minimize the adverse effects discussed above:

- Except for escapement (redd) surveys, no in-water work will occur within 300 feet of spawning areas during anadromous fish spawning and incubation times.
- Persons conducting redd surveys will be trained in redd identification, likely redd locations, and methods to minimize the likelihood of stepping on redds or delivering fine sediment to redds (PNF 2001e).
- Workers will avoid redds and listed spawning fish while walking within or near stream channels to the extent possible. Avoidance will be accomplished by examining pool tail outs and low gradient riffles for clean gravel and characteristic shapes and flows prior to walking or snorkeling through these areas (PNF 2001e).
- If redds or listed spawning fish are observed at any time, workers will step out of the channel and walk around the habitat unit on the bank at a distance from the active channel (PNF 2001e).
- Snorkel surveys will follow a statistically valid sampling design or rely on a single pass approach (NMFS 2000b).
- Surveyors will coordinate with other local agencies to prevent redundant surveys (NMFS 2000b).
- Excavated material from cultural resource test pits will be placed away from stream channels. All material will be replaced back into test pits when testing is completed (NMFS 2000b).
- Multiple stream sites will be used for field trips to minimize effects on any given stream or riparian buffer area (NMFS 2000b).
- BPA will prepare an annual report of activities, including stream mileage surveyed and inventoried, categorized by method and by WRIA, HUC, or other appropriate spatial information (NMFS 2000b).

The primary effect of this proposed activity would be the collection of environmental conditions in both upland and stream habitats. Survey data will provide information on the presence and condition of individual listed species and their habitat. Streamflow and temperature data will supplement the survey data by gauging the abiotic conditions of a stream. Together these activities will provide either continuing or baseline data regarding the habitat and species conditions from which decisions regarding the conservation, protection, and rehabilitation opportunities or effects will be made. These activities are some of the initial steps necessary to make informed decisions on how to best improve upon the existing environmental baseline as discussed in Section 2.1. The collection of annual or bi-annual data on a site over a period of years will reveal how a site is responding to the habitat improvement activities. Through ongoing collection of these data over a number of years, a better understanding of the process can be achieved, and further adjustments can be made to the conservation, protection or rehabilitation activities in order to attain a properly functioning habitat.

2.2.1.2.2 Fee-Title or Easement Acquisition, Cooperative Agreements and/or Leasing of Land and/or Water

The primary proposed acquisition, agreement, and/or leasing activities would include funding the purchase or lease of, or implementation of cooperative agreements on, good quality upland, riparian, and aquatic habitat. This includes funding the acquisition of riparian buffers under the Conservation Reserve Program administered by the Natural Resources Conservation Service. For most transactions, management of the property or rights will be conducted by a land managing or water conservation entity. For land habitat acquisitions, a long-term management plan will be developed. The acquisition of a water right for instream flow is an administrative process where water that otherwise would have legally been withdrawn from the stream will instead remain instream for the benefit of fish and the riparian system as a whole. Management activities occurring subsequent to the acquisition, leasing, or agreement, such as fencing, revegetation, *etc.*, are not included in this description of the fee-title or easement acquisition, cooperative agreements, and/or leasing of land and/or water activity, since many of these potential activities are addressed elsewhere in this consultation.

BPA is proposing this activity to preserve existing habitat for fish and wildlife by preventing development or degradation; increase connectivity by reconnecting patches of high quality habitat or extending habitat out from a core area; and/or increase tributary water flow to: (1) Improve conditions in a 303d water quality limited stream; (2) improve fish spawning, rearing, and migration; and (3) restore riparian functions.

Land acquisitions, conservation easements, and leasing activities have no direct effects on listed salmon or steelhead or their habitats. Indirect effects of land acquisitions, conservation easements, and leasing activities would be the preservation of existing habitat for fish and wildlife by preventing development or degradation, and the increase in connectivity of habitat resulting from reconnecting patches of high quality habitat or extending habitat out from a core area.

The direct effects of water rights acquisitions (leaving the water instream) would be enhanced flow, improved water quality, and temperatures more favorable to anadromous fish. Indirect effects would include the improvement of fish spawning, rearing, and migration habitat and the restoration of riparian functions.

No adverse effects are anticipated from the fee-title or easement acquisition, cooperative agreements, and/or leasing of land and/or water activity. In order to maximize the benefits of this activity, BPA will evaluate and prioritize these acquisitions for funding according to criteria developed for RPAs 150 and 151 (see Section 1.2.4.2 for more discussion of the criteria).

2.2.1.3 Small Scale Instream Habitat Activities

2.2.1.3.1 Streambank Protection Using Bioengineering Methods

The primary proposed streambank protection activity is the use of large wood and vegetation to increase bank strength and resistance to erosion in an ecological approach to engineering streambank protection (Mitsch 1996; WDFW *et al.* 2000). All actions intended for streambank protection will provide the greatest degree of natural stream and floodplain function achievable through application of an integrated, ecological approach by requiring the selection of protection measures to be constrained by an analysis of the mechanisms and causes of streambank failure, reach conditions, and habitat impacts (NOAA Fisheries 2003b). The following bank protection techniques are proposed for use either individually or in combination:

- Woody plantings and variations (*e.g.,* live stakes, brush layering, facines, brush mattresses).
- Herbaceous cover, where analysis of available records (*e.g.,* historical accounts and photographs) shows that trees or shrubs did not exist on the site within historic times, primarily for use on small streams or adjacent wetlands.
- Deformable soil reinforcement, consisting of soil layers or lifts strengthened with fabric and vegetation that are mobile ('deformable') at approximately two- to five-year recurrence flows.
- Coir logs (long bundles of coconut fiber), straw bales and straw logs used individually or in stacks to trap sediment and provide growth medium for riparian plants.
- Bank reshaping and slope grading, when used to reduce a bank slope angle without changing the location of its toe, increase roughness and cross-section, and provide more favorable planting surfaces.
- Floodplain roughness, *e.g.,* floodplain tree and large woody debris rows, live siltation fences, brush traverses, brush rows and live brush sills; used to reduce the likelihood of avulsion[51] in areas where natural floodplain roughness is poorly developed or has been removed.
- Floodplain flow spreaders, consisting of one or more rows of trees and accumulated debris used to spread flow across the floodplain.
- Flow-redirection structures known as barbs, vanes, or bendway weirs, when designed as follows, unless otherwise approved in writing by NOAA Fisheries.
    1. No part of the flow-redirection structure will exceed bank full elevation, including all rock buried in the bank key.
    2. Build the flow-redirection structure primarily of wood or otherwise incorporate large wood at a suitable elevation in an exposed portion of the structure or the bank key. Placing the large woody debris near streambanks in the depositional area between flow-direction structures to

[51] 'Avulsion' means a significant and abrupt change in channel alignment resulting in a river moving into a new channel across the floodplain. It is usually associated with large flood events, and may be caused by either natural events or actions such as straightening or moving channels by building dikes or levees, or building deep, floodplain gravel pits too near the river.

satisfy this requirement is not included, unless those areas are likely to be greater than 1 meter in depth, sufficient for salmon rearing habitats.

3. Fill the trench excavated for the bank key above bankfull elevation with soil and top with native vegetation.
4. The maximum flow-redirection structure length will not exceed 1/4 of the bankfull channel width.
5. Place rock individually without end dumping.
6. If two or more flow-redirection structures are built in a series, place the flow-redirection structure farthest upstream within 150 feet or 2.5 bankfull channel widths, from the flow-redirection structure farthest downstream.
7. Include woody riparian planting as a project component.

No other types of streambank protection are included in this Opinion. Work may require the use of heavy equipment, power tools, and/or hand crews. BPA is proposing to conduct these activities to protect and repair eroding streambanks, thereby reducing sediment loading in streams and promoting more stable stream courses.

The following potential effects to listed species and their habitats associated with the proposed streambank protection activities - exposure of bare soil and reduction or elimination of large woody debris, shade, slope and bank stability, and sediment filtering habitat functions due to removal of vegetation; compaction of soil and disturbance of streambeds resulting in sedimentation, increased water turbidity, and increased flows and stream energy; fuel and other contamination from spills or use of heavy equipment in water; sedimentation and contamination from discharge of construction water; stress to fish from capture and release from coffered areas during isolation of instream work areas, noise, and avoidance behavior; and changes in flows - are addressed under the general construction section (2.2.1.1). The streambank protection activities will incorporate the conservation measures for general construction as applicable.

The primary means of streambank protection proposed is the use of large wood and vegetation to increase resistance to bank erosion (bioengineering). This approach protects banks by using natural materials to increase erosion resistance and bank roughness to disrupt stream energy. Roots and other small and large pieces of vegetation are used to collect and bind bank sediments. This helps to avoid or minimize loss of riparian function associated with more traditional approaches to streambank protection that rely primarily on rock, cement, steel and other hard materials. Bioengineered bank treatments develop root systems that are flexible and regenerative, and respond more favorably to hydraulic disturbance than conventional hard alternatives. Besides the conservation measures listed above, the effects of streambank protection will be further minimized or avoided by the following conservation measure:

- <u>Use of large wood and rock</u>. Whenever possible, use large wood as an integral component of all streambank protection treatments.[52] Avoid or minimize the use of

[52] See, Washington Department of Fish and Wildlife, Washington Department of Transportation, and Washington Department of Ecology, *Integrated Streambank Protection Guidelines*, Appendix I:Anchoring and placement of large

rock, stone and similar materials. Large wood will be intact, hard, and undecayed to partly decaying with untrimmed root wads to provide functional refugia habitat for fish. Use of decayed or fragmented wood found laying on the ground or partially sunken in the ground is not acceptable.

The proposed use of "hard" scour protection is limited to construction of a footing, facing, headwall, or other structure necessary to prevent scouring or downcutting of an existing culvert or bridge support. Direct and indirect effects of these scour protection activities are similar to the effects of general construction discussed above, including the creation of new impervious surfaces, and will follow the conservation measures for general construction as applicable.

The direct effects of barb construction include redirection of instream flow away from the bank and toward the thalweg. This is believed to improve bank stability along smoothed channels or bends, especially when used in combination with bioengineering techniques (WDFW *et al.* 2000). This combination is most effective for reducing bank erosion along the outer edge of the channel migration zone in reaches where sedimentation and flows remain relatively constant over time. Barbs are designed to be overtopped by channel forming flows. This ensures that any direct effect they may have on channel forming processes or floodplain connectivity are avoided or minimized. As a result a more physically diverse habitat is either maintained or created.

The following conservation measure will avoid or minimize the adverse effects discussed above:

- Rock may be used instead of wood for the following purposes and structures. The rock will be class 350 metric or larger, wherever feasible, but may not impair natural stream flows into or out of secondary channels or riparian wetlands. Rock will be used:
    a. As ballast to anchor or stabilize large woody debris components of an approved bank treatment.
    b. To fill scour holes, as necessary to protect the integrity of the project, if the rock is limited to the depth of the scour hole and does not extend above the channel bed.
    c. To construct a footing, facing, headwall, or other protection necessary to prevent scouring or downcutting of an existing culvert or bridge support.
    d. To construct a flow-redirection structure as describe above.

The indirect environmental effects of proposed bioengineered bank treatments are similar to those discussed above for general construction, particularly those related to ecological recovery. The indirect effects of scour protection for public infrastructures are similar, with the area occupied by the hard structure itself being analogous to an area of new

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woody debris (June 2002) (http://www.wa.gov/wdfw/hab/ahg/ispgdoc.htm); Oregon Department of Forestry and Oregon Department of Fish and Wildlife, *A Guide to Placing Large Wood in Streams*, May1995

http://www.odf.state.or.us/divisions/protection/forest_practices/RefsList.asp impervious surface. However, this effect will be offset with additional planting of riparian trees and shrubs or restoration of nearshore habitats. The indirect effects of construction of a barb are also similar, but can also include the beneficial effects due to development of scour holes, deepened pools, and other low energy habitats useful as juvenile rearing areas down gradient of the barb (USEPA 1998, Piper *et al.* 2001, cf., Rosgen, undated, describing hydrological problems caused by improperly designed barbs and other flow controls).

2.2.1.3.2 Install Habitat-Forming Natural Material Instream Structures (Large Wood and Boulders)

All activities intended for installing habitat-forming, instream structures will provide the greatest degree of natural stream and floodplain function achievable through application of an integrated, ecological approach (NOAA Fisheries 2003b). Instream structures capable of enhancing habitat forming processes and migratory corridors will be installed within previously degraded stream reaches. These structures include engineered log jams and other cover structures designed with large woody debris and/or boulder materials. Structures will be installed only in streambed gradients of 6% or less. Structure placement activities include structure types that are designed to lower a stream's width to depth ratio while providing habitat and migratory corridors capable of connecting existing habitats and promoting a naturally-functioning channel. Large woody debris (LWD) structures will be designed to minimize the need for anchoring. However, dependent on site location and design criteria, some structures may be anchored. If anchored, a variety of methods may be used. These include buttressing the wood between riparian trees, cabling the structure to existing structures, and/or anchoring with boulders, concrete blocks or new log wedges. Roni *et al.* (2002) citing Thom (1997) stated that pinning channel spanning logs between trees in the riparian zone is an effective method of naturally anchoring LWD (NMFS 2001f). Biodegradable manila/sisal rope may be used to temporarily stabilize structures. Work may require the use of heavy equipment, power tools, and/or hand crews.

Placement of large wood will occur in channels with an intact, well-vegetated riparian buffer area that is not mature enough to provide large wood, or in conjunction with riparian rehabilitation and/or management. Wood placement will be limited to areas where the absence of large wood has been identified as a limiting factor for fish habitat using survey data.

The placement of large boulders will be restricted to streams where boulders naturally occur but are currently lacking. Boulder placement projects will rely on the size of boulder for stability, not on any artificial cabling or other devices. Total length of a placement project will be limited to 250 feet. Boulders will be placed in random patterns replicating natural conditions without substantially modifying stream hydraulics. The use of boulders to construct weirs or other channel-spanning structures is not included under this activity (see section 2.2.1.3.1 above for activities regarding use of boulders for constructing barbs). Permanently anchored structures, engineered structures and deflectors, debris jam structures relying on large rock, rebar and cable, and other similar habitat construction activities are not included in this Opinion.

Some of the instream habitat improvement projects may involve pulling or felling trees into streams. Although trees would be sacrificed and maneuvered within the riparian zone and stream channel, in these projects, no trees would be harvested or removed from riparian reserves. In addition, the projects would extend over substantial distances and stocking levels of remaining trees would remain high, so BPA does not believe that riparian indicators would be degraded. In projects where logs would be hauled to the site, the logs would be obtained from upland areas or would be salvaged and hauled by the project sponsor after having been cut in the course of highway repair.

BPA is proposing to install habitat-forming, natural material instream structures to: (1) Provide instream spawning, rearing and resting habitat for salmonids; (2) provide high flow refugia; (3) increase interstitial spaces for benthic organisms and juvenile salmonids; (4) increase instream structural complexity and diversity; (5) promote natural vegetation composition and diversity; (6) reduce embeddedness in spawning gravels; (7) reduce siltation in pools; (8) reduce the width/depth ratio of the stream; (9) mimic natural input of large woody debris in aquatic systems that have been altered by channelization and land use practices; (10) restore historic hydrologic regimes; (11) decrease flow velocities; and (12) deflect flows into adjoining floodplain areas.

The following potential effects to listed species and their habitats associated with installation of instream structures - compaction and disturbance of instream sediments; sedimentation and increased water turbidity, fuel and other contamination from spills or use of heavy equipment in water; sedimentation and contamination from discharge of construction water; stress to fish from noise and avoidance behavior; and changes in flows, and modification of vegetation in the riparian area - are addressed under the general construction section (2.2.1.1). The installation of instream structures will incorporate the conservation measures for general construction as applicable.

In the long term, installing instream structures will be beneficial to listed species and their habitats. Large woody debris (LWD) is central to determining channel morphology and biological condition in many Pacific Northwest streams (Spence *et al.* 1996). Pool formation, gravel and organic material retention, velocity disruption, instream channel complexity, and predatory cover for fish are all strongly reliant on LWD. Over the long term, suitable spawning substrate could collect in the vicinity of the LWD (NMFS 2001d).

The presence and abundance of LWD is positively related with growth, abundance and survival of juvenile salmonids (Spalding *et al.* 1995; Fausch and Northcote 1992). Therefore the creation of pools by LWD will positively influence the distribution and abundance of juvenile salmonids (Beechie and Sibley 1997; Spalding *et al.* 1995). Carlson *et al.* (1990) found that pool volume was inversely related to stream gradient with a direct relation to the amount of LWD. Bilby and Ward (1989) state that LWD influences the physical form of the channel, retention of organic matter, and biological community composition. Retention of organic matter reduces the amount of suspended bedload, thereby reducing siltation of spawning gravels, and overall increasing water quality.

Fausch and Northcote (1992) indicate that size of LWD is important for habitat creation. Hicks *et al.* (1991) indicate that lack of LWD available for recruitment from the riparian zone also leads to reduction in the quality of fish habitat. LWD has a substantial influence on intermediate streams (10-30 m bankfull width, <4% gradient), but is less important in small (<10 m bankfull width, >4% gradient) and large (>30 m bankfull width, <2% gradient) streams (Hogan and Ward 1997). Kauffman *et al.* (1997) indicate that length of LWD is critical in retaining the piece in the sited area, with pieces longer than the active channel width less likely to move during high flows. BPA proposes the following conservation measure for the installation of LWD:

- Installation of LWD will comply with the size requirements outlined in A Guide to Placing Large Wood in Streams (ODFW/ODF 1995) and placement guidance in the Oregon Aquatic Habitat Restoration and Enhancement Guide (ODFW/ODF 1999) (NMFS 2001f) or Appendix I of the Integrated Streambank Protection Guidelines[53] (WDFW *et al.* 2003). The wood length requirement is at least two times the bankfull stream width (1.5 times the bankfull width for wood with rootwad attached) (ODFW/ODF 1999). The minimum diameter size requirements are based on the bankfull width of the stream as follows (ODFW/ODF 1995):

Bankfull Width (feet)	Minimum Diameter (inches)
0 to 10	10
10 to 20	16
20 to 30	18
Over 30	22

Boulder placement is a common method used to create rearing habitat (Reeves *et al.* 1991) and can provide suitable habitat for salmonids (Ward 1997). Ward (1997) indicates that clusters of spaced boulders placed at the lower end of riffle habitats that complement the natural stream curvature are well utilized by fish and durable to flows. Koning and Keeley (1997) state, “Boulder clusters provide rearing habitat for juvenile salmonids”. Although boulder placement has been successful in salmonid habitat creation, potential problems should not be overlooked and hydrologist and geomorphologists should help plan projects to ensure their success (Reeves *et al.* 1991).

Collectively, instream structures such as LWD and boulders provide overhead cover for both adults and rearing juveniles, increase sediment transport capacity, prevent down cutting, and increase stream depth by decreasing width-to-depth ratio (NMFS 2001h). Coho salmon take full advantage of large wood and debris jams in Oregon coastal streams. Young coho salmon move into side channels, sloughs, and beaver ponds during the winter and are typically found close to large woody debris, roots, overhanging

[53] See Washington Department of Fish and Wildlife, Washington Department of Transportation, and Washington Department of Ecology, *Integrated Streambank Protection Guidelines*, April 2003, Appendix I, Anchoring and Placement of Large Woody Debris (http://www.wa.gov/wdfw/hab/ahg/ispgdoc.htm).

brush, or undercut banks (NMFS 2000d citing Meehan 1991, Bearner and Henderson 1998). Additionally, the instream structures will serve to dissipate stream energy, reduce the erosive force of the stream on vulnerable banks, and provide areas for pools and gravel bars to form.

The overall effect of the proposed activity on the species habitat is expected to be beneficial. The placement of LWD and boulders is expected to improve riparian functions and values by enhancing the native plant community over the long term. In turn, these efforts will improve the habitat quality, provide a source for natural large woody debris recruitment, improve bank stability, reduce erosion, and improve micro-climatic conditions (NMFS 1999f).

2.2.1.3.3 Improve Secondary Channel Habitats

The primary proposed improvement of secondary channel habitats activities include removing or modifying sediment bars or terraces that block fish passage and removing channel and bank sediments to open the channel or increase the channel area. All activities intended for improving secondary channel habitats will provide the greatest degree of natural stream and floodplain function achievable through application of an integrated, ecological approach (NOAA Fisheries 2003b). Activities that will alter streambank or channel conditions are not included in this consultation except for the following:

- Removal of trash and other artificial debris dams that block fish passage.
- Removal of sediment bars or terraces that block fish passage within 50 feet of a tributary mouth.
- Streambed grading within 50 feet of the mouth of a stream.

Work may entail use of heavy equipment, power tools, and/or hand crews.

Improving secondary channel habitats will increase the area available for rearing habitat; improve access to rearing habitat; increase hydrologic capacity of side channels; increase channel diversity and complexity; provide resting areas for fish and wildlife species at various levels of inundation; reduce flow velocities; disrupt benthic food communities; and provide protective cover for fish and other aquatic species.

The following potential effects to listed species and their habitats associated with improvement of secondary channel habitats - compaction and disturbance of instream sediments, resulting in sedimentation and increased water turbidity, fuel and other contamination from spills or use of heavy equipment in water, sedimentation and contamination from discharge of construction water, stress to fish from capture and release from coffered areas during isolation of instream work areas, noise, and avoidance behavior, and changes in flows - are addressed under the general construction section (2.2.1.1). The improvement of secondary channel habitats will incorporate the conservation measures for general construction as applicable.

Further direct physical and chemical effects of trash and debris removal can include resuspension and deposition of sediment and contaminants contained in or buried under the trash and debris. Land uses practices such as agriculture and urban development have contributed increased sediment in streams. Sometimes this sediment can accumulate at the stream mouth, forming a bar or terrace. The bar or terrace can spread the streamflow into finely braided or sheet flow patterns, forming temporal or complete passage barriers to fish. While removal of sediment bars that block fish passage would normally be beneficial to anadromous fish in the long term, excessive amounts of removal may lead to ancillary effects to stream bed and banks that impair habitat formation and stream processes. Additional analyses of the project to evaluate these impacts are necessary. Additionally, removing sediment far upstream from the mouth of a stream increases the amount of habitat adversely impacted by the re-suspended sediment. Therefore, limits on the amount and location of sediment bar and terrace removal are required.

- For removal of sediment bars or terraces, no more than 25 cubic yards of sediment may be removed from within 50 feet of the mouth of the stream.

Similarly, there is the potential for trampling a negligible amount of vegetation during the use of heavy equipment, but the vegetation would be expected to recover. Fish passage can be impaired during the proposed activity, preventing adult and juvenile fish from gaining access to safer waters. Riparian function and stream channel morphology may potentially be temporarily altered, causing short-term adverse impacts to salmonids until the restored riparian habitat is properly functioning. The following conservation measures will avoid or minimize these adverse effects:

- Projects will be designed to provide fish passage in accordance with NOAA Fisheries "Anadromous Salmonid Passage Facility Guidelines and Criteria" (NOAA Fisheries 2003).
- Adequate precautions will be taken to prevent post-construction stranding of juvenile or adult fish.

The positive direct effect of removing trash, debris dams, sediment bars and terraces will be the increased access to secondary channel habitats over the range of stream flow conditions. This increase in habitat connectivity will benefit listed fish by greatly increasing spawning and rearing habitat availability.

Removal of sediment from streambeds will improve habitat for spawning. In addition, the removal of trash, artificial debris, and sediment bars reduces the potential for the accumulation of sediment behind these barriers and creates a more properly functioning habitat where sediment is naturally dispersed throughout the watershed. Removal of these barriers will also return streamflow to a more properly functioning condition, creating an opportunity for the natural creation of pools and other cold-water refuge.

2.2.1.3.4 Riparian and Wetland Habitat Creation, Rehabilitation, and Enhancement

For purposes of this consultation, the riparian and wetland habitat creation, rehabilitation,[54] and enhancement activity is limited to the following list. No other projects that would alter streambank or channel conditions are included in this proposed action.

- Removal of levees, dikes, berms, weirs or other water control structures (NOAA Fisheries 2003b).
- Setback of levees, dikes, and berms (NOAA Fisheries 2003b)
- Reshaping of streambanks as necessary to reestablish vegetation (NOAA Fisheries 2003b).
- Excavation and removal of artificial fill materials from former wetlands (NMFS 2002).
- Developing berms or impoundments in upland areas with or without installing water control structures, to create a geomorphic depression in conjunction with a water source.
- Reintroducing beavers in areas where they have been removed.
- Excavating pools and ponds to groundwater to create wetlands in uplands.
- Removing structural bank protections and other engineered or created structures that do not meet the description and conservation measures under Section 2.2.1.3.1 "Streambank Protection Using Bioengineering Methods."
- Recontouring offstream areas that have been leveled.

All activities intended for riparian and wetland habitat creation, rehabilitation, and enhancement will provide the greatest degree of natural stream and floodplain function achievable through application of an integrated, ecological approach (NOAA Fisheries 2003b). This work will involve careful design to retain or reclaim natural conditions and the functions of the natural, active floodplain. The design will consider data and results from current and historic aerial photos, maps, hydraulic models, original plans, local knowledge of historic conditions and recent literature. Projects will be designed to mimic natural conditions for gradient, width, sinuosity and other hydraulic parameters. Bioengineering methods will be employed to help stabilize the banks and floodplains as the new features perform minor self-adjustment during bankfull (and larger) flood events.

Common practices for riparian or wetland habitat creation include the use of heavy equipment, such as excavators, backhoes, and graders. Power tools and crews with hand tools may also be used. Soil may be moved out of or brought onto a site, depending on the specific characteristics of the site. Hydric soils may be salvaged to provide appropriate substrate and/or seed source for hydrophytic plant community development. Hydric soils will only be obtained from wetland salvage sites.

[54] "Rehabilitation project" means a habitat rehabilitation activity whose primary purpose is to restore natural aquatic or riparian habitat process or conditions, which would not be undertaken but for its rehabilitation purpose.

The purpose of these activities are to: (1) Collectively reestablish a hydrologic regime that has been disrupted by human activities, including functions such as water depth, seasonal fluctuations, flooding periodicity, and connectivity; (2) increase area available for rearing habitat; (3) improve access to rearing habitat; (4) increase hydrologic capacity of side channels; (5) increase channel diversity and complexity; (6) provide resting areas for fish and wildlife species at various levels of inundation; (7) reduce flow velocities; (8) provide protective cover for fish and other aquatic species; and (9) improve or reestablish wetland processes and functions which have been disrupted by human activities, such as provision of fish and wildlife habitat, flood water attenuation, nutrient and sediment storage, support of native plant communities and removal of pollutants.

The following potential effects to listed species and their habitats associated with riparian or wetland creation, rehabilitation, and enhancement activities - exposure of bare soil and reduction or elimination of large woody debris, shade, slope and bank stability, and sediment filtering habitat functions due to removal of vegetation; compaction of soil and disturbance of streambeds resulting in sedimentation, increased water turbidity, and increased flows and stream energy; fuel and other contamination from spills or use of heavy equipment in water; sedimentation and contamination from discharge of construction water; stress to fish from capture and release from coffered areas during isolation of instream work areas, noise, and avoidance behavior; and changes in flows - are addressed under the general construction section (2.2.1.1). The stream or wetland creation, rehabilitation, and enhancement activities will incorporate the conservation measures for general construction as applicable.

Riparian and wetland creation and enhancement will require some modification of physical and biological characteristics at the project site. The direct effects of these activities on conditions that support listed fish will vary. Simply stated, large projects will impact a larger geographic area, and complex projects will have more variables and uncertain results. Therefore, we have limited the types of projects to those listed above.

The direct physical effects of removing water control structures and setting back levees, dikes and berms include an increase in effective floodplain and wetland area by the restoration of seasonal flood flows to these areas. Additional biological effects of removing fish passage obstructions and removing or setting back water control structures can include an increase in the total habitat area available, however there is a possibility of fish stranding during the construction phase or a poor design resulting in decreased fish passage (NMFS 2001a).

The proposed activity will avoid or minimize these adverse effects with the following conservation measures:

- Adequate precautions will be taken to prevent stranding of juvenile or adult fish (NOAA Fisheries 2003b).
- All passage will be designed in accordance with NOAA Fisheries “Anadromous Salmonid Passage Facility Guidelines and Criteria” (NOAA Fisheries 2003).

Most riparian or wetland creation, rehabilitation, and enhancement projects will alter environmental conditions in the project area, changing an upland biological community and ecosystem to a riparian, wetland or aquatic community and ecosystem. Many complex changes in soil, vegetation and hydrological conditions accompany this conversion and are beneficial for the restoration of proper functioning habitat conditions for listed salmon and steelhead (Williams *et al.* 1997).

Over the long term, the reintroduction of beavers will naturally recreate the hydrologic conditions necessary for stream and wetland ecosystems, minimizing any need for human influence and disturbance associated with maintenance at a site. In the absence of beavers, use of berms or impoundments with or without water control structures will establish a wetland community that requires minimal hydrologic changes or disturbance of the site.

Riparian and wetland habitat creation and enhancement are important means to protect and recover listed fish and these projects will likely result in improvement to listed species habitats. Yet, implementing rehabilitation and enhancement activities can be complicated and require substantial expertise and skill (NMFS 2001g). Planning and design conducted and/or reviewed by experienced people are essential to minimizing the adverse effects of these activities. Indirect effects can result from projects that are not well planned or designed, as they may fail with subsequent impacts to stream channels and banks. Roper *et al.* (1997) recommend that professionals from numerous disciplines such as range ecology, silviculture, ecology, engineering and geology be part of the planning process for creation or enhancement projects. Carlson *et al.* (1990) also stressed the importance of considering all aspects of a watershed for its potential capacity for fish production (NMFS 2001g).

The success of a wetland enhancement or creation project is not readily predictable and the benefits are hard to quantify (Fox 1992, Zedler 1996, Simenstad and Thom 1996). Current ecological understanding does not allow easy prediction of how a site will perform (Zedler 1996). Mitsch and Wilson (1996) propose that wetlands creation and enhancement projects fail when three general concepts are ignored: understanding wetland function, giving the system time, and allowing for the self-design capacity of nature. Fox (1992) suggests that such projects are individual in nature and usually require tailored and innovative design approaches if they are to have any chance of success.

The proposed activity will avoid or minimize the adverse effects of poor planning and/or design with the design procedures discussed above that are incorporated into the activity description.

Monitoring the effectiveness of a riparian or wetland habitat creation, rehabilitation, or enhancement project is also important and "any habitat manipulation proposal should specify procedures for pre- and post-construction studies so resulting physical and biological changes can be evaluated" (Reeves *et al.* 1991). Roper *et al.* (1997) state that only through monitoring can specific activities be evaluated as to their effect in overall watershed enhancement (NMFS 2001b). Monitoring is required for these projects as discussed under the construction section (2.2.1.1).

2.2.1.3.5 Fish Passage Activities

Fish passage will be improved by:

- Removal of trash and other artificial debris dams that block fish passage.
- Removal of permanent or intermittent dams, if fish cannot readily pass at any streamflow where either adult or juvenile upstream migrants are present.
- Removal of tide gates that block fish passage to estuarine habitat.
- Modification of a dam apron with shallow depth (less than 10 inches), or high flow velocity to provide depths velocities passable to upstream migrants.
- Modification of a diffused or braided flow that impedes approach to the impediment.
- Re-engineer improperly designed fish passage or fish collection facilities.
- Periodic maintenance of fish passage or fish collection facilities to ensure proper functioning, *e.g.,* cleaning debris buildup, replacement of parts.

Work may entail use of heavy equipment, power tools, and/or hand crews. BPA is proposing to conduct these activities to facilitate fish passage past obstacles in streams.

The following potential effects to listed species and their habitats associated with fish passage activities - exposure of bare soil and reduction or elimination of large woody debris, shade, slope and bank stability, and sediment filtering habitat functions due to removal of streambank vegetation; compaction of soil and disturbance of streambeds resulting in sedimentation, increased water turbidity, and increased flows and stream energy; fuel and other contamination from spills or use of heavy equipment in water; sedimentation and contamination from discharge of construction water; stress to fish from capture and release from coffered areas during isolation of instream work areas, noise, and avoidance behavior; and changes in flows - are addressed under the general construction section (2.2.1.1). The fish passage activities will incorporate the conservation measures for general construction as applicable.

Additional potential adverse effects associated with improving fish passage facilities may result from an incomplete or poor planning and design process that does not integrate the biological and physical information for the specific site. Fish passage improvement designs are rarely transferable from site to site. Therefore implementing a design or improvement without careful scrutiny of the specific site may lead to only partial improvement to fish passage at best, and complete failure at worst. Similarly, after the construction or enhancement of a fish passage project monitoring will be needed to assess the project's long-term effects.

The issue of establishing that certain debris jams and sediment bars are barriers to anadromous species passage is a concern. What may appear to be a passage issue during a low flow period may not appear the same during a different flow regime. Making the judgment to remove certain debris jams or sediment bars to facilitate passage will require careful consideration by persons with knowledge of species run-timing and movement characteristics (NMFS 2001j).

The following conservation measures will avoid or minimize the adverse effects discussed above:

- Preliminary designs for modifying upstream passage facilities will be developed in an interactive process with NOAA Fisheries, in accordance with "Anadromous Salmonid Passage Facility Guidelines and Criteria" (NOAA Fisheries 2003). The preliminary design will be developed on the basis of synthesis of the required site and biological information listed in NOAA Fisheries 2003. NOAA Fisheries will review fish passage facility designs in the context of how the required site and biological information was integrated into the design. Submittal of all information discussed in the document may not be required in writing for NOAA Fisheries review, however, BPA and the project sponsor will be prepared to describe how the biological and site information listed in the document was included in the development of the preliminary design. NOAA Fisheries will be available to discuss these criteria in general or in the context of a specific site. BPA and the project sponsor will initiate coordination with NOAA Fisheries fish passage specialists early in the development of the preliminary design to allow an iterative, interactive, and cooperative process (NOAA Fisheries 2003).

- NOAA Fisheries staff will conduct post-construction evaluations to assure the intended results are accomplished, and that mistakes are not repeated elsewhere. There are three parts to this evaluation: (1) Verification that the fish passage facility is installed in accordance with proper design and construction procedures; (2) measurement of hydraulic conditions to assure that the facility meets these guidelines; and (3) biological evaluations to confirm the hydraulic conditions are resulting in successful passage. Step 1 is always required; steps 2 and 3 are may be waived on a project-by-project basis if it is clear that the hydraulic conditions are being met (usually applies to smaller facilities). NOAA Fisheries technical staff may assist in developing a hydraulic or biological evaluation plan to fit site-specific conditions and species. These evaluations are not intended to cause extensive retrofits of any given project unless the as-built installation does not reasonably conform to the design guidelines, or an obvious fish passage problem continues to exist (NOAA Fisheries 2003).

- Operation and maintenance of fish passage structures will be conducted in accordance with the operation and maintenance plan outlined in Section 7 of Form 1 in Appendix A.

Removing fish passage barriers and restoring hydrologic functions will be beneficial to populations of listed fish species in the long term. Thousands of human-made barriers, including dikes, culverts and tide gates block passage to thousands of miles of freshwater spawning and rearing habitat in the Columbia River Basin. Any significant contribution to reducing this number of passage barriers will have obvious long-term beneficial effects on salmonid production (NMFS 2002). Habitat improvement projects that remove fish blockages have an obvious population impact by allowing access to unoccupied habitat. Estimates of the increased amount of salmonid production resulting from these activities can be made based on supporting data or assumptions about the quantity (area) and quality of aquatic habitat that becomes accessible (NMFS 2002).

2.2.1.4 Livestock Impact Reduction

General effects of livestock on fish habitat.
The following section discusses effects that occur from livestock grazing, to give the context in which BPA is proposing the three specific activities for livestock impact reduction. These adverse effects on listed species that are now occurring due to livestock grazing (which is part of the baseline but not part of the proposed action) will be reduced with the implementation of the three activities discussed in this livestock impact reduction section.

The effects of grazing on fish habitat can include altered stream banks and riparian areas, which can result in sediment loading, increased water temperatures, and altered water tables and flow regimes (Platts 1991). Increased sediment from grazing is usually the result of bank trampling and collapse of undercut banks, overused trail crossings and overgrazed riparian areas. The threshold level at which fine sediments begin to adversely affect the emergence and survival of salmonid embryos is somewhere between 10-15% (particle diameter less than 6.3 mm) and 20% (particle diameter including 6.3 mm) (Irving and Bjornn 1984).

Direct effects of livestock grazing may occur when livestock enter the streams occupied by fish to loaf, drink, or cross the stream. Livestock entering fish spawning areas can trample redds, and destroy or dislodge embryos and alevins. Belsky *et al.* (1997) provides a review of these direct influences on stream and riparian areas. Wading in streams by livestock can be assumed to induce mortality on eggs and pre-emergent fry at least equal to that demonstrated for human wading (Roberts and White 1992). Cattle wading into a stream also have the potential to frighten juvenile fish from streamside cover. Once these juvenile fish are frightened from cover and swim into open water, they become more susceptible to predation from larger fish and avian predators. In addition, livestock grazing in or near streams can also increase nutrient loading because of fecal input to streams.

Indirect effects of livestock grazing on riparian and instream habitats include compacting stream substrates, destabilized streambanks, localized reduction or removal of herbaceous and woody vegetation along streambanks and within riparian areas, increased stream width/depth ratios, reduced pool frequency, promotion of incised channels, and lowered water tables (Platts 1991). Belsky *et al.* (1997) provides a review of these indirect influences on stream and riparian areas. Riparian areas in poor condition are unable to buffer the effects of accelerated runoff. Accelerated runoff can cause unstable stream channels to downcut or erode laterally, accelerating erosion and sediment production (Chaney *et al.* 1990). Lateral erosion results in progressively wider and shallower stream channels that have warmer water temperatures, less structure, and are less productive, thus adversely affecting fish populations. Streambank hoof shearing, hummocking, bank sloughing and inadequate carry-over vegetation reduces bank stability and silt filtration capacity (Kinch 1989, NMFS 2001c).

Increased water temperatures can result from the removal of stream bank vegetation that provides shade, and from shallow, slow-moving reduced water flows through open stream areas. Salmonid species do not usually persist in waters where maximum temperatures consistently exceed 22º C, although they can withstand brief periods of temperatures as high as 25º C if nighttime cooling occurs (Behnke and Zarn 1976, PNF 2001e).

2.2.1.4.1 Construct Fencing for Grazing Control

The primary proposed projects under this activity are the construction of permanent or temporary livestock exclusion fences and cross-fences. Individual fence posts will be pounded or dug using hand tools or augers on backhoes or similar equipment. Fence posts will be set in the holes, backfilled, and fence wire strung or wooden rails placed. Installation may involve the removal of native or non-native vegetation along the proposed fence line. Occasionally rustic wood X-shaped fence that does not require setting posts will be used.

BPA is proposing fencing construction to eliminate or reduce livestock degradation of streams, streambanks, lakeshores, riparian/wetland vegetation, and unstable upland slopes; reduce soil compaction and erosion; reduce fecal input to streams and wetlands; thereby improving riparian habitat function.

The following potential effects to listed species and their habitats associated with constructing fences for grazing controls - minor removal and trampling of vegetation, negligible erosion and sedimentation, and possible use of heavy equipment in the riparian area - are addressed under the general construction section (2.2.1.1). The construction of fences for grazing control will incorporate the conservation measures for general construction as applicable.

When fences are used to exclude livestock from a riparian area, use of the upland by livestock must be managed as necessary to ensure restoration of ecological links between the upland and aquatic areas, otherwise riparian recovery will be minimal. Thus, the use of corridor fencing to separate heavily a grazed pasture from a narrow riparian zone is unacceptable, unless upland grazing practices are simultaneously redesigned to reverse upland degradation. Where riparian zones are large enough to manage separately from the uplands, fences may be used to create a riparian pasture in which livestock may be managed specifically to meet riparian or aquatic restoration goals. The following conservation measures will avoid or minimize the adverse effects discussed above:

- Fenced enclosures and exclosures will be implemented in conjunction with a prescribed grazing plan that minimizes the impact to riparian areas. The prescribed management plan will follow the criteria, specifications, and operation and maintenance protocols of the National Resource Conservation Service (NRCS) Conservation Practice Standard 528a for prescribed grazing (NRCS 2000g).

- Modify grazing practices, such as the season and amount of use, that prevent attainment of salmon habitat quality indicators, as described above. In particular, insure that grazing use does not cause bank instability for more than 5% lineal bank distance (including both banks), or exceed more than 30% or the current year's growth of woody vegetation. Pasture moves will occur before these annual thresholds are reached.
- Manage the timing and distribution of livestock to ensure that they do not enter the specific stream reaches used by ESA-listed salmon or steelhead for spawning during times when reproductive adults, eggs, or pre-emergent fry are expected to be present.

Beneficial effects of constructing grazing control fences in or near streams include the rapid re-growth of grasses, shrubs, and other vegetation released from overgrazing and the reduction of excessive nitrogen, phosphorous, and sediment loads in the streams (Line *et al.* 2000, Brenner and Brenner 1998). Further, Owens *et al.* (1996) found that stream fencing has proven to be an effective means of maintaining appropriate levels of sediment in the streambed. Another documented, beneficial, long-term effect is the reduction in bankfull width of the active channel and the subsequent increase in pool area in streams (Magilligan and McDowell 1997). Both effects contribute to a more properly functioning habitat for listed species by providing additional spawning and cover habitat. When combined with other activities discussed in this programmatic opinion, such as vegetation planting and the creation of riparian buffers, this activity will be beneficial to the rehabilitation and preservation of stream and riparian habitat necessary for listed species.

2.2.1.4.2 Install Off-Channel Watering Facilities

The primary proposed water facility installation activities will consist of the construction of various low volume pumping or gravity fed systems to move water to a trough or pond at an upland site. Either above ground or underground piping will be installed between the troughs or ponds and the water source. Water sources will include springs and seeps, streams, or groundwater wells. Off-channel watering facility projects involving instream diversions from fish-bearing streams will be accomplished in accordance with Section 1.2.8.5, "Remove, Consolidate, or Improve Diversion Dams." Pipes will generally range from 0.5 to 4 inches, but may exceed 12 inches in diameter. Placement of the pipes in the ground will typically involve minor trenching using a backhoe or similar equipment.

BPA proposes to install off-channel watering facilities to preclude or limit the need for cattle to access a creek or wetland for drinking water. Implementation of this activity will eliminate or reduce livestock degradation of streams, streambanks, lakeshores, and riparian/wetland vegetation; reduce soil compaction and erosion; and reduce fecal input to streams and wetlands, thereby improving riparian habitat function.

The following potential effects to listed species and their habitats associated with water facility installation activities - minor removal and trampling of vegetation, negligible erosion and sedimentation, soil compaction, and possible use of heavy equipment in the riparian area - are addressed under the general construction section (2.2.1.1). The installation of off-channel water facilities will incorporate the conservation measures for general construction as applicable.

Livestock traveling to and from, and drinking at, an off-channel watering facility result in compacted soils and trampled vegetation. Livestock herds can alter soil permeability; reduce plant diversity to only the most stress-tolerant species, allowing for non-native species to establish; and, degrade naturally-existing slopes in the vicinity of the watering facility, leading to a less stable slope with greater erosive potential.

The following conservation measures will avoid or minimize the adverse effects discussed above:

- Off-channel livestock watering facilities will be located to minimize compaction and/or damage to sensitive soils, slopes, vegetation, or fish spawning habitat due to congregating livestock (NMFS 2002).
- Wherever feasible, place new livestock water developments and move existing water developments at least 0.5 miles away from riparian areas, unless livestock movement is otherwise limited by terrain.
- Ensure that each watering development has a float valve, fenced overflow area, return flow system, or other means, as necessary, to minimize water withdrawal and potential runoff and erosion.

Another direct effect of placing an intake to divert water from a stream is the potential for entrainment or injury of listed fish species. Also, the alternative of installing groundwater wells that pump from an aquifer that is in direct continuity with a stream, can significantly decrease the baseflow conditions of the stream, possibly reducing or eliminating breeding, feeding and shelter habitats for listed species. The following conservation measures will avoid or minimize the adverse effects discussed above:

- All intake screening projects will be consistent with NOAA Fisheries' Pump Intake Screen Guidelines[55] (NMFS 2002).
- Withdrawals from all new wells or other stock watering sources installed under this activity will not exceed 1 cfs and will be permitted by the appropriate state agency. Project biologists will verify clearance with agency contacts (NMFS 2002).

Beneficial impacts of installing off-channel watering facilities are similar to those of installing fencing for grazing control discussed above (Section 2.2.1.4.1).

[55] NMFS *Addendum: Juvenile Fish Screen Criteria for Pump Intakes* (May 9, 1996) at (http://www.nwr.noaa.gov/1hydrop/hydroweb/ferc.htm). NOTE: new criteria are currently being drafted by NOAA Fisheries (2003).

2.2.1.4.3 Harden Fords for Livestock Crossings of Streams

The hardening of fords for livestock crossings of streams will allow access to pastures and watering sources where livestock and other farm animals access and cross a stream channel on a somewhat infrequent basis. Culverts or bridges will be installed for frequent crossing locations in accordance with Section 2.2.1.8.2, "Bridge, Ford, and Culvert Maintenance, Removal, and Replacement." Hardening stream crossings will involve the placement of rock along the stream bottom.

Work will entail the use of heavy equipment, power tools, and/or hand crews. Additional use of fences will reduce straying off fords or watering areas into spawning gravels or large rearing pools. BPA is proposing to conduct these activities to eliminate or reduce livestock degradation of streams and streambanks and reduce soil compaction and erosion.

The following potential effects to listed species and their habitats associated with hardening fords for livestock stream crossings - minor removal of streambank vegetation; compaction of soil and disturbance of streambeds resulting in sedimentation, increased water turbidity, and increased flows and stream energy; fuel and other contamination from spills or use of heavy equipment in water; sedimentation and contamination from discharge of construction water; noise, and avoidance behavior; and changes in flows - are addressed under the general construction section (2.2.1.1). The hardening of fords for livestock stream crossings will incorporate the conservation measures for general construction as applicable.

The stream-crossing site can reduce or remove critical redd habitat if placed in or in close proximity to such habitat. Additionally, multiple stream crossings increase the potential for a negative effect on listed fish species and their habitats.

The following conservation measures will avoid or minimize the adverse effects discussed above:

- Minimize the number of crossings.
- Locate crossings to minimize compaction and/or damage to sensitive soils, slopes, or vegetation. Place fords on bedrock or stable substrates whenever possible (NMFS 2002).
- Do not place crossings in areas where ESA-listed salmon or steelhead spawn or are suspected of spawning, or within 300 feet upstream of such areas if spawning areas may be disturbed.
- Manage livestock to minimize time spent in the crossing or riparian area.

The placement of any type of stream crossing can inhibit fish passage from above and below the structure, cause debris jams, and divert streamflow during a flood or low flow. Bank cutting to install such crossings can destabilize streambank conditions, increasing the risk of a degraded channel habitat. However, when ford crossings are constructed properly they have been shown to have little to no difference in the overall movement of fish when compared to natural reaches of streams (Warren and Pardew 1998).

The following conservation measures will avoid or minimize the adverse effects discussed above:

- Design and construct or improve essential crossings to accommodate reasonably foreseeable flood risks, including associated bedload and debris, and to prevent the diversion of streamflow out of the channel and down the trail if the crossing fails (NMFS 1999).
- Stabilize bank cuts, if any, with vegetation and protect approaches and crossings with river rock (not crushed rock) when necessary to prevent erosion (NMFS 1999).
- Ensure that livestock crossings in and of themselves do not create barriers to the passage of adult and juvenile fish (NMFS 1999).

Hardening fords decreases the amount of total solids, total dissolved solids, and total suspended solids deposited in streams (Sample *et al.* 1998). Hardened ford stream crossings will consolidate livestock traffic, minimizing the amount of instream and adjacent habitat disturbed.

2.2.1.5 Control of Soil Erosion from Upland Farming

2.2.1.5.1 Implement Upland Conservation Buffers

The proposed activity of implementing upland conservation buffers will prevent soil from agricultural fields entering streams. Field borders of perennial vegetation will be created along edges of fields, consisting of shrub and/or herbaceous cover. Close-growing ground cover species will be planted to encircle areas that may serve as a source of sediment to prevent contamination of streams, rivers and lakes. Grassed waterways will be constructed with a swale cross-section to assure bank stability and retain vegetation, with vegetation suitable for conveyance of runoff. The criteria, plans and specifications, and operation and maintenance protocols of the following NRCS conservation practice standards will be followed:

- 332 Contour Buffer Strip (NRCS 1999)
- 380 Windbreak/Shelterbelt Establishment (NRCS 2002a)
- 386 Field Border (NRCS 1999d)
- 393 Filter Strip (NRCS 1999b)
- 412 Grassed Waterway (NRCS 2000b)
- 601 Vegetative Barriers (NRCS 2001)

BPA is proposing to conduct these activities to reduce sediment and nutrient pollution from upland agricultural lands to streams, and to provide a contributing mechanism for farmers and ranchers to meet the water quality requirements established under Federal and state laws.

Most of the adverse effects of these activities will be limited to upland agricultural land and therefore will have no or negligible impact on listed species habitat. When these techniques are initially implemented on or near a slope adjacent to stream habitat, erosion can contribute to increased stream turbidity, and filling of gravels with fine sediment. Minimizing the amount of sediment, nutrients, and herbicides entering stream systems will not be fully accomplished unless riparian buffer systems are in place directly adjacent to listed fish habitat to filter runoff from the agricultural fields.

The following conservation measure addresses the adverse effects discussed above:

- Implement these activities in combination with a riparian forest buffer (NRCS measure 391) (NRCS 2000e) wherever trees and/or shrubs can grow, or a riparian herbaceous cover (NRCS measure 390) (NRCS 1998) where analysis of available information (e.g., historical accounts, photographs, or USDA Plant Association Groups) indicates that no trees or shrubs, including willow (*Salix spp.*), existed on the site within historic times. Installation and management of the full range of field and landscape buffers will be encouraged by BPA as necessary to address small but unavoidable pollutant discharges associated with active agricultural operations, catastrophic pollution-associated episodic storm events, and other landscape level concerns.

Conservation buffers are designed to filter and absorb excess nutrients and prevent agricultural sediment from entering the stream channel. Filter strips are an effective means of removing excess nitrogen, as a byproduct of livestock manure and fertilizer, both from surface and subsurface flows (Verchot *et al.* 1997, 1997a, Eghball *et al.* 2000). Additionally, grassed waterways planted over 15 years ago can reduce and continue to stabilize the erosive qualities of adjacent agricultural fields by retaining a significant amount of soil (Alberts *et al.* 2001).

2.2.1.5.2 Implement Conservation Cropping Systems

The proposed activity involves the implementation of residue management, cropping practices, and nutrient management practices. Conservation tillage and no-till direct seeding methods will be used to minimize tilling of agricultural fields. Crops will be arranged so that close-growing crops or grasses alternate with bands of clean-tilled crops. The contour of the land will be followed during all preparation, planting, and cultivation of crops. Slopes will be altered to create a stair-step or inclining ridge and swale appearance. Green manure crops and grasses and legumes will be planted in rotation to increase organic matter in the soil and reduce the need for synthetic fertilizers. The following NRCS Conservation Practice Standards will be followed:

- 329a Residue Management, No-till and Strip Till (NRCS 2000c)
- 329b Residue Management – Mulch Till (NRCS 1999a)
- 328 Conservation Crop Rotation (NRCS 2000f)
- 330 Contour Farming (NRCS 2000a)
- 585 Contour Strip Cropping (NRCS 2000)

- 590 Nutrient Management (NRCS 1999e)
- 777 Residue Management Direct Seed (NRCS 2000h)
- 586 Stripcropping (NRCS 2002b)

BPA is proposing to conduct these activities to reduce sediment and nutrient pollution from upland agricultural lands to streams, and to provide a contributing mechanism for farmers and ranchers to meet the water quality requirements established under Federal and state laws.

Most of the direct effects of these activities will be limited to upland agricultural land and therefore will have no or negligible impact on listed species habitat. These agricultural practices will result in periodic disturbances to upland soils, although the amount of disturbance will not increase from the existing (no lands will be converted to agricultural use under this activity). When these techniques are used on or near a slope adjacent to stream habitat, erosion can contribute to increased stream turbidity, and filling of gravels with fine sediment. The implementation of no-till or minimal-till farming often requires farmers to use more fertilizers and herbicides than normal till farming. Minimizing the amount of sediment and nutrients lost from agricultural lands and entering stream systems will not be fully accomplished unless riparian buffer systems are in place directly adjacent to listed fish habitat.

The following conservation measures address the adverse effects discussed above:

- Employ conservation tillage and residue management practices that leave 30% or more of the previous crop residue on the soil surface after planting, as feasible, to reduce erosion potential.
- Implement these activities in combination with a riparian forest buffer (NRCS measure 391) (NRCS 2000e) wherever trees and/or shrubs can grow, or a riparian herbaceous cover (NRCS measure 390) (NRCS 1998) where analysis of available information (*e.g.,* historical accounts, photographs, or USDA Plant Association Groups) indicates that no trees or shrubs, including willow (*Salix spp.*), existed on the site within historic times. Installation and management of the full range of field and landscape buffers will be encouraged by BPA as necessary to address small but unavoidable pollutant discharges associated with active agricultural operations, catastrophic pollution-associated episodic storm events, and other landscape level concerns.
- Employ nutrient management practices to increase the efficiency of fertilizer inputs and decrease the transport of nutrients to ground and surface water. Nutrients will be applied at an agronomic rate.[56]

[56] "Agronomic rate" means a quantity and timing of total nutrient application that does not exceed the requirements of the crop production and harvest or grazing system, as opposed to a nutrient application rate based on production goals that are difficult to define and variable. Calculation of the agronomic rate should take into account the total nitrogen or phosphorus resources for plant nutrition, and any retention of phosphorus in the soil and losses of nitrogen through dentrification and ammonia volatilization.

- Employ vegetation management practices, including nonchemical vegetation control measures, that will reduce losses dues to herbicide contamination during transport, handling, and use, and nonpoint pollution losses after use.[57]

Beyond the short-term detrimental effects of ground disturbance to plant and rotate crops, the indirect long-term effects will be beneficial to the farmer, the agricultural land, and to adjacent riparian and stream habitat. Wagner (1997) indicates that the multiple uses of green manure make it an invaluable resource to farmers who cannot afford to purchase chemical fertilizers. Crop rotation reduces the amount of time soil could erode off site due to plant roots ability to retain soil. The retention of soil in upland habitats minimizes erosion into streams improving water quality for listed species (Kuo *et al.* 2001). Additionally, the legumes and green manure contribute to the fixation of atmospheric nitrogen, which serves as a natural fertilizer for the land (Kuo *et al.* 2001). Further, Biederbeck *et al.* (1996) states that when compared to chemically fertilized plots of land, plots with legume and manure rotation yield more productive crops.

2.2.1.5.3 Soil Stabilization by Planting and Seeding

The proposed activity is planting or seeding pastures and rangelands with native or adapted perennial and biannual vegetation. The ground will be scarified as necessary to promote seed germination. In areas with severe erosion or high erosion potential, trees, shrubs, vines, grasses, and legumes will be planted to stabilize soils. Since noxious weeds, nonnative invasive plants, and aggressive, weedy species can take over disturbed lands and degrade range values, vegetation will be controlled through the use of herbicide applications, mechanical removal, and hand pulling. Plant control activities will be conducted in accordance with the descriptions and conservation measures in Section 2.2.1.7, "Native Plant Community Establishment and Protection."

Planting and seeding will be accomplished, as appropriate, in accordance with:

- The applicable best management practices outlined in the NRCS Conservation Practice Standards in sections 2.2.1.5.1 and 2.2.1.5.2 above; and
- Sloping Agricultural Land Technology (SALT) to reduce erosion and soil loss on sloping lands (Escano and Tababa 1998).

BPA is proposing to conduct soil stabilization by planting and seeding to reduce sediment pollution from upland agricultural lands to streams and to provide a contributing mechanism for farmers and ranchers to meet the water quality requirements established under Federal and state laws.

Most of the direct effects of these activities will be limited to upland agricultural land and therefore will have no or negligible impact on listed species habitat. These agricultural practices will result in a short-term disturbance to upland soils. When these techniques are used on or near a slope adjacent to stream habitat, erosion can contribute to increased

[57] Take of ESA-listed species caused by any aspect of pesticide use is not included in this HIP consultation and must be evaluated in an individual consultation if it is funded by BPA.

stream turbidity, and filling of gravels with fine sediment. Minimizing the amount of sediment and nutrients lost from agricultural lands and entering stream systems will not be fully accomplished unless riparian buffer systems are in place directly adjacent to listed fish habitat. Site preparation is also the most opportune time for invasive, non-native species to establish in a habitat due to the lack of competition with other plants.

The proposed activity will avoid or minimize the adverse effects discussed above with the following conservation measure:

- Implement the applicable conservation measures in sections 2.2.1.5.1 and 2.2.1.5.2 above.

The long-term benefits of established plant communities include their ability to retain the soil even on steep grades, and in doing so, retain nutrients. The conversion of agricultural land to permanent vegetation or the seeding of overgrazed land can also provide cover for wildlife species, providing optimum temperature and shelter, and ultimately acting as food source for some species. Over the long term, in conjunction with other activities described in this Opinion, such as constructing off-site water facilities and livestock fencing, these actions will contribute to a more properly functioning habitat for fish and wildlife.

2.2.1.5.4 Implement Erosion Control Practices

The proposed activities include the creation of small impoundments with water detention and release capabilities in natural swales in uplands. Water will be released from the top of the water column so that sediment is retained. This practice will be applied where physical conditions or land ownership preclude treatment of a sediment source by the installation of erosion-control measures to keep soil and other material in place, or where a sediment basin offers the most practical solution to the problem. The criteria, plans and specifications, and operation and maintenance protocols of the following NRCS conservation practice standards will be employed:

- 342 Critical Area Planting (NRCS 2002)
- 350 Sediment Basin (NRCS 1978)
- 362 Diversion (NRCS 2001a)
- 410 Grade Stabilization Structure (NRCS 1985a)
- 683 Water and Sediment Control Basins (NRCS 1985)

BPA is proposing to conduct these activities to trap and contain water and sediment from uplands prior to entering streams, to prevent sediment from entering fish-bearing streams, and to retain runoff for release during low streamflow periods in late summer and fall.

Most of the direct and indirect effects of these activities will be limited to upland agricultural land and therefore will have no or negligible impact on listed species habitat. When construction occurs on or near a slope adjacent to stream habitat, erosion will contribute to increased stream turbidity, and filling of gravels with fine sediment. Minimizing the sediment and nutrients lost from agricultural lands and from entering stream systems will not be fully accomplished unless riparian buffer systems are in place directly adjacent to listed fish habitat.

- Implement these activities in combination with a riparian forest buffer (NRCS measure 391) (NRCS 2000e) wherever trees and/or shrubs can grow, or a riparian herbaceous cover (NRCS measure 390) (NRCS 1998) where analysis of available information (*e.g.,* historical accounts, photographs, or USDA Plant Association Groups) indicates that no trees or shrubs, including willow (*Salix spp.*), existed on the site within historic times. Installation and management of the full range of field and landscape buffers will be encouraged by BPA as necessary to address small but unavoidable pollutant discharges associated with active agricultural operations, catastrophic pollution-associated episodic storm events, and other landscape level concerns.

Beneficial indirect effects associated with the construction of retention/detention basins includes the ability of these structures to effectively reduce the amount of sediment erosion from upland agricultural fields into adjacent water bodies (Baade, 2001). Along with the sediment, excessive nutrients from agricultural fertilizer and livestock are retained from entering stream systems (Rushton and Bahk 2001). Further, the slow but steady return of retention water from basins to nearby streams during low flow conditions can extend stream flow conditions necessary for listed species, extending the time for adult migration, and reducing the chance of stranding fish.

2.2.1.6 Irrigation and Water Delivery/Management Actions

2.2.1.6.1 Convert Delivery System to Drip or Sprinkler Irrigation

Under this proposed activity, flood or furrow irrigation systems will be converted to drip or sprinkler irrigation and education will be provided to irrigators on ways to make their systems more efficient. This proposed activity will involve the installation of pipe, possibly trenched and buried into the ground, and possibly pumps to pressurize the system. The criteria, plans and specifications, and operation and maintenance protocols of the NRCS conservation practice standards for Irrigation System - Sprinkler (NRCS 1987) will be employed. The purpose of this proposed activity is to increase the amount of instream flow for fish and to increase riparian functions.

The following potential adverse effects to listed species and their habitats associated with irrigation conversion activities - minor removal and trampling of vegetation, negligible erosion and sedimentation, and possible use of heavy equipment in the riparian area - are addressed under the general construction section (2.2.1.1). The irrigation conversion activities will incorporate the conservation measures for general construction as applicable.

There would not be any additional direct effects on fish or their habitat from this activity. Drip and sprinkler irrigation system indirect effects include the conservation of water instream. Much less water is needed to irrigate crops via drip or sprinkler irrigation than via flood irrigation because there is less water lost through evaporation, and because the application is more precise. The delivery of the water can be controlled to meet the needs of the plants without wastage. Drip irrigation technology can also incorporate agricultural wastewater and water from retention/detention basins, serving to further reduce the amount of water that must be withdrawn from streams (Trooein *et al.* 2000, Venhuizen 1998). The application of water via drip and sprinkler irrigation can also significantly reduce the amount of soil erosion and nutrient and pesticide runoff that is normally associated with furrow irrigation systems (Ebbert and Kim 1998).

2.2.1.6.2 Convert Water Conveyance from Open Ditch to Pipeline or Line Leaking Ditches and Canals

Under this proposed activity, open ditch irrigation water conveyance systems will be replaced with pipelines to reduce evaporation and transpiration losses. Leaking irrigation ditches and canals will be converted to pipelines or lined with concrete, bentonite, or appropriate lining materials. The criteria, plans and specifications, and operation and maintenance protocols of the NRCS conservation practice standards for irrigation water conveyance dealing with galvanized steel ditch and canal lining (NRCS 1977); flexible membrane ditch and canal lining (NRCS, 1980), nonreinforced concrete ditch and canal lining (NRCS 1985b); aluminum tubing pipeline (NRCS 1988); asbestos-cement pipeline (NRCS 1988a); and high-pressure, underground, plastic pipeline (NRCS 1988b) will be employed. The purpose of this activity is to increase the amount of in-stream flow for fish and to increase riparian functions.

The following potential effects to listed species and their habitats associated with irrigation conveyance activities - minor removal and trampling of vegetation, negligible erosion and sedimentation, and possible use of heavy equipment in the riparian area - are addressed under the general construction section (2.2.1.1). The irrigation conveyance activities will incorporate the conservation measures for general construction as applicable.

There would not be any additional direct effects on fish or their habitat from this activity. The indirect effects include the conservation of water instream to improve fish habitat. Less water is needed to deliver irrigation water via pipelines or lined ditches and canals than via unlined open ditches or canals, since the conveyance losses are smaller. Pipelines also eliminate water losses via evaporation. The replacement of canals with pipelines will significantly reduce the amount of herbicides and fertilizers entering streams, as these substances can easily drain to streams through open ditch networks in agricultural fields (Louchart *et al.* 2001). The lining of leaking ditches will cover exposed soil, reducing the erosion of sediment from unlined ditch bottoms, sides, and berms. Lining of ditches will also decrease the colonization potential of invasive species, which typically establish on bare, disturbed sites.

2.2.1.6.3 Convert from Instream Diversions to Groundwater Wells for Primary Water Source

Under this proposed activity, wells will be drilled as an alternative water source to surface water withdrawals. Water from the wells will be pumped into ponds or troughs for livestock, or used to irrigate agricultural fields. Instream diversion infrastructure will be removed or downsized, if feasible. The criteria, plans and specifications, and operation and maintenance protocols of the Natural Resources Conservation Service (NRCS) conservation practice standards for waterwell code (NRCS 1999c) will be employed. The purpose of this activity is to increase the amount of in-stream flow for fish and to increase riparian functions.

The following potential effects to listed species and their habitats associated with conversion from instream diversion to groundwater well activities - minor removal and trampling of vegetation, negligible erosion and sedimentation, and possible use of heavy equipment in the riparian area - are addressed under the general construction section (2.2.1.1). The conversion from instream diversion to groundwater well activities will incorporate the conservation measures for general construction as applicable.

There would not be any additional direct effects on fish or their habitat from this activity. The indirect effects include the conservation of water instream to improve fish habitat. The irrigation water would come from groundwater, leaving more water instream for fish habitat. However, if wells are not well regulated, pump rates can significantly reduce the level of the local water table and create a deficit in the groundwater budget. Other indirect effects include significantly reduced risks of fish passage problems, injury, or death if the instream diversion is removed, and eliminating the need to periodically maintain an instream diversion system over the long term, which reduces the risk of ongoing disturbance to listed fish habitat.

In addition to the conservation measures for construction mentioned above, the following conservation measure will further minimize the adverse effects discussed above:

- All new wells installed under this activity will obtain applicable permits from the appropriate state agency (NMFS 2002).

2.2.1.6.4 Install New or Upgrade/Maintain Existing Fish Screens

The proposed activity involves maintaining, designing or replacing fish screens to prevent salmonids of all life stages from swimming or being entrained into the irrigation system. Intake pipes or discharges will be screened with mesh sizes small enough to prevent access to the withdrawal and outlet structures. Salmonids will be prevented from becoming entrained or impinged by improperly designed screens. Periodic maintenance of fish screens will be conducted to ensure their proper functioning, *e.g.,* cleaning debris buildup, and replacement of parts. BPA is proposing to conduct these activities to reduce losses of juvenile fish and food organisms from entrainment into inadequately screened or unscreened diversions. Work may entail use of heavy equipment, power tools, and/or hand crews.

The following potential effects to listed species and their habitats associated with fish screening activities - minor removal and trampling of vegetation; possible use of heavy equipment in the riparian area; sedimentation and contamination from discharge of construction water; stress to fish from capture and release from coffered areas during isolation of instream work areas; noise; and avoidance behavior - are addressed under the general construction section (2.2.1.1). The fish screening activities will incorporate the conservation measures for general construction as applicable.

One direct effect of the proposed activity is the injury of fish from improperly designed screens. Improper design flows can result in the entrainment and subsequent injury of fish. Juvenile fish can also be sucked into irrigation diversions and stranded if the mesh size of the screen is too large. Also, the unregulated flow of water into irrigation diversions can reduce baseflow conditions in waterways, fragmenting and reducing the spawning and resting habitat of listed species.

The following conservation measures will avoid or minimize these adverse effects:

- All fish screening projects will be consistent with NOAA Fisheries' Juvenile Fish Screen Criteria (NMFS 1995b), and all intake-screening projects will be consistent with NOAA Fisheries' Pump Intake Screen Guidelines[58] (NMFS 1996) (NMFS 2002).
- All fish screens will be sized to match the owner's documented or estimated historic water use.

Improperly designed fish screen projects can impede fish migration pathways, thereby affecting the timing of normal spawning periods for adult fish and inhibiting fish from finding protective cover. The following conservation measure will minimize this potential adverse effect:

- All passage will be designed in accordance with NOAA Fisheries "Anadromous Salmonid Passage Facility Guidelines and Criteria" (NOAA Fisheries 2003) including the described interactive design process with NOAA Fisheries Engineering staff.

The proposed fish screening activities will reduce the risk for fish being entrained or sucked into irrigation systems. Well-designed fish screens and associated diversions ensure that fish injury or stranding is minimized and fish are able to migrate through stream systems at the normal time of year.

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[58] NMFS (National Marine Fisheries Service), *Juvenile Fish Screen Criteria* (revised February 16, 1995) and *Addendum: Juvenile Fish Screen Criteria for Pump Intakes* (May 9, 1996) (guidelines and criteria for migrant fish passage facilities, and new pump intakes and existing inadequate pump intake screens) (http://www.nwr.noaa.gov/1hydrop/hydroweb/ferc.htm). NOTE: new criteria are currently being drafted by NOAA Fisheries (2003).

An indirect effect of this activity is the ongoing need for maintenance of the structures. This maintenance often requires the irrigators to either conduct work instream or shut down the stream or diversion, creating the possibility of fish stranding. The following conservation measure will address this potential adverse effect:

- Operation and maintenance of fish passage structures will be conducted in accordance with the operation and maintenance plan outlined on Form 1 in Appendix A.

2.2.1.6.5 Remove, Consolidate, or Improve Irrigation Diversion Dams

Under this proposed activity, push-up dams will be replaced with permanent structures or pumping stations that improve fish passage and habitat. The installation of instream infiltration galleries is not included under this Opinion at this time. Multiple diversions may be replaced with one permanent diversion or pumping station. Diversion dams will be removed or improved where they are barriers to fish passage, have created unacceptable habitat modifications, or are causing sediment concerns through deposition behind the dam or downstream scour. They will also be removed where they are abandoned, in need of repair, or are considered unnecessary to meet demand. Projects will be supported by watershed-based analyses with the involvement of multiple owners and users. Coordination with appropriate local governments, irrigation districts, and state and Federal agencies will be required. Periodic maintenance of irrigation diversions will be conducted to ensure their proper functioning, *e.g.,* cleaning debris buildup and replacement of parts. Work will entail use of heavy equipment, power tools and/or crew.

The purpose of this proposed activity is to reduce the number of diversions (*e.g.,* push-up dams) on streams and thereby conserve water and improve habitat for fish; to improve the design of diversions to allow for fish passage and adequate screening; and/or to reduce the annual in-stream construction of push-up dams.

The following potential effects to listed species and their habitats associated with irrigation diversion dam activities - exposure of bare soil and reduction or elimination of large woody debris, shade, slope and bank stability, and sediment filtering habitat functions due to removal of streambank vegetation; compaction of soil and disturbance of streambeds resulting in sedimentation, increased water turbidity, and increased flows and stream energy; fuel and other contamination from spills or use of heavy equipment in water; sedimentation and contamination from discharge of construction water; stress to fish from capture and release from coffered areas during isolation of instream work areas, noise, and avoidance behavior; and changes in flows - are addressed under the general construction section (2.2.1.1). The irrigation dam diversion activities will incorporate the conservation measures for general construction as applicable.

In addition to the general construction effects, one direct effect of replacing irrigation diversion dams with new ones is that fish passage can be limited or completely blocked if fish passage is not properly taken into consideration in the design, which can lead to disorientation and stranding of listed fish within the irrigation system (Helfrich *et al.* 1999). Also, the unregulated flow of water into irrigation diversions can reduce baseflow conditions in waterways, fragmenting and reducing the spawning and resting habitat of listed species.

The potential adverse effects discussed above will be addressed through the following conservation measures:

- The design of the proposed irrigation diversion structure will enable the irrigators to comply with all appropriate state water right agency rules and regulations. No new or replacement diversion structure will be sized to exceed the amount of the irrigators' documented or estimated historic water use (NOAA Fisheries 2002a).
- Diversion structures will be designed and screened to meet NOAA Fisheries' criteria[59] (NMFS 1995b, 1996 and "Anadromous Salmonid Passage Facility Guidelines and Criteria" NOAA Fisheries 2003) including the described interactive design process with NOAA Fisheries Engineering staff (NMFS 2002).
- Project design will include the installation of a totalizing flow meter device on all diversion structures for which installation of this device is possible (NOAA Fisheries 2002a).

Other direct effects associated with removing and consolidating diversion dams include the release of large amounts of bedload materials (boulders, cobbles, gravels, sand and silt) as the dams are notched or removed, which will cause immediate effects on sedimentation and turbidity, and dam debris input into the stream channel during dam removal. A release of bedload behind the dams may degrade instream habitat in the short term (Spence *et al.* 1996) as the stream absorbs and assimilates the bedload, but this will eventually contribute to enhanced downstream habitat conditions.

The indirect effects include the conservation of water instream to improve fish habitat. As an indirect effect, existing refugia and resting cover will be disturbed, but will reestablish as the channel adjusts to the changes (NOAA Fisheries 2002d). Long-term effects include increased access to spawning, rearing and migration habitat due to the elimination of annual push-up dam construction, increased gravel recruitment for spawning downstream of the dam sites as a result of dam removal and free bedload movement, and increased floodplain connectivity and channel migration capability that will likely produce an increase of off-channel habitat production and function.

Another indirect effect of this activity is the ongoing need for maintenance of the structures. This maintenance often requires the irrigators to either conduct work instream or shut down the stream or diversion, creating the possibility of fish stranding. The following conservation measure will address this potential adverse effect:

- Operation and maintenance of irrigation diversion structures will be conducted in accordance with the operation and maintenance plan outlined on Form 1 in Appendix A.

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[59] ibid

2.2.1.6.6 Install or Replace Return Flow Cooling Systems

The primary proposed return flow cooling systems activities include the replacement of aboveground pipes and open ditches that return tailwater from flood-irrigated fields back to the river. Return flow cooling systems will be constructed by trenching and burying a network of perforated PVC pipes that will collect irrigation tailwater below ground, eliminating pools of standing water in the fields and exposure of the water to direct solar heating. No instream work is involved except for installing the drain pipe outfall; most work will be in uplands or in riparian buffer areas that are already plowed or grazed. BPA is proposing to conduct these activities to reduce temperatures of return flows from irrigation systems, and possibly to reduce instream temperatures in localized areas.

The following potential effects to listed species and their habitats associated with return flow cooling system activities - minor removal and trampling of vegetation; possible use of heavy equipment in the riparian area; sedimentation and contamination from discharge of construction water; stress to fish from capture and release from coffered areas during isolation of instream work areas; noise; and avoidance behavior - are addressed under the general construction section (2.2.1.1). The return flow cooling system activities will incorporate the conservation measures for general construction as applicable.

Beyond the direct effects associated with general construction activities, the long-term indirect effects of installing or replacing return flow cooling systems include the return of cool water to streams to maintain stream channel conditions that can support listed species' habitat. The underground pipes collect and transport excess irrigation water back to the streams below ground, thereby reducing the accumulation of this water on the surface. This should lead to a reduction in heating of this water from solar radiation (NOAA Fisheries 2002d). A potential adverse long-term effect of using return flow cooling systems is the leaching of chemicals from agricultural fields into the return water, thereby contributing to the eutrophication of streams. However, the implementation of this activity in conjunction with other agricultural activities addressed in this Opinion, such as the use of green manure crops, will result in a positive long-term effect for listed species habitat.

2.2.1.7 Native Plant Community Establishment and Protection

2.2.1.7.1 Vegetation Planting

The primary proposed vegetation-planting activities include planting trees, shrubs, herbaceous plants, and aquatic macrophytes to help stabilize soils. A vegetation plan will be developed that is responsive to the biological and physical factors at the site. Large trees such as cottonwoods and conifers will be planted in areas where they historically occurred but are currently either scarce or absent. Plants and seeds will be obtained from local sources to ensure plants are adapted to local climate and soil chemistry. Planting sites will be prepared by cutting, digging, grubbing roots, scalping sod, decompacting soil as needed, and removing existing vegetation. Woody debris, wood chips, or soil at select locations will be used to alter microsites. Plants will be fertilized, mulched, and stems wrapped to protect from rodent girdling. Buds will be capped to protect plants from herbivores. Work may entail use of heavy equipment, power tools, and/or hand crews.

BPA is proposing to conduct these activities to recover watershed processes and functions associated with native plant communities, such as thermal and microclimate regulation, hydrologic and nutrient cycling, channel formation and sediment storage, soil development and stability, flood energy dissipation and filtering; and to provide feeding, breeding, and sheltering habitat for native wildlife.

The following potential effects to listed species and their habitats associated with vegetation planting activities - possible use of heavy equipment in the riparian area and vegetation removal if regrading is necessary; and negligible erosion and sedimentation - are addressed under the general construction section (2.2.1.1). The vegetation planting activities will incorporate the conservation measures for general construction as applicable.

Site-specific biological and physical information is necessary to create and implement vegetation plans that will result in properly functioning habitat. Vegetation plans will be prepared that:

- Require the use of native species.
- Specify seed/plant source, seed/plant mixes, soil preparation, *etc.,* (NPS 2001),
- Include vegetation management strategies that are consistent with local native succession and disturbance regimes (USFWS 1999).
- Address the abiotic factors contributing to the sites' succession, *i.e.,* weather and disturbance patterns, nutrient cycling, and hydrologic condition.
- Specify only certified noxious weed-free seed, hay, straw, mulch, or other vegetation material for site stability and revegetation projects.

Vegetation plantings will improve fish habitat in the long term by improving bank stabilization, encouraging pool development, and by providing terrestrial insect drop for fish. Increased shading by the larger plants will lead to a reduction of water temperatures (NMFS 2001h). Additionally, plantings of native shrubs and trees will allow large wood to develop over time, and will provide future sources of recruitment (NOAA Fisheries 2002c).

2.2.1.7.2 Vegetation Control by Physical Means

The primary proposed activities for vegetation management by physical control are:

- Manual. Manual control includes hand pulling and grubbing with hand tools; bagging plant residue for burning or other proper disposal; mulching with organic materials; shading or covering unwanted vegetation; controlling brush and pruning using hand and power tools such as chain saws and machetes; using grazing goats.
- Mechanical. Mechanical control includes techniques such as mowing, tilling, disking, or plowing. Cables and chains attached between vehicles may also be used to clear

vegetation. Mechanical control may be carried out over large areas or be confined to smaller areas (known as scalping).

BPA is proposing to conduct these activities to control or eliminate non-native, invasive plant species that compete with or displace native plant communities, to:

- Maximize habitat processes and functions associated with native vegetation diversity, form, structure, and decomposition.
- Recover watershed processes and functions associated with native plant communities, such as thermal and microclimate regulation, hydrologic and nutrient cycling, channel formation and sediment storage, soil development and stability, flood energy dissipation and filtering.
- Provide feeding, breeding, and sheltering habitat for native wildlife.

Work may entail use of heavy equipment, power tools, and/or hand crews.

The following potential effects to listed species and their habitats associated with physical vegetation control activities - possible use of heavy equipment in the riparian area, vegetation removal, and negligible erosion and sedimentation - are addressed under the general construction section (2.2.1.1). The physical vegetation control activities will incorporate the conservation measures for general construction as applicable.

The use of manual control for treating sensitive areas (*i.e.,* riparian areas, special status plant populations, developed recreation sites), and spot control of individual plants and small patches reduces the need to use herbicides that may adversely affect fish. However, manual control is not necessarily effective in all areas, and in some cases may result in the spread of noxious weeds. Disposing of noxious weeds improperly can lead to the spread of the weeds in other areas, simply displacing the problem to another site (PNF 2001e).

The following conservation measures will avoid or minimize the adverse effects discussed above:

- When possible, manual control (*e.g.,* hand pulling, grubbing, cutting) will be used in sensitive areas to avoid adverse effects to listed species or water quality. (PNF 2001e).
- All noxious weed material will be disposed of in a manner that will prevent its spread. Noxious weeds that have developed seeds will be bagged and burned (PNF 2001e).

Disking, plowing, mowing, and tilling can disturb stream habitats by introducing additional sediment. The risk increases if such activities are carried out on slopes adjacent to stream habitats. The following conservation measures will avoid or minimize the adverse effects associated with mechanical control that disturbs soil:

- For mechanical control that will disturb the soil, an untreated or modified treatment area will be maintained within the immediate riparian buffer area to prevent any potential adverse effects to stream channel or water quality conditions. The width of the untreated riparian buffer area will vary depending on site-specific conditions and type of treatment (NMFS 2001g).

- Ground-disturbing mechanical activity will be restricted in established buffer zones (USDA 1997) adjacent to streams, lakes, ponds, wetlands and other identified sensitive habitats based on percent slope. For slopes less than 20%, a buffer width of 35 feet will be used. For slopes over 20% no ground-disturbing mechanical equipment will be used (BPA 2000).

The indirect effects of the proposed activities will include the enhancement of native plant species and improvement of stream bank stability and riparian condition toward achieving properly functioning salmonids habitat. Native plant re-establishment will result in less maintenance of vegetation over time and therefore its associated disturbance will be minimized. Plowing will improve a degraded or non-native community by turning up the native seed bank, if one exists, creating a potential for a native community to return to the site (Sprenger *et al.* 2002). The indirect effects of mowing have shown an actual increase in plant diversity and the subsequent decline of non-native species in some wetland communities (Gusewell *et al.* 1998).

2.2.1.7.3 Vegetation Management by Herbicide Use

The primary proposed activities for vegetation management by herbicide use are to apply herbicides in liquid or granular form through the use of wand or broom sprayers mounted on or towed by trucks, backpack equipment containing a pressurized container with an agitation device, injection, hand wicking cut surfaces, and ground application of granular formulas. Herbicides will be mixed with water as a carrier (no oil-based carriers will be used) and may also contain a variety of adjuvants (additives) to promote saturation and adherence, to stabilize, or to enhance chemical reactions.

During 2003, BPA sponsors plan to treat about 2880 acres of upland properties and about 975 acres of riparian properties. Of these, approximately 780 acres of upland properties and about 395 acres of riparian properties occur in watersheds with anadromous fish. Table 1-4 shows the BPA-funded project proposals for 2003 that would occur in watersheds with anadromous fish. These projects are mainly for noxious weed control of wildlife mitigation and management areas, however, some of the projects include reestablishment of native vegetation. A more detailed description of the proposed projects, including 6th field HUC locations, is located in Appendix C.

For the Opinion, BPA proposes to use only the products evaluated in risk assessments by the US Forest Service (http://www.fs.fed.us/foresthealth/pesticide/risk). BPA addressed the use and effects of the proposed herbicides in its Final Transmission System Vegetation Management EIS (BPA 2000). BPA proposes to use the herbicides in Table 2-3 below for vegetation management (see Section 1.2.9.3 for more detail).

Table 2-3. Herbicides Proposed for Use by BPA

Common Name	Trade Name	Typical Application Rates (ai/ac)	Maximum Label Application Rate (ai/ac)	General Geographic Application Areas	Aquatic Level of Concern (See Table F-2 in Appendix F)
2,4-D (amines)	Many	0.5-1.5 lb	4.0 lb	Upland and Riparian	Low[1]
Chlorsulfuron	Telar®	0.25-1.33 oz	3.0 oz	Upland	Low
Clopyralid	Transline®	0.1-0.375 lb	0.5 lb	Upland and Riparian	Low
Dicamba	Banvel®	0.25-7.0 lb	8.0 lb	Upland and Riparian	Moderate
Glyphosate 1 Glyphosate 2	Many Many	0.5-2.0 lb 0.5-2.0 lb	3.75 lb 3.75 lb	Upland and Riparian Upland	Low[1] Moderate
Metsulfuron methyl	Escort®	0.33-2.0 oz	4.0 oz	Upland	Low
Picloram	Tordon®	0.125-0.50 lb	1 lb	Upland	Moderate
Sulfometuron methyl	Oust®	0.023-0.38 oz	2.25 oz	Upland	Low
Triclopyr (TEA)	Garlon 3A®	1.0-2.5 lb	9.0 lb	Upland and Riparian	Low[1]

[1] USEPA Registered for aquatic use.

Adjuvants BPA proposes to use in this consultation are listed in Table 2-4. The use areas and amount of colorants, surfactants, and drift retardants will be in accord with Table 2-4.

Table 2-4. Adjuvants Proposed for Use by BPA

Type Adjuvant	Trade Name	Labeled Mixing Rates per Gallon of Application Mix	General Geographic Application Areas	Aquatic Level of Concern (See Table F-4 in Appendix F)
Colorants	Dynamark™ U.V. (red)	0.1 fl oz	Riparian	Low (Food Grade)
	Dynamark™ U.V. (yel)	0.1 fl oz	Riparian	Low (Food Grade)
	Dynamark™ U.V. (blu)	0.5 fl oz	Upland	Moderate (Non-Crop Use)
	Hi-Light® (blu)	0.5 fl oz	UpLand	Moderate (Non-Crop Use)
Surfactants	Activator 90®	0.16 – 0.64 fl oz	Upland	Moderate[1]
	Agri-Dex®	0.16 – 0.48 fl oz	Riparian	Low[1]
	Entry II®	0.16 – 0.64 fl oz	Upland	High
	Hasten®	0.16 – 0.48 fl oz	Riparian	Low[1,2]
	LI 700®	0.16 – 0.48 fl oz	Riparian	Moderate [1,2]
	R-11®	0.16 – 1.28 fl oz	Riparian	Moderate[1]
	Super Spread®	0.16 – 0.32 fl oz	Riparian	Low
	Syl-Tac®	0.16 – 0.48 fl oz	Upland	Moderate
	Generic POEA	Pre-formulated	Upland	High
Drift Retardants	41-A®	0.03 – 0.06 fl oz	Riparian	Low
	Valid®	0.16 fl oz	Upland	Moderate

[1] USEPA Registered for aquatic use in California.
[2] USEPA Registered for aquatic use in Washington.

Application Methods

Liquid or granular forms of herbicides would be applied either with machinery or by hand. Mechanized application would be done with vehicle-mounted (pick-up, 4-wheeler, or tractor) fixed-booms, or spray guns. Hand application methods to be used are: (1) Spot-spraying with hand-held spray nozzles either mounted on a vehicle or attached to a backpack system; (2) hand-spreading granular formulations, and (3) wicking, wiping, dripping, painting, or injecting target weeds. Except as described in Tables 1-7, 1-8, and 1-9, all application methods may be used for each herbicide and herbicide combination.

BPA is proposing to conduct these activities to recover watershed processes and functions associated with native plant communities, such as thermal and microclimate regulation, hydrologic and nutrient cycling, channel formation and sediment storage, soil development and stability, flood energy dissipation and filtering; to control or eliminate non-native, invasive plant species that compete with or displace native plant communities, in order to maximize habitat processes and functions associated with native vegetation diversity, form, outputs, structure, and decomposition; and to provide feeding, breeding, and sheltering habitat for native wildlife.

The following potential effects to listed species and their habitats associated with vegetation management by herbicide use - possible use of motorized equipment in the riparian area, vegetation removal, and negligible erosion and sedimentation - are addressed under the general construction section (2.2.1.1). The herbicide activities will incorporate the conservation measures for general construction as applicable.

Appendix F to this Opinion contains details of the risk assessments and technical information reviewed for determining the effects of vegetation management by herbicide use on listed anadromous fish species. The following information is a synopsis of the appendix.

Effects to Listed Fish

The effects of herbicides to listed fish are dependant on the level of exposure and the level of toxicity. No effect from harassment is expected to occur to listed fish from chemical noxious weed control activities. BPA's proposed use of chemicals to control noxious weeds is intended to have no adverse toxic effect on fish, however, toxic effects could occur in certain circumstances. Sublethal effects are reported for some of herbicides that will be used, at herbicide concentrations in water near or below those concentrations that could occur under the proposed action. Potential toxic effects are minimized by the conservation measures. Only ground-based application methods and spot treatment of noxious weeds with herbicides rated low or moderate for aquatic level of concern are authorized for use within riparian areas. Fuel and herbicide transportation, storage, and emergency spill plans will be implemented to reduce the risk of an accidental spill of fuel or chemicals.

Likelihood of Exposure to Herbicides

Quantitative estimates of exposure to herbicides under the proposed action were not provided in the BA since the exact treatment locations and the amount of chemicals that will be applied are not known ahead of time. A robust exposure scenario of applying the active ingredient directly to a 1 acre-foot pond to provide a general characterization of risk, and results of fate and transport modeling reported in Appendix F are used to characterize exposure. Herbicides can enter water through atmospheric deposition, spray drift, surface water runoff, percolation, groundwater contamination and intrusion, and direct application. The proposed action includes numerous conservation measures intended to minimize or avoid water contamination from herbicides, which are discussed throughout Section 2.2.1.7.3 (Vegetation Management by Herbicide Use), in this Opinion. The conservation measures include stream and riparian buffers where chemical use is restricted or prohibited, limits on the amount of chemicals carried at a given time or applied to a given area, and rules governing application methods and timing. The likelihood of herbicides entering the water depends on the type of treatment and mode of transport, which are described below.

Water Contamination from Wind Drift. Herbicide volatilization and drift are one of the primary mechanisms of off-target movement of herbicides when applied as a spray. Off-target movement can result in unintended injury to desirable plant species, contamination of surface waters, and contamination of ecologically sensitive areas. Volatilization will be minimized with the use of nonvolatile herbicide formulations (2,4-D amines are much less volatile than 2,4-D esters, for example) and avoiding application of herbicides during hot days. Herbicide drift will be minimized with the use of drift control agents and spraying during calm conditions. Ground application minimizes drift because spray nozzles can be in close proximity to target species and to the ground.

Water Contamination from Runoff, Leaching, and Percolation. All herbicides can potentially enter streams through water transported by runoff, leaching, or percolation. Water contamination from rain events could transport chemicals to waterways, and convey them to listed salmon or steelhead habitat. The sorption of herbicides onto soils, stability, solubility, and toxicity of a chemical determine the extent to which it will migrate and adversely affect surface waters and groundwater (Spence *et al.* 1996). For example, picloram is highly soluble and readily leaches through the soil. It is also resistant to biotic and abiotic degradation processes. It can also move from target plants, through roots, down into the soil, and into nearby non-target plants. Given this capability, a sufficient buffer zone is recommended to protect riparian vegetation when using picloram. Glyphosate and 2,4-D, though very soluble, bind well with organic material in soils and therefore are not easily leached. All of the herbicides proposed for use are susceptible to transport in surface runoff, especially if applications are followed immediately by high rainfall events. However, data limitations make it difficult to precisely estimate the degree of ecological risk

The potential concentrations of chemicals in the water, as a result of contamination from the proposed action, are not known. The BA provides rough estimates of the amount of chemicals expected to reach the water, based on modeling or monitoring reported in published literature. Indicators of potential exposure are characterized by available information on factors that determine the likelihood of the chemicals reaching water. Indicators include physical properties of the chemicals; soil properties such as the amount of organic material, soil depth, soil type, pH, water content, and oxygen content; and environmental conditions such as temperature, and rainfall amounts. An environment containing dry soil with low microbial presence, which receives periodic high-intensity rainfall events, will be very susceptible to both leaching and surface runoff of picloram. This will also be true to a lesser extent with 2,4-D and glyphosate.

Herbicide Movement Rating and Evaluation. The Oregon State University (OSU) Extension Pesticides Properties Data Base (Vogue *et al.* 1994) provides an herbicide movement rating, derived from soil half-life, sorption in soil, and water solubility (Table 2-5). The herbicide movement rating indicates the propensity for an herbicide to move toward groundwater. There are five nominal ratings, ranging from very low to very high. As indicated by the movement ratings, glyphosate is least likely to reach groundwater or move from the site, while chemicals such as picloram and dicamba are highly mobile and are likely to be transported by runoff or percolation. Rainfall rates, soil properties, topography, vegetation, and other parameters are factors that influence actual herbicide movement at any given location.

Table 2-5. Herbicide Movement Rating[†]

Herbicide	Herbicide Movement Rating	Soil Half-Life (days)	Water Solubility (mg/l)	Sorption Coefficient (soil Koc)
Clopyralid	Very High	40	300,000	6
Glyphosate	Very Low	47	900,000	24,000
Picloram	Very High	90	200,000	16
2,4-D	Moderate	10	100	100
Sulfometuron-Methyl	Moderate	20	70	78
Metsulfuron-Methyl	High	30	9500	35
Dicamba	Very High	14	400,000	2
Imazapic	Moderate-High[‡]	113	3,600[‡]	206[‡]

[†] From Vogue *et al.* (1994); This database relies heavily on the SCS/ARS/CES Pesticide Properties Database for Environmental Decision Making (Wauchope *et al.*, 1992).
[‡]From Tu *et al.* (2001).

Likelihood of Direct Effects

Most direct effects of the proposed action on listed salmon and steelhead are likely to be from sublethal herbicide effects, rather than outright mortality from herbicide exposure, or from weed control activities that do not involve herbicides. Sublethal effects are considered under the ESA to constitute "take," if the sublethal effects "harm" listed fish. NOAA Fisheries defines harm as "an act which actually kills or injures fish or wildlife. Such an act may include significant habitat modification or degradation which actually kills or injures fish or wildlife by significantly impairing essential behavioral patterns including breeding, spawning, rearing, migrating, feeding or sheltering" (50 CFR 222.102). These behavioral patterns, and their underlying physiological processes are typically reported for individual test animals. However, the ecological significance of sub-lethal toxicological effects depends on the degree to which they influence behavior that is essential to the survival and reproductive potential of individual fish, and the viability and genetic integrity of wild populations. It is important to note that many sublethal toxicological endpoints or biomarkers may harm fish in ways that are not readily apparent. When small changes in the health or performance of individual fish are observed (*e.g.,* a small percentage change in the activity of a certain enzyme, an increase in oxygen consumption, the formation of pre-neoplastic hepatic lesions), it may not be possible to infer a significant loss of essential behavior patterns of fish in the wild, even in circumstances where a significant loss could occur.

The analysis of direct impacts of herbicides on salmonids in this Opinion relates site-specific exposure conditions (*i.e.,* expected environmental concentration, bioavailability, and exposure duration) to the known or suspected impacts of the chemical on the health of exposed fish. The analysis considers: (1) The life history stage (and any associated vulnerabilities) of the exposed salmonid; (2) the known or suspected mechanism of toxicity for the active ingredient or adjuvant in question; (3) local environmental conditions that may modify the relative toxicity of the contaminant; and (4) the possibility of additive or synergistic interactions with other chemicals that may enter surface waters as a result of parallel or upstream land use activities.

A probabilistic risk assessment (PRA), based on the relationship between the likelihood of exposure and the magnitude of effect is used to determine the likelihood that the proposed herbicide use would "harm" listed salmon or steelhead. Traditionally, a PRA incorporates data from a standard lethal concentration required to kill half of a test population (LC_{50}), exposure study, as well as chronic exposure data to predict the sensitivity of an organism to the herbicide or chemical. The lethality endpoint has little predictive value for assessing whether real world herbicide exposure will cause sublethal neurological and behavioral disorders in wild salmon (Scholz *et al.* 2000), but in most cases, the LC_{50} is the only toxicity data available. Although little information is available on the sublethal effects of the herbicides on listed fish, there can be subtle sublethal effects that can potentially affect the survival or reproduction of large population segments. For example, Scholz *et al.* (2000), Moore and Waring (1996) indicate that environmentally relevant exposures to diazinon can disrupt olfactory capacity in the context of survival and reproductive success of chinook salmon, both of which are key management considerations under the ESA (Scholz *et al.* 2000). The likelihood of similar effects with the chemicals proposed for use is unknown.

Based on the analysis provided in the BA, and available literature, it appears unlikely that the proposed herbicide use would cause outright fish kills at concentrations of the active ingredients likely to occur in water from the proposed action. In rare circumstances, high concentrations of herbicides could wash into streams from rainfalls shortly after herbicides are applied along road ditches or other surfaces that rapidly generate overland flows, or as a result of an accidental spill. In such instances, localized fish kills could occur, particularly in small tributary streams where the contaminated flows would not be readily diluted. All LC_{50}s for salmonids with the active ingredients in the herbicides proposed for use are above 1 mg/L (see Appendix F). Environmental concentrations, as a result of the proposed action, would typically be at least 1 to 2 orders of magnitude lower than the reported LC_{50}s. However, while the active ingredients pose a low risk of mortality, the product formulations sometimes include unspecified inactive ingredients and adjuvants with unknown toxic effects on listed fish. In one notable example, the surfactant in the product Roundup (Roundup is not proposed for use in this action) causes the formulation to be extremely toxic to salmonids, while the product Rodeo, which contains the same active ingredient (glyphosate), but no surfactants, has very low toxicity (SERA 1996).

Although outright mortality from exposure to herbicides from the proposed action is unlikely (with rare exceptions noted above), listed fish are likely to be exposed to herbicide concentrations where sublethal effects could occur. The consequences of many sublethal effects are uncertain, but the loss or impairment of physiological or behavioral functions from sublethal exposures can adversely affect the survival, reproductive success, or migratory behavior of individual fish. Such effects, in turn, can be expected to reduce the viability of wild populations. Weis *et al.* (2001) reviewed published literature on consequences of changes in behavior of fish from exposure to contaminants, and noted studies reporting impaired growth and population declines from altered feeding behavior, and impaired predator avoidance. Potential sublethal effects, such as those leading to a shortened lifespan, reduced reproductive output, or other deleterious biological outcomes are a threat to listed species from the proposed action. Anadromous fish in the Snake River are exposed to multiple physiological sublethal stressors with apparent cumulative effects (Ebel *et al.*, 1975; Matthews *et al.* 1986; Coutant 1999). Cumulative exposure to multiple sublethal stressors associated with the Snake River hydropower system has been attributed to delayed mortality in Snake River salmon (Budy *et al.* 2002). Mortality resulting from a history of multiple physiologically sublethal stressors is referred to as "ecological death" (Kruzynski *et al.* 1994; Kruzynski and Birtwell 1994). Cumulative effects of multiple stressors are thought to be the cause of declines in some fish populations, even though the effects of any single stressor appeared to be insignificant (Korman *et al.* 1994; Vaughan *et al.* 1984). Although exposure to herbcides is not a reported factor in delayed mortality of fish, one can reasonably assume that physiological stress created from sublethal exposure to herbicides would contribute to effects of other stressors attributed to delayed mortality in fish.

The toxicological endpoints identified below are possible for a variety of herbicides and are generally considered to be important for the fitness of salmonids and other fish species. They include:

- Direct mortality at any life history stage.
- An increase or decrease in growth.
- Changes in reproductive behavior.
- A reduction in the number of eggs produced, eggs fertilized, or eggs hatched.
- Developmental abnormalities, including behavioral deficits or physical deformities.
- Reduced ability to osmoregulate or adapt to salinity gradients.
- Reduced ability to tolerate shifts in other environmental variables (*e.g.*, temperature or increased stress).
- An increased susceptibility to disease.
- An increased susceptibility to predation.
- Changes in migratory behavior.

Most of these endpoints (above) have not been investigated for the herbicides used in the proposed action. The available information on lethal and sublethal effects is summarized in Appendix F.

Likelihood of Indirect Effects

Indirect effects of herbicides can occur through their effects on the aquatic environment and non-target species. The likelihood of adverse indirect effects is dependent on environmental concentrations, bioavailability of the chemical, and persistence of the herbicide in salmon habitat. For most herbicides, including the chemicals in the proposed action, there is little information available on environmental effects, such as negative impacts on primary production, nutrient dynamics, or the trophic structure of macroinvertebrate communities. Most available information on potential environmental effects must be inferred from laboratory assays; however, a few observations of environmental effects are reported in the literature. Due to the paucity of information, there are uncertainties associated with the following factors: (1) The fate of herbicides in streams; (2) the resiliency and recovery of aquatic communities; (3) the site-specific foraging habits of salmonids and the vulnerability of key prey taxa; (4) the effects of pesticide mixtures that include adjuvants or other ingredients that may affect species differently than the active ingredient; and (5) the mitigating or exacerbating effects of local environmental conditions. Where uncertainties cannot be resolved using the best available scientific literature, the benefit of the doubt should be given to the threatened or endangered species in question [H.R. Conf. Rep. No. 697, 96th Cong., 2nd Sess. 12 (1979)].

It is becoming increasingly evident that indirect effects of contaminants on ecosystem structure and function are a key factor in determining a toxicant's cumulative risk to aquatic organisms (Preston 2002). Moreover, aquatic plants and macroinvertebrates are generally more sensitive than fish to the acutely toxic effects of herbicides. Therefore, chemicals can potentially impact the structure of aquatic communities at concentrations that fall below the threshold for direct impairment in salmonids. The integrity of the aquatic food chain is an essential biological requirement for salmonids, and the possibility that herbicide applications will limit the productivity of streams and rivers should be considered in an adverse effects analysis.

The potential effects of herbicides on prey species for salmonids are also an important concern. Juvenile Pacific salmon feed on a diverse array of aquatic macroinvertebrates (*i.e.* larger than 595 microns in their later instars or mature forms; Cederholm *et al.* 2000). Terrestrial insects, aquatic insects, and crustaceans comprise the large majority of the diets of fry and parr in all salmon species (Higgs *et al.* 1995). Prominent taxonomic groups include: Chironomidae (midges), Ephemeroptera (mayflies), Plecoptera (stoneflies), Tricoptera (caddisflies), and Simuliidae (blackfly larvae) as well as amphipods, harpacticoid copepods, and daphniids. Chironomids in particular are an important component of the diet of nearly all freshwater salmon fry (Higgs *et al.* 1995). In general, insects and crustaceans are more acutely sensitive to the toxic effects of environmental contaminants than fish or other vertebrates. However, with a few exceptions (*e.g.,* daphniids), the impacts of herbicides on salmonid prey taxa have not been widely investigated. Where acute toxicities for salmonid prey species are available, however, they should be used to estimate the potential impacts of herbicide applications on the aquatic food chain.

Human activities that modify the physical or chemical characteristics of streams often lead to changes in the trophic system that ultimately reduce salmonid productivity (Bisson and Bilby, 1998). In the case of herbicides, a primary concern is the potential for impacts on benthic algae. Benthic algae are important primary producers in aquatic habitats, and are thought to be the principal source of energy in many mid-sized streams (Minshall, 1978; Vannote *et al.*, 1980; Murphy, 1998). Herbicides can cause significant shifts in the composition of benthic algal communities at concentrations in the low parts per billion (Hoagland *et al.* 1996). Moreover, based on the data available, herbicides have a high potential to elicit significant effects on aquatic microorganisms at environmentally relevant concentrations (DeLorenzo *et al.* 2001). In many cases, however, the acute sensitivities of algal species to herbicides are not known. In addition, Hoagland *et al.* (1996) identify key uncertainties in the following areas: (1) The importance of environmental modifying factors such as light, temperature, pH, and nutrients; (2) interactive effects of herbicides where they occur as mixtures, (3) indirect community-level effects, (4) specific modes of action, (5) mechanisms of community and species recovery, and (6) mechanisms of tolerance by some taxa to some chemicals. Herbicide applications have the potential to impair autochthonous production and, by extension, undermine the trophic support for stream ecosystems. However, existing data gaps make it difficult to precisely estimate the degree of ecological risk, and limited information is available on the ecological effects of the chemicals in the proposed action.

The growth of salmonids in freshwater systems is largely determined by the availability of prey (Chapman 1966, Mundie 1974). For example, supplementation studies (*e.g.,* Mason 1976) have shown a clear relationship between food abundance and the growth rate and biomass yield or productivity of juveniles in streams. Therefore, herbicide applications that kill or otherwise reduce the abundance of macroinvertebrates in streams can also reduce the energetic efficiency for growth in salmonids. Less food can also induce density-dependent effects, that is, competition among foragers can be expected to increase as prey resources are reduced (Ricker 1972). These considerations are important because juvenile growth is a critical determinant of freshwater and marine survival (Higgs *et al.* 1995). For example, a recent study on size-selective mortality in chinook salmon from the Snake River (Zabel and Williams 2002) found that naturally-reared wild fish did not return to spawn if they were below a certain size threshold when they migrated to the ocean. There are two primary reasons mortality is higher among smaller salmonids. First, fish that have a slower rate of growth suffer size-selective predation during their first year in the marine environment (Parker 1971, Healey 1982; Holtby *et al.* 1990). Growth-related mortality occurs late in the first marine year and may determine, in part, the strength of the year class (Beamish and Mahnken 2001). Second, salmon that grow more slowly may be more vulnerable to starvation or exhaustion (Sogard 1997).

Please refer to the risk assessments for effects of each herbicide on salmon, steelhead, and their environment in Appendix F.

The following conservation measures address potential toxic effects:

- The measures listed below are for terrestrial application of chemicals only, and, are designed to prevent chemicals from entering any surface waters. *Aquatic application of chemicals is not covered by this Opinion.*
- Applicators will only use the herbicides and adjuvants as proposed in this Opinion as follows.
- BPA will use the following factors to determine whether to use herbicides instead of or in combination with other types of vegetation control method(s), and when and how often they will be applied: (1) Physical growth characteristics of target weeds (rhizomatous vs. tap-rooted, *etc.*); (2) seed longevity and germination; (3) infestation size; (4) relationship of the site to other infestations; (5) relationship of the site to listed and/or proposed species; (6) distance to surface water; (7) accessibility to site for equipment; (8) type and amount of use of the area by people; (9) effectiveness of treatment on the target weed; and (10) cost.
- Within the buffers identified in Tables 1-7, 1-8, and 1-9, applicators will time all vegetation management activities described in this Opinion to occur when aquatic ESA species are not likely to be present during spawning and/or sensitive life stages.
- Product label directions will be followed as required by the Federal Insecticide, Fungicide, and Rodenticide Act, including "mandatory" statements (such as registered uses, maximum use rates, application restrictions, worker safety standards, restricted entry intervals, environmental hazards, weather restrictions, and equipment cleaning) (BPA 2000).
- All product label "precautionary" statements such as environmental hazards, physical or chemical hazards, soil and climate application restrictions, wildlife warnings, and threatened and endangered species warnings will be followed (BPA 2000 [modified] and EPA Label Review Manual, 1995 as revised http://www.epa.gov/oppfead1/labeling/lrm/).
- Herbicides will only be applied by a licensed applicator (valid for the state where the work is located) and only in accordance with EPA labeling or the restrictions identified in the Opinion, whichever are more restrictive. Applicators will use the herbicide specifically targeted for a particular weed species that will cause the least impact to non-target vegetation (BPA 2000).
- Applicators will never leave herbicides or equipment unattended in unrestricted access areas (BPA 2000).
- Only the minimum area necessary for the control of noxious weeds will be treated (NMFS 2002a).
- *Before application*, applicators will thoroughly review the site to identify and mark, if necessary, the buffer requirements (see Tables 1-7, 1-8, and 1-9) (BPA 2000). The most restrictive buffer for the conditions at the site will apply.
- Applicators will observe restricted entry intervals specified by the herbicide label (BPA 2000).
- No 2,4-D ester formulations of any kind will be used (NMFS 2002a).

- Only glyphosate that is factory-formulated *without* a surfactant will be used within 100 feet of any surface waters. See Appendix D for listing of acceptable glyphosate formulations.
- Tank mixing of surfactants or other additives to glyphosate without factory-formulated surfactants for use within 100 feet of any surface waters will be in strict accordance with all tables in Section 1.2.9.3.
- Only triclopyr TEA (acid) (Garlon 3A/Tahoe 3A) formulations of triclopyr will be used. No triclopyr BEE (ester) (Garlon 4) formulations of any kind will be used (NMFS 2002a).
- Only surfactants listed in Table 2-4 will be used for any project within the buffer specified in Tables 1-7, 1-8, and 1-9, specifically: only *surfactants registered and approved for aquatic use* as shown on Table 2-4 will used within 15 feet of any surface waters.
- No carrier other than water will be used for tank mixing (NMFS 2002a).
- Herbicides/adjuvants with a groundwater or surface water label advisory will not be used within 100 feet of any surface water.
- For basal bark/stem and stump applications, applicators will directly spray the root collar area, sides of the stump, and/or the outer portion of the cut surface, including the cambium, until thoroughly wet, but not to the point of runoff, in order to avoid or minimize deposition to surrounding surfaces. A marker colorant/dye is recommended to establish coverage and prevent plant runoff.
- Treatment will be delayed if precipitation is forecasted to occur within 24 hours, except for pellet application (NMFS 2002a).
- Applicators will prepare spray mixtures in accordance with the label(s) instructions and will not exceed the amount of herbicide per acre specified on the label (BPA 2000).
- Applicators will perform mixing at suitable locations with respect to buffer zones and recommended buffer widths (see Table 1-7 re: buffers) (BPA 2000).
- Except as indicated by Table 1-7, applicators will mix and load herbicides at least 100 feet from any surface waters and only in locations where accidental spills cannot flow into waters, or contaminate groundwater (BPA 2000, NMFS 2002a).
- The applicator will develop a Spill Containment and Control Plan (SCCP) prior to herbicide application. The plan will contain notification procedures, specific clean up and disposal instructions for different products, quick response containment and clean up measures that will be available on site, proposed methods for disposal of spilled materials, and employee training for spill containment. All individuals involved, including any contracted applicators, will be instructed on the plan (NMFS 2002a).
- In addition to an applicator's SCCP, applicators will report spills and misapplications to EPA in accordance with the BPA's Government Agency Plan (GAP) (See Appendix E). Applicators will report spills and misapplications and clean up according to Federal and applicable state laws and regulations. At a minimum:
    - Notify BPA within 24 hours of any spill or misapplication;
    - Contain spill or leak, or halt misapplication;
    - Isolate area; and request help as appropriate;

- As soon as possible, notify the owner of the land and any other potentially affected parties;
- Clean up the spill;
- Clean up equipment and vehicles;
- Dispose of cleanup materials properly; and
- Follow up with appropriate cleanup documentation (BPA 2000).

- Upon notification of a spill or misapplication by an applicator, BPA will immediately notify the nearest NOAA Fisheries field office and provide copies of all subsequent relevant information generated from the event.
- During transportation, applicators will secure herbicide containers to prevent movement within the vehicle or loss from the vehicle during the operation of the vehicle (BPA 2000).
- When spray equipment is not being used, applicators will ensure that all valves and tank covers will be closed during any movement of the vehicle (BPA 2000).
- Applicators will firmly secure any portable tanks used for herbicide application to the frame of the vehicle (BPA 2000).
- Applicators will follow label requirements for storage (BPA 2000).
- Storage of herbicides will be in strict compliance with the relevant regulations of the State in which the herbicides are being stored.
- Applicators will inspect storage areas frequently for leakage and clean up spill areas immediately (BPA 2000).
- Applicators will store only minimum amounts of chemicals at field and temporary locations, and will order out no more chemicals than necessary (BPA 2000).
- Applicators will dispose of unwanted or unusable products promptly and correctly (BPA 2000).
- In temporary storage locations, such as the field, applicators will store all chemicals in buildings or vehicles that can be locked up (BPA 2000) and no closer than 300 feet from any surface water.
- Applicators will use water-soluble packaging (WSP) when available, to eliminate the need for container disposal (BPA 2000).
- Applicators will not burn paper and carton-type containers unless stated as permissible on the label (BPA 2000).
- Applicators will dispose of containers or cartons in one of three ways:
- Triple rinse containers of liquid herbicides before disposal. The rinse solution will be poured into the mix-tank and used for treatment. Each rinse solution will be equal to at least 10% of the container volume. Dispose of the empty containers as non-contaminated waste, at any legal landfill dump;
- Use a rinsing nozzle (instead of triple rinsing). A rinsing nozzle has a sharp point that can puncture a plastic or metal empty herbicide container and flush the container's contents into the mix tank; or
- Return returnable "mini-bulk" type containers to the distributor for refill (BPA 2000).
- Applicators will observe the applicable buffers (see Table 1-7) when washing or rinsing spray tanks near waters (BPA 2000, NMFS 2002a).

- Applicators will dispose of unwanted or unusable herbicide products as contaminated waste at an approved waste facility (BPA 2000).
- Applicators will dispose of contaminated materials (including contaminated soil) resulting from cleanup procedures according to EPA directives (BPA 2000).
- Applicators will place any contaminated materials to be transported in watertight containers (BPA 2000).
- Applicators will use drift reduction agents, as appropriate and as identified in this Opinion, to reduce the drift hazard when applying herbicides as broadcast or localized foliar treatments (BPA 2000).
- Colorants will be used to the extent practicable to ensure proper coverage and targeting.
- Weather Considerations/Restrictions – Tables 1-7, 1-8, and 1-9 identify BPA's proposed minimum weather and wind speed restrictions (to be used in the absence of more stringent label instructions and restrictions). During application, applicators will monitor weather conditions hourly at sites where spray methods are being used (BPA 2000, NMFS 2002a).
- Applicators will conduct regular testing on field calibration and calculations to prevent gross application errors (BPA 2000, NMFS 2002a).

Application of herbicides according to the EPA label and identified conservation measures is not expected to result in mortality to listed fish. However, there is some uncertainty about the effectiveness of the conservation measures and the amount of chemical expected to reach the water. While the amounts are expected to be very low, we cannot conclude with certainty that the levels of chemicals that will reach streams with listed fish will be zero. Sublethal effects are reported at very low concentrations that are likely to occur. Most of the potential sub-lethal effects from the herbicides and adjuvants proposed for use have not been investigated in regard to toxicological endpoints that are generally considered important to the overall health and fitness of salmonids and other fish, as discussed above.

To address the uncertainties relating to sub-lethal effects, BPA will implement the following conservation measures:

- Applicators will keep records of each application, the active ingredient, formulation, application rate, date, time, location, *etc.* Records will be available to state and Federal inspectors, and will be supplied to applicable regulatory agencies and land managers as requested (*e.g.,* USDA Forest Service and Washington Department of Natural Resources) (BPA 2000).

- Applicators will also supply application information to BPA for the annual NOAA Fisheries reporting and monitoring requirements described in the Reporting, Monitoring, Evaluation, and Adaptive Management portion of conservation measures.

- For the 2002 program years, BPA will prepare and deliver a summary of the previous year's activities or planned activities on July 15, 2003. For subsequent years, the previous year's report will be prepared and delivered to NOAA Fisheries on March 1. Table 1-10 illustrates the proposed schedule.

- The summary of the previous year's activities will, at a minimum, include a table showing: (1) The drainage name/code and description; (2) 6th level hydrologic unit code; (3) upland acres treated; (4) riparian acres treated; (5) accomplished treatment (previous year); (6) proposed treatment (subsequent year); (7) herbicide product name (including mixtures); (8) active ingredient(s) (a.i.) and percent a.i.; (9) type and percent of each adjuvant used; (10) application rate; (11) application method(s); (12) date(s) of treatment; (13) treatment for noxious weeds only;(14) treatment for weed control plus restoration/revegetation; and (15) fish and wildlife species and life stages potentially affected. A copy of the table sent to project sponsors is attached in Appendix C, "BPA-Funded Projects FY2002/03 Herbicide Applications."

- BPA will also prepare an annual update report of the BA. The update will identify in separate sections: (1) Any new literature findings brought to the attention of the BPA on the herbicides in use, indicating adverse effects (especially sub lethal effects) of the use of the herbicides on listed fish or critical habitat; (2) a discussion of the ways adverse effects could be minimized further through modification of the proposed activity, or through additional activities; (3) a description of any changes in the environmental baseline; and (4) recommended remedies to address the problems identified through monitoring or literature findings.

- By October 1, 2003, and each subsequent year, BPA will present the proposed program for NOAA Fisheries approval of work for the upcoming year that includes the proposed sites, methods of treatment, and site specific information about baseline conditions of the proposed treatment areas (when available), adjustments to the program resulting from the monitoring results of the previous year, and planned monitoring (the 2003 proposed program is included in this Opinion in Table 1-4 and Appendix C). The program of work will be reported in the format described above and on the form in Appendix C along with a written report that will also include the upcoming year's proposed monitoring plan, as described below.

- BPA will monitor and evaluate the effectiveness of the noxious weed/vegetation restoration program on both a site-specific treatment level and on a landscape level.

- Site-specific treatment level monitoring will involve assessing the effectiveness of the treatment agent or control method on a specific patch of noxious weeds. Follow-up treatments will occur as staffing and funding allow. Monitoring of physical, cultural, and chemical control methods will be conducted on randomly selected sites within one to two months of treatment through visual observation of target species' relative abundance/site dominance compared to pre-treatment conditions. Non-target plant mortality will also be monitored in riparian areas to determine if mortality of non-target plants is affecting riparian functions in

NOAA Fisheries' Matrix of Pathways and Indicators (NMFS 1996a). Also during 2003/4, in consultation with NOAA Fisheries, BPA will develop a monitoring plan that includes the efforts described above plus a standardized sampling and analytical protocol for the purpose of monitoring potential herbicidal effects on applicable non-target resources as a result of atmospheric drift and deposition, and, lateral and/or vertical movement of the applied chemicals through water and soil. Subsequent results will be used in determining the continuation, modification, and/or termination of a particular weed control/vegetation restoration method. The target year for implementing such a plan would be 2005. Table 1-10 illustrates the proposal for both reporting and monitoring.

- Landscape level effectiveness monitoring will be accomplished through the Research, Monitoring and Evaluation (RME) Program being developed for the Federal Columbia River Power System (FCRPS) 2000 Biological Opinion (NOAA Fisheries and Action Agencies 2003). While little detail can be provided at this point, the FCRPS RME, when finalized, will provide a consistent approach for the monitoring and evaluation of the processes currently underway for the protection and restoration of ESA species within the Columbia River basin.
- The habitat improvement program is a long-term endeavor that includes control of noxious weeds, removal of unwanted vegetation, and revegetation where and when practicable. However, because there are areas of scientific and management uncertainty, management actions may require refinement or change over time as data from specific effectiveness monitoring is analyzed. With the likely development of new control methods and technology, changes in existing or use of new noxious weed treatments and/or vegetation restoration methods may be authorized and warranted. Any changes to the proposed action, as described in the Opinion, would be analyzed for impacts to listed/proposed species and critical habitat, and consultation would be reinitiated as appropriate.

Effects to Habitat
The implementation of the conservation measures listed above will reduce adverse effects to listed species' habitat during use of chemicals to control vegetation to a very minimum, as discussed below.

<u>Water quality indicators: Temperature, sediment, and chemical contamination</u>. Changes in water temperature resulting from herbicide use to control noxious weeds would be negligible to non-existent. Noxious weeds provide little to no shade to streams, and the risk for adverse effects to non-target vegetation is low with backpack or hand-operated sprayers. Removal of solid stands of vegetation by chemical treatment may result in short-term, insignificant increases in surface erosion that will diminish as vegetation reoccupies the treated site. No large-scale changes in land cover conversions or stand structure (*e.g.,* timber to grass, shrubs to grass) will result from chemical noxious weed control as proposed in this Opinion. Chemical control is expected to minimize the risk of water contamination because of the buffers that will be used along riparian areas and the implementation of the conservation measures for ground based herbicide application within riparian areas and along live waters, as outlined in the conservation measures

above. Only aquatic-approved herbicides and surfactants will be used within 15 feet of live waters or on soils over shallow water tables (*i.e.* supersaturated soils). Implementation of hazardous materials (fuel and herbicide) transportation, storage, and emergency spill plans will result in a low risk of hazardous material contamination (fuels and herbicides) of ground water and surface water.

Habitat access indicators: Physical barriers. Chemical control of vegetation would not create physical barriers to anadromous fish.

Habitat element indicators: Substrate, large woody debris, pool frequency and quality, off-channel habitat, and refugia. Chemical control of noxious weeds would not affect these habitat element indicators. The herbicides BPA proposes to use would not affect large trees that will provide large woody debris.

Channel condition and dynamics indicators: Width/depth ratio, streambank condition, floodplain conductivity. Ground-based herbicide application would result in reduction of noxious weeds within riparian areas and along streambanks. No adverse impacts to streambank stability are expected. A reduction of noxious weeds in riparian areas and along streambanks will benefit native plant species and result in improved streambank stability and riparian condition in the long term. There would be no effect to the other indicators.

Flow/hydrology indicators: Peak/base flows, drainage network increase. Chemical control of noxious weeds is expected to result in no measurable effect to peak/base flow or water yield of watersheds.

Watershed condition indicators: Road density and location, disturbance history, and riparian reserves. No new roads or disturbances will result from the use of chemicals to control noxious weeds. Noxious weed infestations are a threat to overall watershed ecological condition. Long-term beneficial effects from the reduction of noxious weeds encroaching on and invading riparian areas, wetlands, and streams and subsequent increases in desirable vegetation (*e.g.,* native species) will result in improved watershed conditions.

2.2.1.8 Road Actions

2.2.1.8.1 Road Maintenance

The primary proposed road maintenance activities are:

- Creating barriers to human access: Gates, fences, boulders, logs, tank traps, vegetative buffers, and signs.
- Surface maintenance, such as building and compacting the road prism, grading, and spreading rock or surfacing material.
- Drainage maintenance and repair of inboard ditch lines, waterbars, and sediment traps.

- Removing and hauling or stabilizing pre-existing cut and fill material or slide material.
- Snowplowing.
- Dust abatement.
- Relocating portions of roads and trails to less sensitive areas outside of riparian buffer areas.

Interrelated activities addressed elsewhere in this consultation are:

- Native Plant Community Establishment and Protection (see section 2.2.1.7)
- Bridge, Culvert, and Ford Maintenance, Removal, and Replacement (see section 2.2.1.8.2).

The proposed activity does not include construction of any new, permanent road inside a riparian buffer area except for a bridge approach in accordance with Section 2.2.1.8.2, "Bridge, Culvert, and Ford Maintenance, Removal, and Replacement." The activity also does not include a new bridge pier or abutment below the bankfull elevation, a new bridge approach within the Federal Emergency Management Agency (FEMA) designated floodway that will require embankment fills that significantly impair floodplain function, or a baffled culvert or fishway. Extensive asphalt resurfacing also is not included.

In general, road maintenance will involve minor construction efforts, typically using a small work crew equipped with one or two vehicles. In some cases, heavy equipment may be used.

BPA is proposing to conduct these activities to eliminate or reduce erosion and mass-wasting hazards, and thereby the sedimentation potential to down slope habitats, and to eliminate or reduce human access and use/disturbance associated impacts, such as, timber theft, disturbance to wildlife, road density, poaching, illegal dumping of waste, erosion of soils, and sedimentation of aquatic habitats, particularly in sensitive areas such as riparian habitats or geologically unstable zones.

The following potential effects to listed species and their habitats associated with road maintenance activities - possible use of heavy equipment in the riparian area, vegetation removal, and erosion and sedimentation - are addressed under the general construction section (2.2.1.1). The road maintenance activities will incorporate the conservation measures for general construction as applicable.

Roads and their associated drainage systems can cause accelerated runoff of sediment and contaminated water. However, with the incorporation of the conservation measures listed below, the amount of sediment that enters a stream is expected to be small, infrequent, and of short duration. Substrate quality would not be expected to decrease over time. Additional biological effects can include accelerating the introduction of alien plant and animal species by disturbing native vegetation, which can make ecological recovery more uncertain (Gucinski *et al.* 2001). When roads or trails are relocated, riparian shrubs and trees may be cut and excavated to access each site. This vegetation removal will have negligible or very localized effects on water temperature because of the small amount of vegetation involved.

The following conservation measures will avoid or minimize the adverse effects discussed above:

- Road maintenance will comply with ODOT (1999) practices or the most current version of the Regional Road Maintenance Endangered Species Act Program Guidelines.[60] (NOAA Fisheries 2003b)
- Soil-disturbing maintenance activities will be conducted during dry conditions to the greatest extent practicable. Road maintenance work in riparian areas will follow the appropriate state agency In-Water Work Timing guidelines, where relevant, except where the potential for greater damage to water quality and fish habitat exists if the emergency road maintenance is not performed as soon as possible (NMFS 2001g).
- Unsurfaced roads will be managed to avoid delivery of sediment to streams (*e.g.,* closing during the wet season, surfacing, adding drainage). See http://www.dnr.wa.gov/forestpractices/board/manual/ for guidance.
- Road maintenance will not be attempted when surface material is saturated with water and erosion problems could result (PNF 2001, PNF 2001a-e).
- Disturbance of existing vegetation in ditches and at stream crossings will be minimized to the greatest extent possible (NMFS 2001g).

Asphalt used during resurfacing can leach out hydrocarbons, which can influence pH. Because routine maintenance would consist of small road segment patches applied during dry conditions, hydrocarbon leaching would not be a major concern to water quality. Extensive asphalt laying during wet periods would pose a greater risk and is not included under this Opinion.

Dust abatement materials can pose a risk to water quality if not properly applied. The most common dust abatement materials are calcium chloride, magnesium chloride, and ligninsulfonates. Usually, applying calcium chloride or magnesium chloride does not injure fish or degrade water quality beyond background levels of calcium or magnesium. Even where dust abatement materials wash into ditchlines and streams, effects to water quality would typically not last more than a few hours. Martin (1989) found that contamination from using dust abatement compounds could be reduced by restricting their use within 25 feet of a waterbody and in areas of shallow ground water (NMFS 2001g). Using unscreened intake pumps to pump water from streams to use in dust suppression can directly injure fish. Pumping out too much water from the stream at once can strand fish.

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[60] Oregon Department of Transportation, *Routine Road Maintenance: Water Quality and Habitat Guide, Best Management Practices*, 21 pp. + appendices (July 1999) (providing guidance on routine road maintenance activity only) (http://www.odot.state.or.us/eshtm/images/4dman.pdf) or, see, Regional Road Maintenance ESA Program Guidelines (March 2002) (http://www.metrokc.gov/roadcon/bmp/pdfguide.htm)

The following conservation measures will avoid or minimize the adverse effects discussed above:

- Dust-abatement additives and stabilization chemicals (typically magnesium chloride or calcium chloride salts) will be used only where a minimum of 25 feet of well-vegetated ground is present between a stream channel and the road. Application will be avoided during or just before wet weather and at stream crossings or other locations that could result in direct delivery to a water body (typically within 25 feet of a waterbody or stream channel). Spill containment equipment will be available during chemical dust abatement application (NMFS 2001g).
- Water drafting.
    a. Water source. Non-stream sources will be used instead of streams whenever feasible. When non-stream sources are unavailable, streams with the greatest flow will be used whenever feasible.
    b. Stream flow. Water drafting/pumping (for dust suppression or other needs) will maintain a continuous surface flow of the stream, without altering the original wetted width. No dams or channel alterations will be made for pumping in streams occupied by listed fish species (USDI/USDA 2002).
    c. Pumps. Pumping will follow the NOAA Fisheries guidelines for screening pump intakes (NMFS 1996).
    d. Adult fish. No water will be drafted from sites where adult salmonids are visibly present to prevent interference with spawning activities. If redds have been identified downstream of drafting sites, a fish biologist will ensure water drafting will not have adverse effects to eggs or emergent alevins.

Waste and fill material associated with road maintenance activities can contribute to blocking fish passage, creating shallower pools, disrupting sub-surface flow conditions, and simplifying channel morphology. Additionally, these and other materials can collect in ditches and culverts associated with roads and further block migratory pathways and restrict channel connectivity, fragmenting fish populations. The following conservation measures will avoid or minimize the adverse effects discussed above:

- Waste material generated from road maintenance activities and slides will be disposed of in stable, non-floodplain sites approved by a geotechnical engineer or other qualified personnel (NMFS 2001g).
- Ditches and culverts will be promptly cleaned of materials resulting from slides or other debris (NMFS 1999c).
- Ditch back slopes will not be undercut to avoid slope destabilization and erosion acceleration (PNF 2001, PNF 2001a-e).

The shaping and grading of roads can also have direct effects on stream channels. Berms left in place can redirect stream flow permanently, and block fish passage. Over time, the erosion of the berm will serve as a continuous source of fine sediment that will reduce the depth of holding pools and fill in suitable spawning gravels. Road grading can have similar results, with excess material sliding down slope into streams and simplifying channel conditions. Additionally, grading can reshape the drainage design of the road, which under high water conditions can ultimately wash out the road, carrying all road materials into the stream system.

The following conservation measures will avoid or minimize the adverse effects discussed above:

- Berms will not be left along the outside edge of roads, unless an outside berm was specifically designed to be a part of the road, and low-energy drainage is provided (PNF 2001, PNF 2001a-e).
- Road grading material will not be side cast along roads within one-quarter mile of perennial streams and from roads onto fill slopes having a slope greater than 45% (PNF 2001, PNF 2001a-e).
- Roads will be graded and shaped to conserve existing surface material. Road grading and shaping will maintain, not destroy, the designed drainage of the road, unless modification is necessary to improve drainage problems that were not anticipated during the design phase (PNF 2001, PNF 2001a-e).
- When blading and shaping roads, excess material will not be side cast onto the fill. All excess material that cannot be bladed into the surface will be end hauled to an appropriate site. End haul and prohibition of side casting will not be required for organic material like trees, needles, branches, and clean sod; however, fine organics like sod and grass will not be cast into water. Slides and rock failures including fine material of more than approximately ½ yard at one site will be hauled to disposal sites. Fine materials (1-inch minus) from slides, ditch maintenance, or blading may be worked into the road. Scattered clean rocks (1-inch plus) may be raked or bladed off the road except within 300 feet of perennial or 100 feet of intermittent streams (PNF 2001, PNF 2001a-e).
- All fill-associated wood will be removed during sidecast removal (NMFS 2002).
- Large woody debris (LWD > 9 m in length and >50 cm in diameter) present on roads will be moved intact to down slope of the road, subject to site-specific consideration Movement down-slope will be subject to the guidance of a fisheries biologist (PNF 2001, PNF 2001a-e).

Beneficial effects occur where road maintenance reduces the potential for catastrophic erosion and delivery of large amounts of sediment to stream channels. Severe erosion is almost inevitable if roads are not regularly maintained, and thus regular maintenance is a high priority (NMFS 1999f). Effects of proper road maintenance activities also include the reduction of human disturbance on unstable or sensitive sites.

2.2.1.8.2 Bridge, Culvert, and Ford Maintenance, Removal and Replacement

The primary proposed bridge, culvert and ford activities are:

- Culvert removal, where possible, and natural channel cross section reestablishment.
- Replacement of undersized culverts that present a barrier to fish movement with appropriately-sized culverts or bridges.

- Lowering of perched culverts to meet the natural bed of the stream.
- Excavation and realignment of misaligned culverts.
- Modification of culverts by means such as installing step-and-pool weirs at culvert outlets, trash/debris racks, or erosion protection structures at culvert outlets or inlets where replacement or lowering is not feasible.
- Redesign of stream crossings determined to be inappropriate for culvert installations to steel/concrete reinforced bridge installations or fords;
- Removal or lowering of artificial structures that impede fish passage;
- Repair, upgrade or replacement of bridges and culverts, except that bridge replacements will be full-span, *i.e.,* no bents, piers, or other support structures below bankfull elevation.

New or replacement culverts and bridges will be designed using an interdisciplinary stream simulation approach involving team members with skills in engineering, hydrology/fluvial geomorphology, and fisheries biology. Culverts and bridges will be designed mimic the natural stream processes and allow for fish passage, sediment transport, and flood and debris conveyance. Culvert installations will be designed to avoid upstream headcutting.

Restoring fish passage at existing culvert crossing sites implies that road access is available and that the need for new road construction and the associated impacts can be largely avoided. In the case of large fills, or dependent on the engineered solution, some constructed road access may be required to gain access to the culvert structure itself (NMFS 2002). Work may entail use of heavy equipment, power tools, and/or hand crews.

<u>Exclusions</u>. The following types of bridge and culvert maintenance removal and replacement are not included under this Opinion:

- Culverts with widths less than bankfull width.
- Culverts with widths less than 6 feet in fish-bearing streams.
- Embedded culverts in a slope greater than 6%.
- Modifying an existing culvert in place.
- A new bridge pier or abutment below the bankfull elevation, or in an active channel migration zone.[61]

[61] "Bankfull elevation" means the bank height inundated by an approximately 1.2 to 1.5 year (maximum) average recurrence interval and may be estimated by morphological features such as the following: (1) A topographic break from vertical bank to flat floodplain; (2) a topographic break from steep slope to gentle slope; (3) a change in vegetation from bare to grass, moss to grass, grass to sage, grass to trees, or from no trees to trees; (4) a textural change of depositional sediment; (5) the elevation below which no fine debris (*e.g.,* needles, leaves, cones, seeds) occurs; and (6) a textural change of matrix material between cobbles or rocks (Castro and Jackson, 2001). "Channel migration zone" means the area defined by the lateral extent of likely movement along a stream reach where there is evidence of active stream channel movement over the past 100 years, *e.g.,* alluvial fans or floodplains formed where the channel gradient decreases, the valley abruptly widens, or at the confluence of larger streams.

- A new bridge approach within the Federal Emergency Management Agency (FEMA) designated floodway that will require embankment fills that significantly impair floodplain function.
- A baffled culvert or fishway.

BPA is proposing to conduct these activities to improve fish passage, prevent streambank and roadbed erosion, facilitate natural sediment and wood movement, and eliminate or reduce excess sediment loading and dynamic changes in stream flow that cause streambank erosion, undermining of roadbeds, and the washout of culverts. Proper road drainage upgrades, culvert replacements, etc., are likely to diminish the potential adverse effects of roads, including turbidity, sedimentation, and channel extension, by allowing the drainage design features to work properly and erosion to be minimized.

The following potential effects to listed species and their habitats associated with bridge, culvert, and ford activities - exposure of bare soil and reduction or elimination of large woody debris, shade, slope and bank stability, and sediment filtering habitat functions due to removal of vegetation; compaction of soil and disturbance of streambeds resulting in sedimentation, increased water turbidity, and increased flows and stream energy; fuel and other contamination from spills or use of heavy equipment in water or spills of wet concrete; sedimentation and contamination from discharge of construction water; stress to fish from capture and release from coffered areas during isolation of instream work areas, noise, and avoidance behavior; and changes in flows - are addressed under the general construction section (2.2.1.1). The bridge, culvert, and ford activities will incorporate the conservation measures for general construction as applicable.

Installation of a new culvert, bridge, or ford will require a certain amount of fill material around the structure. Excess fill material can reduce stream width, resulting in channel constriction. Channel constriction can increase streamflow velocity, effectively blocking fish passage and potentially scouring redd habitat. Further increased streamflow can reduce the amount of holding pools.

The proposed activity will avoid or minimize the adverse effects discussed above with the following conservation measures:

- All fish passage will be designed in accordance with NOAA Fisheries "Anadromous Salmonid Passage Facility Guidelines and Criteria" (NOAA Fisheries 2003), including the described interactive design process with NOAA Fisheries Engineering staff.
- Permanent stream crossings will be designed in the following priority[62] (NOAA Fisheries 2003b):
    1. Nothing – road will be realigned to avoid crossing the stream

[62] For a discussion of crossing design types, see, National Marine Fisheries Service, Southwest Region, *Guidelines for Salmonid Passage at Stream Crossings* (September 2001) (http://swr.nmfs.noaa.gov/hcd/NMFSSCG.PDF) and Washington Department of Fish and Wildlife, *Fish Passage Design at Road Culverts: A Design Manual for Fish Passage at Road Crossings* (March 3, 1999) (http://www.wa.gov/wdfw/hab/engineer/cm/toc.htm).

2. Bridge – new bridges will span the stream to allow for long-term dynamic channel stability, *i.e.,* no bents, piers or other support structures below bankfull elevation.
3. Streambed simulation – bottomless arch, embedded culvert, or ford
4. No-slope design culvert[63]– limit new culverts to 0% slopes.

- New culvert widths will meet or exceed bankfull width.
- To provide for upstream passage of juvenile salmonids, the maximum average water velocity[64] will not exceed 1 foot per second.
- Include suitable grade controls to prevent culvert failure caused by changes in stream elevation.
- If the crossing will occur near an active spawning area, only full-span bridges or streambed simulation will be used (NOAA Fisheries 2003b).
- Fill width will be limited to the minimum necessary to complete the crossing, and will not reduce existing stream width (NOAA Fisheries 2003b).

The following conservation measures will avoid or minimize the potential adverse effects of increased stream velocities, scouring, and erosion hazards:

- Culvert maintenance. Clean culverts by working from the top of the bank, unless culvert access using work area isolation would result in less habitat disturbance. Remove only the minimum amount of wood, sediment and other natural debris necessary to maintain culvert function without disturbing spawning gravel (NOAA Fisheries 2003b).
  1. Place all large wood, cobbles, and gravels recovered during cleaning downstream of the culvert.
  2. Do all routine work in the dry, using work area isolation if necessary.
- Culverts or bridge abutments will not be filled with vegetation, debris, or mud. Abutments will be properly protected (*e.g.,* rock armored) to prevent future scouring actions and erosion hazards (NMFS 2002).

The periodic maintenance of culverts and ditches will ensure fish passage, floodplain connectivity, allow for dynamic flow conditions, and maintain access to spawning, rearing, and resting habitats for listed species. The following conservation measure will avoid or minimize the adverse effects of blocked culverts:

- Maintenance schedules will be developed for culvert installations to ensure the culverts remain in proper functioning condition (NMFS 2002).

Beneficial effects of the proposed activities include habitat connectivity and increases in fish populations. Improved fish passage provides access to upstream spawning and

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[63] "No-slope design culvert" means a culvert that is sufficiently large and installed flat to allow the natural movement of bedload to form a stable bed inside the culvert. See, WDFW (Washington Department of Fish and Wildlife), *Design of Road culverts for Fish Passage* (2003)
http://www.wa.gov/wdfw/hab/engineer/cm/

[64] "Maximum average water velocity" means the average of water velocity within the barrel of the culvert calculated using the 10% annual exceedance of the daily average flow.

rearing habitat for fish species. Access can lead to increased spawning and rearing success and can increase numbers and health of individual fish and populations (NMFS 2001i). Additionally, the removal of impassable barriers will enable the movement of fish and drift of aquatic insects, and greatly improve biotic linkages and increase genetic exchange (WDFW 1999, NMFS 2001).

The installation of properly designed culverts will increase the fluvial transport of sediment important in the formation of diverse habitats. Such culverts also will enable additional recruitment of debris to downstream reaches when compared to current conditions. Allowing debris (including plant material and substrate) to pass through culverts also encourages LWD recruitment and natural fluvial deposition at downstream locations (restoration of LWD and substrate indicators). These processes create rearing and spawning habitat that is essential to listed species. Additionally, the use of properly designed culverts will reduce the probability of catastrophic damage to aquatic habitats that is often associated with undersized culverts (*e.g.,* during extreme natural events, debris accumulation, beaver dams). The installation of such culverts also should increase the stability of the streambed (NMFS 2001).

Overall, the improvement in baseline passage conditions will contribute to increased survival and recovery of listed species. The improvement in passage conditions for salmonids provides an immediate benefit that is likely to increase the numbers of fish moving upstream and downstream from portions of stream that previously were inaccessible. The increased accessibility to diverse habitats fosters the development and maintenance of locally adapted subpopulations, and may reduce the likelihood of extinction for endangered species. When sufficient freshwater habitat diversity exists, single species of salmonids may exhibit wide variation in life history and morphometric traits (*e.g.,* Blair *et al.* 1993). These traits are often unique to a specific geographic location and are referred to as locally adapted traits. Locally adapted subpopulations maintain reserves of genetic information that allow salmonids to recolonize disturbed areas and adapt to environmental changes (Milner and Baily 1989).

2.2.1.8.3 Road Decommissioning

The proposed road decommissioning activities will obliterate roads that are no longer needed, *e.g.,* logging roads. Water bars will be installed, road surfaces will be insloped or outsloped, asphalt and gravel will be removed from road surfaces, culverts and bridges will be altered or removed, streambanks will be recontoured at stream crossings, cross drains installed, fill or sidecast will be removed, road prism reshaped, sediment catch basins created, all surfaces will be revegetated to reduce surface erosion of bare soils, surface drainage patterns will be recreated, and dissipaters, chutes or rock will be placed at remaining culvert outlets. Work may require the use of heavy equipment, power tools, and/or hand crews.

BPA is proposing this activity to:

- Decommission roads to eliminate or reduce erosion and mass-wasting hazards and thereby the sedimentation potential to down-slope habitats.
- Reduce the impact of roads on the hydrology of watersheds.
- Eliminate or reduce human access and use/disturbance associated impacts, such as: timber theft, disturbance to wildlife, road density, poaching, illegal dumping of waste, erosion of soils, and sedimentation of aquatic habitats, particularly in sensitive areas such as riparian habitats or geologically unstable zones.

The following potential effects to listed species and their habitats associated with road decommissioning activities - compaction of soil and disturbance of streambeds resulting in sedimentation, increased water turbidity, and increased flows and stream energy; fuel and other contamination from spills or use of heavy equipment in water or riparian areas; sedimentation and contamination from discharge of construction water; stress to fish from capture and release from coffered areas during isolation of instream work areas, noise, and avoidance behavior; and changes in flows - are addressed under the general construction section (2.2.1.1). The road decommissioning activities will incorporate the conservation measures for general construction as applicable.

In addition to the conservation measures for general construction, the following measures will avoid or minimize the potential adverse effects that can occur from poorly designed road decommissioning and culvert removal:

- A fisheries biologist and/or hydrologist will be involved in the design and implementation of each road-decommissioning project (NMFS 2000b).
- Slide and waste material will be disposed in stable, non-floodplain sites. Disposal of slide and waste material within the existing road prism or on adjacent hillslopes will be allowed to restore natural or near-natural contours, if approved by a geotechnical engineer or other qualified personnel (NMFS 2000b).
- Culvert removal will be designed to restore the natural drainage pattern (NMFS 1999a).

Waste and fill material associated with road decommissioning activities can contribute to blocking fish passage, creating shallower pools, disrupting sub-surface flow conditions, and simplifying channel morphology. Additionally, these and other materials can collect in ditches and culverts associated with roads and further block migratory pathways and restrict channel connectivity, fragmenting fish populations. The following conservation measures will avoid or minimize the adverse effects discussed above:

- All fill-associated wood will be removed during sidecast removal (NMFS 2002).
- Disturbance of existing vegetation in ditches and at stream crossings will be minimized to the extent necessary to restore hydrologic functions (NMFS 2000b).

Road obliteration and decommissioning should be even more beneficial than road and culvert upgrades in that all or nearly all of the hydrologic and sediment regime effects of the roads would be removed. Long-term beneficial effects will result from these activities including rehabilitation of hydrologic functions, reduced risk of washouts and landslides, and reduction of sediment delivery to streams. In the long term, these projects will tend to rehabilitate habitat substrate by reducing the risk of sediment delivery to streams and restore fish passage by correcting fish barriers caused by roads. Road decommissioning projects will also tend to rehabilitate hydrology by reducing peak flows and reducing the drainage network. Watershed conditions will also be improved as road densities are reduced and riparian reserves are rehabilitated. These projects may also potentially improve floodplain connectivity (NMFS 1999d).

Additional effects of road decommissioning activities include reconnecting natural habitats and the exclusion of human disturbance. Decommissioning a road allows for the recolonization of native flora and fauna, increasing the total amount of space available for fish and wildlife, and decreasing the amount of human traffic originally responsible for habitat disturbances. Consequently, native plant communities can reestablish and move towards more properly functioning habitats for fish.

2.2.1.9 Special Actions

2.2.1.9.1 Install/Develop Wildlife Structures

The proposed wildlife structure activities involve the installation or development of a variety of structures that mimic natural features and provide support for wildlife foraging, breeding, and or resting/refuge. These can include bat roosting/breeding structures, avian nest boxes, hardwood snags, brush/cover piles, coarse woody debris, and raptor perches. Work may entail use of power tools and/or crews.

BPA is proposing to conduct these activities to enhance terrestrial habitats until native plant communities or other natural habitat features become established, and to augment, not replace, natural habitat features and processes.

NOAA Fisheries does not anticipate that these activities will have an adverse effect on listed anadromous fish species.

2.2.2 Consistency with Listed Species ESA Recovery Strategies

Whether the proposed action is consistent with recovery planning efforts is another important aspect of effects analysis. Recovery is defined by NOAA Fisheries regulations (50 CFR 402) as an "improvement in the status of listed species to the point at which listing is no longer appropriate under the criteria set out in section 4 (a)(1) of the Act." Recovery planning is underway for listed Pacific salmon in the Northwest with technical recovery teams identified for each domain. NOAA Fisheries also intends that recovery planning identify the areas/stocks most critical to species conservation and recovery and thereby evaluate proposed actions on the basis of their effects on those areas/stocks.

In 1995, NOAA Fisheries relied on the proposed Snake River salmon recovery plan, issued in draft in March 1995 (NMFS 1995a). Since 1995, the number of listed salmonid species and the need for recovery planning for Columbia Basin salmonids has quadrupled. Rather than finalize the 1995 proposed recovery plan, NOAA Fisheries has developed guidelines for basin-level, multispecies recovery planning on which individual, species-specific recovery plans can be founded. "Basin-level" encompasses habitat, harvest, hatcheries, and hydro. This recovery planning analysis is contained in the document entitled "Conservation of Columbia Basin Fish: Final Basinwide Salmon Recovery Strategy" and the related "December 2000 Memorandum of Understanding Among Federal Agencies Concerning the Conservation of Threatened and Endangered Fish Species in the Columbia River Basin" (together these are referred to as the Basinwide Salmon Recovery Strategy) (Federal Caucus 2000).

Recovery plans for each individually listed species will provide the particular statutorily required elements of recovery goals, criteria, management actions, and time estimates that are not developed in the Basinwide Salmon Recovery Strategy. While the species-specific recovery plans are being developed, the Basinwide Salmon Recovery Strategy provides the best guidance for judging the significance of an individual action relative to the species-level biological requirements. In the absence of completed recovery planning, NOAA Fisheries strives to ascribe the appropriate significance to actions to the extent available information allows. Where information is not available on the recovery needs of the species, either through recovery planning or otherwise, NOAA Fisheries applies a conservative substitute that is likely to exceed what would be expected of an action if information were available. The Basinwide Salmon Recovery Strategy identifies immediate actions to prevent extinction and foster recovery by improving survival across all life stages. It emphasizes actions that are currently authorized, that have predictable benefits, and that benefit a broad range of species.

Current science suggests that recovery may hinge on efforts to restore health to the tributaries and estuary where these populations spawn and rear. Measures to protect and restore tributary and estuary areas are among the foremost actions recommended for the habitat component of the Basinwide Salmon Recovery Strategy. This is because survival improvements are likely to have the biggest effect in the first year of life (when most of the fish are in the tributaries) and during the transition to salt water (when the fish are in the estuary). Fixing tributary and estuary habitats is key to recovering the fish and is the centerpiece of the Strategy. The proposed action will mean improvement of thousands of acres of estuary and tributary habitat over the next five to ten years to benefit listed fish.

The Federal Caucus agencies anticipate that accomplishing actions described in the habitat element of the Basinwide Salmon Recovery Strategy will have significant measurable benefits for listed salmonids and resident fish, including increased cumulative survival and lowered risk of extinction. Thus, actions that are consistent with those called for in the Basinwide Salmon Recovery Strategy, such as the actions proposed in this Opinion, are also consistent with the Strategy's primary goal of increasing the likelihood of survival and recovery of listed salmonids.

2.2.3 Effects on Critical Habitat

The proposed action may occur within areas designated as critical habitat for the listed species addressed in this Opinion. The above analyses and discussions examined all habitat effects of the proposed action, including potential effects to the three ESUs with designated critical habitat (see Table 2-2). We have determined that all effects on designated critical habitat have been addressed.

2.2.4 Cumulative Effects

Cumulative effects are defined in 50 CFR 402.02 as "those effects of future State or private activities, not involving Federal activities, that are reasonably certain to occur within the action area of the Federal action subject to consultation." Other activities within the watershed have the potential to adversely affect the listed species and critical habitat within the action area. Future Federal actions, including the ongoing operation of hydropower systems, hatcheries, fisheries, and land management activities are being reviewed through separate section 7 consultation processes. Federal actions that have already undergone section 7 consultations have been added to the description of the environmental baseline in the action area.

State, Tribal, and local government actions will likely be in the form of legislation, administrative rules or policy initiatives. Government and private actions may encompass changes in land and water uses, including ownership and intensity, any of which could impact listed species or their habitat. Government actions are subject to political, legislative, and fiscal uncertainties.

Changes in the economy have occurred in the last 15 years, and are likely to continue, with less large-scale resource extraction, more targeted extraction, and significant growth in other economic sectors. Growth in new businesses, primarily in the technology sector, is creating urbanization pressures and increased demands for buildable land, electricity, water supplies, waste-disposal sites, and other infrastructure.

Economic diversification has contributed to population growth and movement, and this trend is likely to continue for the next few decades. Such population trends will: (1) Result in greater overall and localized demands for electricity, water, and buildable land in the action area; (2) affect water quality directly and indirectly; and (3) increase the need for transportation, communication, and other infrastructure. The impacts associated with these economic and population demands will probably affect habitat features such as water quality and quantity, which are important to the survival and recovery of the listed species. The overall effect will be negative, unless carefully planned for and mitigated.

Non-federal activities within the Oregon portion of the action area are expected to increase with a projected 34% increase in human population over the next 25 years in Oregon (ODAS 1999). Thus, NOAA Fisheries assumes that future private and state actions will continue within the action area, but at increasingly higher levels as population density climbs. Most future actions by the state of Oregon are described in the Oregon Plan for Salmon and Watershed measures, which includes a variety of programs designed to benefit salmon and watershed health.

The U.S. Census projects a similar 28% increase in human population over the next 25 years in the state of Washington, resulting in a similar increase in future private and State actions (U.S. Census at www.census.gov/population/projections/state/stpjpop.txt). Washington has various strategies and programs designed to improve the habitat of listed species and assist in recovery planning. Washington's 1998 Salmon Recovery Planning Act provided the framework for developing watershed restoration projects and established a funding mechanism for local habitat restoration projects. The Watershed Planning Act, also passed in 1998, encourages voluntary planning by local governments, citizens, and Tribes for water supply and use, water quality, and habitat at the Water Resource Inventory Area or multi-Water Resource Inventory Area level. Washington's Department of Fish and Wildlife and tribal comanagers have been implementing the Wild Stock Recovery Initiative since 1992. The comanagers are completing comprehensive species management plans that examine limiting factors and identify needed habitat activities. The state is also establishing the Lower Columbia Fish Recovery Board to begin drafting recovery plans for the lower Columbia region. Water quality improvements will be proposed through development of TMDLs. The state of Washington is under a court order to develop TMDL management plans on each of its 303(d) water-quality-listed streams. It has developed a schedule that is updated yearly; the schedule outlines the priority and timing of TMDL plan development. Washington state closed the mainstem Columbia River to new water rights appropriations in 1995. These efforts should help improve habitat for listed species.

The U.S. Census is projecting an increase in the human population of 51% in the state of Idaho (U.S. Census at www.census.gov/population/projections/state/stpjpop.txt). NOAA Fisheries assumes that future private and state actions will continue within the Idaho portion of the action area, but at even higher levels as population density climbs even faster than for the Oregon and Washington portions of the action area. The Idaho Department of Environmental Quality will establish TMDLs in the Snake River basin, a program regarded as having positive water quality effects. The TMDLs are required by court order, so it is reasonably certain that they will be set. The state of Idaho has created an Office of Species Conservation to work on subbasin planning and to coordinate the efforts of all state offices addressing natural resource issues. Demands for Idaho's groundwater resources have caused groundwater levels to drop and reduced flow in springs for which there are senior water rights. The Idaho Department of Water Resources has begun studies and promulgated rules that address water right conflicts and demands on a limited resource. The studies have identified aquifer recharge as a mitigation measure with the potential to affect the quantity of water in certain streams, particularly those essential to listed species.

2.2.5 Summary of Effects

The fourth step in NOAA Fisheries' approach to determine jeopardy and adverse modification of critical habitat is to determine whether the proposed action, in light of the above factors, is likely to appreciably reduce the likelihood of species survival and recovery in the wild or adversely modify or destroy critical habitat. For the jeopardy determination, NOAA Fisheries uses the consultation regulations and, where appropriate, the Habitat Approach (NMFS 1996a) to determine whether actions would further degrade the environmental baseline or hinder attainment of PFC at a spatial scale relevant to the listed ESU. The analysis must be applied at a spatial resolution wherein the actual effects of the action upon the species can be determined. The first part of the two-part analysis required in the fourth step is represented below in the summary of the effects on habitat in the action area. The second part of the analysis places the species effects in the context of the ESU as a whole.

NOAA Fisheries has determined that the proposed action of implementing the habitat improvement activities addressed in the Opinion will have long-term beneficial effects, although some of the individual activities may affect, and are likely to adversely affect listed anadromous fish species and their habitats in the action area in the short term (*i.e.,* during the construction phase). Our conclusions are based on the following considerations: (1) Implementation of the Habitat Improvement Program requires individual review of each project to ensure that the proposed activity is covered by this Opinion, and that each applicable conservation measure is included as a condition of authorizing habitat improvement project activities; (2) taken together, the conservation measures applied to each proposed activity will ensure that any short-term effects to water quality, habitat access, habitat elements, channel conditions and dynamics, flows, and watershed conditions will be brief, minor, and timed to occur at times that are least sensitive for the species' life-cycle; (3) the underlying requirement of an ecological design approach that protects and stimulates natural habitat forming processes is expected to result in authorization of many projects that will have beneficial long-term effects; (4) the individual and combined effects of all habitat improvement activities authorized in this Opinion are not expected to impair currently properly functioning habitats, appreciably reduce the functioning of already impaired habitats, or retard the long-term progress of impaired habitats toward proper functioning condition essential to the long-term survival and recovery at the population or ESU scale; and (5) the proposed action is consistent with the specific commitments and primary objectives of the Basinwide Salmon Recovery Strategy.

Based on the habitat effects described above, the proposed action will not reduce survival of the 12 Columbia River Basin ESA-listed ESUs addressed in this Opinion. While a small amount of take may result from isolating and moving fish from instream work areas, this amount of take will not reduce overall survival of the populations involved. The habitat improvements NOAA Fisheries expects from the proposed action, when added to the environmental baseline and cumulative effects occurring in the action area, and given the status of the stocks and condition of critical habitat, will beneficially affect the likelihood of long-term survival and recovery for the species. In reaching these determinations, NOAA Fisheries used the best scientific and commercial data available.

2.3 Conclusions

The two-part analysis in the fourth step (see Section 2.2.5) has led to the following conclusions.

2.3.1 Critical Habitat Conclusion

After reviewing the current condition of the critical habitat, the environmental baseline for the action area, the effects of the proposed action, and cumulative effects in the action area, it is NOAA Fisheries' opinion that the BPA's Habitat Improvement Program is not likely to destroy or adversely modify critical habitat for the three Columbia River salmonid ESUs with listed critical habitat.

2.3.2 Species Conclusion

After reviewing the current status of the 12 listed Columbia River salmonid ESUs, the environmental baseline for the action area, the effects of the proposed actions, and cumulative effects in the action area, it is NOAA Fisheries' opinion that the BPA's Habitat Improvement Program is not likely to jeopardize the continued existence of the listed Columbia River Basin ESUs.

Based on the effects described above, the BPA's Habitat Improvement Program will have a long-term positive effect on the survival and recovery of the 12 listed Columbia River salmonid ESUs.

2.4 Conservation Recommendations

Conservation recommendations are defined as "discretionary measures to minimize or avoid adverse effects of a proposed action on listed species or critical habitat or regarding the development of information" (50 CFR 402.02). Section 7 (a)(1) of the ESA directs Federal agencies to use their authorities to further the purposes of the ESA by carrying out conservation programs for the benefit of the threatened and endangered species. The conservation recommendations listed below are consistent with these obligations, and therefore should be implemented by the BPA.

1. In overappropriated streams (*i.e.,* streams on which junior water users are sometimes precluded from diverting water due to lack of flow) with multiple water rights holders, the BPA should consider, especially with projects that would conserve more than 1 cfs of water, transferring the water rights to water saved to a state trust water system, or equivalent, for protection instream. Because many western streams are overappropriated in terms of water rights, another irrigator with a valid water right previously not being met can potentially take the water saved from proposed irrigation and water delivery/management actions. In order to

counter this potential diminishment of the benefit to listed species, NOAA Fisheries is making this conservation recommendation.

2. The BPA should strongly encourage landowners to protect riparian areas on farms and ranches as part of the Natural Resource Conservation Service's Conservation Reserve Enhancement Program (CREP). The width of riparian buffers are currently limited to 135 feet, except that wider buffers are allowed when they may "meet a specific management criteri[on]." NOAA Fisheries recommends that greater riparian buffer widths (possibly tied to floodplain boundaries) be routinely encouraged in CREP contracts in order to maximize the development of fully formed and functional riparian areas under CREP.

3. The BPA should, when consolidating diversions, move the new combined diversion to the most downstream point possible.

In order for NOAA Fisheries to be kept informed of actions minimizing or avoiding adverse effects, or those that benefit listed species or critical habitat, NOAA Fisheries requests notification of the achievement of any conservation recommendations when the BPA submits its monitoring report describing actions under this Opinion.

2.5 Reinitiation of Consultation

As provided in 50 CFR 402.16, reinitiation of formal consultation is required if: (1) The amount or extent of taking specified in the incidental take statement is exceeded, or is expected to be exceeded; (2) new information reveals effects of the action may affect listed species in a way not previously considered; (3) the action is modified in a way that causes an effect on listed species that was not previously considered; or (4) a new species is listed or critical habitat is designated that may be affected by the action. In instances where the amount or extent of incidental take is exceeded, any operations causing such take must cease, pending conclusion of the reinitiated consultation.

If the BPA fails to provide specified monitoring information by the required date, NOAA Fisheries will consider that a modification of the action that causes an effect on listed species not previously considered and causes the incidental take statement of the Opinion to expire. Consultation also must be reinitiated three years after the date this Opinion is signed. To reinitiate consultation, contact the Habitat Conservation Division (Oregon Habitat Branch) of NOAA Fisheries.

2.6 Incidental Take Statement

Section 9 and rules promulgated under subsection 4(d) of the ESA prohibit any taking (harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, collect, or attempt to engage in any such conduct) of listed species without a specific permit or exemption. "Harm" is defined as an act that may include significant habitat modification or degradation where it actually kills or injures fish by impairing breeding, spawning, rearing, migrating, feeding, or sheltering. "Harass" is defined as actions that create the likelihood of injuring listed species by annoying to such an extent as to significantly alter normal behavior patterns which include, but are not limited to, breeding, feeding, and sheltering. "Incidental take" is take of listed species that results from, but is not the purpose of, the Federal agency or the applicant carrying out an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to, and not intended as part of, the agency action is not considered prohibited taking provided that such taking is in compliance with the terms and conditions of this incidental take statement.

An incidental take statement specifies the impact of any incidental taking of endangered or threatened species. It also provides reasonable and prudent measures that are necessary to minimize impacts and sets forth terms and conditions with which the action agency must comply in order to implement the reasonable and prudent measures.

2.6.1 Amount or Extent of Take

NOAA Fisheries anticipates that the proposed actions considered in this Opinion are reasonably likely to take some of the 12 ESA-listed species through habitat-related effects. Further, NOAA Fisheries expects those actions that require isolation of the in-water work area to result in an additional amount of nonlethal and lethal take.

Take associated with the habitat-related effects of actions such as the actions proposed in this Opinion is largely unquantifiable and is not expected to be measurable as long-term effects on populations. Therefore, although NOAA Fisheries expects the habitat-related effects of these actions to cause some low level incidental take, the best scientific and commercial data available are not sufficient to enable NOAA Fisheries to estimate a specific amount of incidental take because of those habitat-related effects. In instances such as these, NOAA Fisheries designates the expected level of take as 'unquantifiable.'

NOAA Fisheries estimated the amount of take associated with those projects requiring isolation of the in-water work area using the following assumptions: (1) The geographic distribution and number of actions covered by this Opinion in 2003 will be similar to the historic distribution; (2) the number of actions is estimated to be 160; (3) approximately 77 of those actions each year will require isolation of the in-water work area; (4) each project requiring in-water work area isolation is likely to capture fewer than 100 juvenile salmonids; (5) of the ESA-listed fish to be captured and handled in this way, 98% or more are expected to survive with no long-term effects and 1 to 2% are expected to be injured or killed, including delayed mortality because of injury. Nonetheless, the more conservative estimate of 5% lethal take will be used here to allow for variations in experience and work conditions.

An estimate of listed fish to non-listed fish in the Columbia Basin was obtained using NOAA Fisheries' data estimation of percentages of listed spring/summer and fall chinook, sockeye salmon and steelhead smolts arriving at various locations in the Columbia River

Basin in 2003[65], then increased several fold to provide a conservative estimate of take due to projects requiring isolation of the in-water work area each year (Table 2-6). Hatchery data for chum are from the Fish Passage Center, Portland, Oregon. Because many ESUs that these actions may affect are similar in appearance, assigning this take to groups below the species level is impossible. Even if monitoring proves the 5% mortality rate is accurate, isolation of in-water work area activities will not affect ESA-listed species at the population level. Capture and release of adult fish is not expected to occur as part of the proposed isolation of in-water work areas. Thus, NOAA Fisheries does not anticipate that any adult fish will be taken.

Table 2-6. Estimate of Nonlethal and Lethal Take Associated with Proposed Projects Requiring Isolation of an In-water Work Area.

Geographic Area Species Life Stage	Total Catch	Nonlethal Take ESA-Listed Fish	Lethal Take ESA-Listed Fish
Willamette/Lower Columbia			
chinook salmon juvenile	219	19	1
chum salmon juvenile	76	2	0
steelhead juvenile	5	0	0
Interior Columbia			
chinook salmon juvenile	5,217	240	12
sockeye salmon juvenile	37	0	0
steelhead juvenile	2,183	41	2

NOAA Fisheries will update this estimate of incidental take before March 31 each year after reviewing information from the preceding year describing isolation of in-water work area operations. Even if monitoring proves the 5% mortality rate is accurate, isolation of in-water work area activities will not affect ESA-listed species at the population level. Capture and release of adult fish is not expected to occur as part of the proposed isolation of in-water work areas. Thus, NOAA Fisheries does not anticipate that any adult fish will be taken.

2.6.2 Reasonable and Prudent Measures

Reasonable and prudent measures are non-discretionary measures to minimize take, that may or may not already be part of the description of the proposed action. They must be

[65] Memorandum from John W. Ferguson, Northwest Fisheries Science Center, to Laurie Allen, NOAA Fisheries (March 20, 2003) (estimation of percentages of listed Pacific salmon and steelhead smolts arriving at various locations in the Columbia River Basin in 2003).

implemented as binding conditions for the exemption in section 7(o)(2) to apply. The BPA has the continuing duty to regulate the activities covered in this incidental take statement. If the BPA fails to require the applicants to adhere to the terms and conditions of the incidental take statement through enforceable terms that are added to the contract, or fails to retain the oversight to ensure compliance with these terms and conditions, the protective coverage of section 7(o)(2) may lapse. NOAA Fisheries believes that activities carried out in a manner consistent with these reasonable and prudent measures, except those otherwise identified, will not necessitate further site-specific consultation. Activities that do not comply with all relevant reasonable and prudent measures will require further consultation.

NOAA Fisheries believes that the following reasonable and prudent measures are necessary and appropriate to minimize the amount or extent of take of listed fish resulting from implementation of the action. These reasonable and prudent measures would also avoid or minimize adverse effects on designated critical habitat.

The BPA shall:

1. Minimize the likelihood of incidental take from administration of the Habitat Improvement Program by ensuring effective administration of the program.
2. Minimize incidental take from construction by excluding non-qualifying actions and applying conditions that avoid or minimize adverse effects to riparian and aquatic systems.
3. Minimize incidental take from stream channel, floodplain, and upland surveys and installation of stream monitoring devices such as streamflow and temperature monitors by excluding non-qualifying actions and applying conditions that avoid or minimize adverse effects to riparian and aquatic systems.
4. Minimize incidental take from streambank protection by excluding non-qualifying activities and applying conditions that provide the greatest degree of natural floodplain and stream functions achievable through the use of an integrated, ecological approach.
5. Minimize incidental take from installing habitat-forming natural material instream structures by excluding non-qualifying activities and applying conditions that provide the greatest degree of natural floodplain and stream functions achievable through the use of an integrated, ecological approach.
6. Minimize incidental take from improving secondary channel habitats by excluding non-qualifying activities and applying conditions that provide the greatest degree of natural floodplain and stream functions achievable through the use of an integrated, ecological approach.
7. Minimize incidental take from riparian and wetland habitat creation, rehabilitation, and enhancement by excluding non-qualifying actions and applying conditions that avoid or minimize adverse effects to riparian and aquatic systems.
8. Minimize incidental take from fish passage activities by excluding non-qualifying

activities and applying conditions that avoid or minimize adverse effects to riparian and aquatic systems.

9. Minimize incidental take from constructing fencing for grazing control by excluding non-qualifying activities and applying conditions that avoid or minimize adverse effects to riparian and aquatic systems.

10. Minimize incidental take from installing off-channel watering facilities by excluding non-qualifying activities and applying conditions that avoid or minimize adverse effects to riparian and aquatic systems.

11. Minimize incidental take from hardening fords for livestock crossings of streams by excluding non-qualifying activities and applying conditions that avoid or minimize adverse effects to riparian and aquatic systems.

12. Minimize incidental take from implementing upland conservation buffers by excluding non-qualifying activities and applying conditions that avoid or minimize adverse effects to riparian and aquatic systems.

13. Minimize incidental take from implementing conservation cropping systems by excluding non-qualifying activities and applying conditions that avoid or minimize adverse effects to riparian and aquatic systems.

14. Minimize incidental take from soil stabilization *via* planting and seeding by excluding non-qualifying activities and applying conditions that avoid or minimize adverse effects to riparian and aquatic systems.

15. Minimize incidental take from implementing erosion control practices by excluding non-qualifying activities and applying conditions that avoid or minimize adverse effects to riparian and aquatic systems.

16. Minimize incidental take from converting from instream diversions to groundwater wells for primary water source by excluding non-qualifying activities and applying conditions that avoid or minimize adverse effects to riparian and aquatic systems.

17. Minimize incidental take from installing new or upgrading/maintaining existing fish screens by excluding non-qualifying activities and applying conditions that avoid or minimize adverse effects to riparian and aquatic systems.

18. Minimize incidental take from removing, consolidating, or improving irrigation diversion dams by excluding non-qualifying activities and applying conditions that avoid or minimize adverse effects to riparian and aquatic systems.

19. Minimize incidental take from vegetation planting by excluding non-qualifying activities and applying conditions that avoid or minimize adverse effects to riparian and aquatic systems.

20. Minimize incidental take from vegetation management by physical control by excluding non-qualifying activities and applying conditions that avoid or minimize adverse effects to riparian and aquatic systems.

21. Minimize incidental take from vegetation management by herbicide use by excluding non-qualifying activities and applying conditions that avoid or

minimize adverse effects to riparian and aquatic systems.

22. Minimize incidental take from road maintenance by excluding non-qualifying actions and applying conditions that avoid or minimize adverse effects to riparian and aquatic systems.

23. Minimize incidental take from bridge, culvert, and ford maintenance, removal, and replacement by excluding non-qualifying activities and applying conditions that avoid or minimize adverse effects to riparian and aquatic systems.

24. Minimize incidental take from road decommissioning by excluding non-qualifying activities and applying conditions that avoid or minimize adverse effects to riparian and aquatic systems.

25. Ensure completion of a comprehensive monitoring and reporting program to confirm this Opinion is meeting its objective of minimizing take from permitted activities

26. Ensure implementation of the general conditions applicable to all actions.

2.6.3 Terms and Conditions

To be exempt from the prohibitions of section 9 of the ESA, BPA must implement the action in compliance with the following terms and conditions, which implement the reasonable and prudent measures described above for each category of activity. These terms and conditions are non-discretionary and are applicable to more than one category of activity. Therefore, terms and conditions listed for one type of activity are also terms and conditions of any category in which they would also minimize take of listed species or their habitats.

1. To implement reasonable and prudent measure #1 (minimize the likelihood of incidental take from administration of the Habitat Improvement Program by ensuring effective administration of the program), the BPA shall ensure the following:

    a. Individual project review. Individually review each project to ensure that all direct and indirect adverse effects to listed salmon and their habitats are within the range of effects considered in this Opinion, and that each applicable term and condition from this Opinion is included as an enforceable term of the contract.
    b. Full implementation required. Departure from full implementation of the terms and conditions of the following incidental take statement will result in the lapse of the protective coverage of section 7(o)(2) regarding "take" of listed species and may lead NOAA Fisheries to a different conclusion as to the effects of the continuing action, including findings that specific projects will jeopardize listed species.
    c. Confirmation of fish presence. Contact a fish biologist from the NOAA Fisheries, ODFW or WDFW, as appropriate for the action area, if necessary to confirm that a project is within the present or historic range of a listed species

or a designated critical habitat.

d. Project access. Require landowners to provide reasonable access to projects permitted under this Opinion for monitoring the use and effectiveness conditions.
e. All applicable terms and conditions shall be included in any contract issued for the implementation of the action described in this Opinion.
f. Salvage notice. Include the following notice with each contract issued. NOTICE. If a sick, injured or dead specimen of a threatened or endangered species is found, the finder must notify the Vancouver Field Office of NOAA Fisheries Law Enforcement at 360.418.4246. The finder must take care in handling of sick or injured specimens to ensure effective treatment, and in handling dead specimens to preserve biological material in the best possible condition for later analysis of cause of death. The finder also has the responsibility to carry out instructions provided by Law Enforcement to ensure that evidence intrinsic to the specimen is not disturbed unnecessarily.
g. Compensatory mitigation projects. Ensure that project sponsors successfully complete site restoration and compensatory mitigation for long-term adverse effects (if any) by including the following information as part of each contract issued that includes work resulting in long-term adverse effects to be covered under this Opinion.
    i. The name and address of the party(s) responsible for meeting each component of the site restoration and compensatory mitigation plan.
    ii. Performance standards for determining compliance.
    iii. Any other pertinent requirements such as financial assurances, real estate assurances, monitoring programs, and the provisions for short and long-term maintenance of the restoration or mitigation site.
    iv. A provision for BPA certification that all action necessary to carry out each component of the restoration or mitigation plan is completed, and that the performance standards are achieved.
h. Failure to provide timely monitoring causes Incidental Take Statement to expire. If the BPA fails to provide specified monitoring information by the required date, NOAA Fisheries will consider that a modification of the action that causes an effect on listed species not previously considered and causes the Incidental Take Statement of the Opinion to expire.
i. Reinitiation. Reinitiate formal consultation on this Opinion within three years of the date of issuance. This term and condition is in addition to reinitiation requirements described in section 2.5 above.
j. Reinitiation contact. To reinitiate consultation, contact the Habitat Conservation Division (Oregon Habitat Branch) of NOAA Fisheries.

2. To implement reasonable and prudent measure #2 (minimize incidental take from construction by excluding unauthorized actions and applying conditions that avoid or minimize adverse effects to riparian and aquatic systems), above, the BPA shall ensure the following:

a. Minimum area. Construction impacts will be confined to the minimum area necessary to complete the project
b. Timing of in-water work. Work below the bankfull elevation[66] will be completed during the appropriate state or U.S. Army Corps of Engineers (COE) preferred in-water work period[67] as appropriate for the project area, unless otherwise approved in writing by NOAA Fisheries.
c. Cessation of work. Project operations will cease under high flow conditions that may result in inundation of the project area, except for efforts to avoid or minimize resource damage.
d. Fish screens. All water intakes used for a project, including pumps used to isolate an in-water work area, will have a fish screen installed, operated, and maintained according to NOAA Fisheries' fish screen criteria.[68]
e. Fish passage. Provide passage for any adult or juvenile salmonid species present in the project area during construction, unless otherwise approved in writing by NOAA Fisheries, and maintained after construction for the life of the project. Passage will be designed in accordance with NOAA Fisheries "Anadromous Salmonid Passage Facility Guidelines and Criteria" (NOAA Fisheries 2003). Upstream passage is not required during construction if it did not previously exist.
f. Pollution and Erosion Control Plan. Prepare and carry out a Pollution and Erosion Control Plan to prevent pollution caused by survey, construction, operation, and maintenance activities. The Plan will be available for inspection upon request by BPA or NOAA Fisheries.
    i. Plan Contents. The Pollution and Erosion Control Plan will contain the pertinent elements listed below, and meet requirements of all applicable laws and regulations.

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[66] "Bankfull elevation" means the bank height inundated by a 1.5 to 2-year average recurrence interval and may be estimated by morphological features such average bank height, scour lines and vegetation limits.
67 Oregon Department of Fish and Wildlife, *Guidelines for Timing of In-Water Work to Protect Fish and Wildlife Resources*, 12 pp (June 2000) (identifying work periods with the least impact on fish) (http://www.dfw.state.or.us/ODFWhtml/InfoCntrHbt/0600_inwtrguide.pdf); U.S. Army Corps of Engineers, Seattle District, Approved Work Windows for Fish Protection (Version: 13 October 2000) http://www.nws.usace.army.mil/PublicMenu/Menu.cfm?sitename=REG&pagename=work_windows In-water work windows for work in the Snake River are set on a case by case basis by the Regulatory Branch of the COE Walla Walla District, based on input from the regional offices of Idaho Dept of Fish and Game (IDFG) and NOAA Fisheries. They are typically June 1 to August 15 (Daly, Brad, October 11, 2002, Chief of Regulatory, COE Walla Walla District Personal communication with Mark Pedersen, Shapiro and Associates, Inc., Seattle WA and Horton, Bill, October 2002, Anadromous Fish Coordinator, IDFG, Personal communication with Mark Pedersen, Shapiro and Associates, Inc., Seattle WA). In-water work windows for work in Montana are established in a similar manner to those for the Snake by either the Seattle or Omaha districts of the COE (Frazer, Ken, October 9, 2002 Regional Fisheries Biologist, Fish and Wildlife Department, Billings MT. Personal communication with Pam Porter, Shapiro and Associates, Inc., Portland, OR).
[68] National Marine Fisheries Service, *Juvenile Fish Screen Criteria* (revised February 16, 1995) and *Addendum: Juvenile Fish Screen Criteria for Pump Intakes* (May 9, 1996) (guidelines and criteria for migrant fish passage facilities, and new pump intakes and existing inadequate pump intake screens) (http://www.nwr.noaa.gov/1hydrop/hydroweb/ferc.htm). NOTE: new criteria are currently being drafted by NOAA Fisheries (2003).

(1) The name and address of the party(s) responsible for accomplishment of the pollution and erosion control plan.
(2) Practices to prevent erosion and sedimentation associated with access roads, decommissioned roads, stream crossings, drilling sites, construction sites, borrow pit operations, haul roads, equipment and material storage sites, fueling operations and staging areas.
(3) Practices to confine, remove, and dispose of excess concrete, cement and other mortars or bonding agents, including measures for washout facilities.
(4) A description of any regulated or hazardous products or materials that will be used for the project, including procedures for inventory, storage, handling, and monitoring.
(5) A spill containment and control plan with notification procedures, specific cleanup and disposal instructions for different products, quick response containment and cleanup measures that will be available on the site, proposed methods for disposal of spilled materials, and employee training for spill containment.
(6) Practices to prevent construction debris from dropping into any stream or water body, and to remove any material that does drop with a minimum disturbance to the streambed and water quality.

ii. Inspection of erosion controls. During construction, monitor instream turbidity and inspect all erosion controls daily during the rainy season and weekly during the dry season, or more often if necessary, to ensure they are working adequately.[69]

(1) If monitoring or inspection shows that the erosion controls are ineffective, mobilize work crews immediately to make repairs, install replacements, or install additional controls as necessary.
(2) Remove sediment from erosion controls once it has reached one-third of the exposed height of the control.

g. Construction discharge water. Treat all discharge water created by construction (*e.g.,* concrete washout, pumping for work area isolation, vehicle wash water, drilling fluids) as follows:

i. Water quality. Design, build, and maintain facilities to collect and treat all construction discharge water using the best available technology applicable to site conditions. Provide treatment to remove debris, nutrients, sediment, petroleum hydrocarbons, metals and other pollutants likely to be present.
ii. Discharge velocity. If construction discharge water is released using an outfall or diffuser port, velocities will not exceed 4 feet per second, and the maximum size of any aperture will not exceed 4 feet per second.
iii. Spawning areas, submerged estuarine vegetation. Do not release construction discharge water within 300 feet upstream of spawning areas or areas with submerged estuarine vegetation.

[69] "Working adequately" means no more than a 10% cumulative increase in natural stream turbidity will be allowed, as measured relative to a control point immediately upstream of the turbidity causing activity.

iv. Pollutants. Do not allow pollutants including green concrete, contaminated water, silt, welding slag, or sandblasting abrasive to contact any wetland or the 2-year floodplain, except cement or grout when abandoning a drill boring or installing instrumentation in the boring.

h. Treated wood.
   i. Projects using treated wood[70] that may contact flowing water or that will be placed over water where it will be exposed to mechanical abrasion or where leachate may enter flowing water will not be used, except for pilings installed following NOAA Fisheries' guidelines.[71]
   ii. Projects that require removal of treated wood will use the following precautions:
      (1) Treated wood debris. Use the containment necessary to prevent treated wood debris from falling into the water. If treated wood debris does fall into the water, remove it immediately.
      (2) Disposal of treated wood debris. Dispose of all treated wood debris removed during a project, including treated wood pilings, at an upland facility approved for hazardous materials of this classification. Do not leave treated wood pilings in the water or stacked on the stream bank.

i. Preconstruction activity. Complete the following actions before significant[72] alteration of the project area:
   i. Marking. Flag the boundaries of clearing limits associated with site access and construction to prevent ground disturbance of critical riparian vegetation, wetlands, and other sensitive sites beyond the flagged boundary.
   ii. Emergency erosion controls. Ensure that the following materials for emergency erosion control are onsite: A supply of sediment control materials (*e.g.,* silt fence, straw bales [73]), and an oil-absorbing, floating boom whenever surface water is present.
   iii. Temporary erosion controls. All temporary erosion controls will be in place and appropriately installed downslope of project activity within the riparian buffer area[74] until site rehabilitation is complete.

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[70] "Treated wood" means lumber, pilings, and other wood products preserved with alkaline copper quaternary (ACQ), ammoniacal copper arsenate (ACA), ammoniacal copper zinc arsenate (ACZA), copper naphthenate, chromated copper arsenate (CCA), pentachlorophenol, or creosote.

[71] Letter from Steve Morris, National Marine Fisheries Service, to W.B. Paynter, Portland District, U.S. Army Corps of Engineers (December 9, 1998) (transmitting a document titled *Position Document for the Use of Treated Wood in Areas within Oregon Occupied by Endangered Species Act Proposed and Listed Anadromous Fish Species, National Marine Fisheries Service, December 1998*).

[72] "Significant" means an effect can be meaningfully measured, detected or evaluated.

[73] When available, certified weed-free straw or hay bales will be used to prevent introduction of noxious weeds.

[74] For purposes of this Opinion only, "riparian buffer area" means land: (1) within 150 feet of any natural water occupied by listed salmonids during any part of the year or designated as critical habitat; (2) within 100 feet of any natural water within 1/4 mile upstream of areas occupied by listed salmonids or designated as critical habitat and that is physically connected by an aboveground channel system such that water, sediment, or woody material delivered to such waters will eventually be delivered to water occupied by listed salmon or designated as critical habitat; and (3) within 50 feet of any natural water upstream of areas

j. Temporary access roads.
   i. Steep slopes. Do not build temporary roads mid-slope or on slopes steeper than 30%.
   ii. Minimizing soil disturbance and compaction. Low-impact, tracked drills will be walked to a survey site without the need for an access road. Minimize soil disturbance and compaction for other types of access whenever a new temporary road is necessary within 150 feet[75] of a stream, water body, or wetland by clearing vegetation to ground level and placing clean gravel over geotextile fabric, unless otherwise approved in writing by NOAA Fisheries.
   iii. Temporary stream crossings.
      (1) Do not allow equipment in the flowing water portion of the stream channel where equipment activity could release sediment downstream, except at designated stream crossings.
      (2) Minimize the number of temporary stream crossings.
      (3) Design new temporary stream crossings as follows:
         (a) Survey and map any potential spawning habitat within 300 feet downstream of a proposed crossing.
         (b) Do not place stream crossings at known or suspected spawning areas, or within 300 feet upstream of such areas if spawning areas may be affected.
         (c) Design the crossing to provide for foreseeable risks (*e.g.,* flooding and associated bedload and debris) to prevent the diversion of streamflow out of the channel and down the road if the crossing fails.
         (d) Vehicles and machinery will cross riparian buffer areas and streams at right angles to the main channel wherever possible.
   iv. Obliteration. When the project is completed, obliterate all temporary access roads, stabilize the soil, and revegetate the site. Abandon and restore temporary roads in wet or flooded areas by the end of the in-water work period.
k. Heavy equipment. Restrict use of heavy equipment as follows:
   i. Choice of equipment. When heavy equipment will be used, the equipment selected will have the least adverse effects on the environment (e.g., minimally sized, low ground pressure equipment).

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occupied by listed salmonids or designated as critical habitat and that is physically connected by an aboveground channel system such that water, sediment, or woody material delivered to such waters will eventually be delivered to water occupied by listed salmon or designated as critical habitat. "Natural water" means all perennial or seasonal waters except water conveyance systems that are artificially constructed and actively maintained for irrigation.

[75] Distances from a stream or water body are measured horizontally from, and perpendicular to, the bankfull elevation, the edge of the channel migration zone, or the edge of any associated wetland, whichever is greater. "Channel migration zone" means the area defined by the lateral extent of likely movement along a stream reach as shown by evidence of active stream channel movement over the past 100 years - *e.g.,* alluvial fans or floodplains formed where the channel gradient decreases, the valley abruptly widens, or at the confluence of larger streams.

ii. Vehicle staging. Fuel, operate, maintain, and store vehicles as follows:
   (1) Complete vehicle staging, cleaning, maintenance, refueling, and fuel storage, except for that needed to service boats, in a vehicle staging area placed 150 feet or more from any stream, water body or wetland, unless otherwise approved in writing by NOAA Fisheries.
   (2) Inspect all vehicles operated within 150 feet of any stream, water body or wetland daily for fluid leaks before leaving the vehicle staging area. Repair any leaks detected in the vehicle staging area before the vehicle resumes operation. Document inspections in a record that is available for review on request by BPA or NOAA Fisheries.
   (3) Before operations begin and as often as necessary during operation, steam clean all equipment that will be used below the bankfull elevation until all visible external oil, grease, mud, and other visible contaminates are removed.
   (4) Diaper all stationary power equipment (*e.g.,* generators, cranes, stationary drilling equipment) operated within 150 feet of any stream, waterbody, or wetland to prevent leaks, unless suitable containment is provided to prevent potential spills from entering any stream or waterbody.

l. Site preparation. Conserve native materials for site rehabilitation.
   i. If possible, leave native materials where they are found.
   ii. If materials are moved, damaged or destroyed, replace them with a functional equivalent during site rehabilitation.
   iii. Stockpile any large wood,[76] native vegetation, weed-free topsoil, and native channel material displaced by construction for use during site rehabilitation.

m. Isolation of in-water work area. If adult or juvenile fish are reasonably certain to be present, or if the work area is less than 300 feet upstream of spawning habitats, completely isolate the work area from the active flowing stream using inflatable bags, sandbags, sheet pilings, or similar materials, unless otherwise approved in writing by NOAA Fisheries.

n. Blasting. In-stream blasting is excluded from this consultation; however, in-stream rock splitting by chemical expansion or shot-shell powered rock splitting is included.

o. Capture and release. Before and intermittently during pumping to isolate an in-water work area, attempt to capture and release fish from the isolated area using trapping, seining, electrofishing, or other methods as are prudent to minimize risk of injury.

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[76] For purposes of this consultation only, "large wood" means a tree, log, or rootwad big enough to dissipate stream energy associated with high flows, capture bedload, stabilize streambanks, influence channel characteristics, and otherwise support aquatic habitat function, given the slope and bankfull channel width of the stream in which the wood occurs. See, Oregon Department of Forestry and Oregon Department of Fish and Wildlife, *A Guide to Placing Large Wood in Streams*, May 1995 http://www.odf.state.or.us/divisions/protection/forest_practices/RefsList.asp

i. The entire capture and release operation will be conducted or supervised by a fishery biologist experienced with work area isolation and competent to ensure the safe handling of all ESA-listed fish.

ii. If electrofishing equipment is used to capture fish, comply with NOAA Fisheries' electrofishing guidelines, listed below.[77]

(1) Do not electrofish near adult salmon in spawning condition or near redds containing eggs.

(2) Keep equipment in good working condition. Complete manufacturers' preseason checks, follow all provisions, and record major maintenance work in a log.

(3) Train the crew by a crew leader with at least 100 hours of electrofishing experience in the field using similar equipment. Document the crew leader's experience in a logbook. Complete training in waters that do not contain listed fish before an inexperienced crew begins any electrofishing.

(4) Measure conductivity and set voltage as follows:

Conductivity (umhos/cm)	Voltage
Less than 100	900 to 1100
100 to 300	500 to 800
Greater than 300	150 to 400

(5) Use direct current (DC) at all times.

(6) Begin each session with pulse width and rate set to the minimum needed to capture fish. These settings should be gradually increased only to the point where fish are immobilized and captured. Start with pulse width of 500us and do not exceed 5 milliseconds. Pulse rate should start at 30Hz and work carefully upwards. In general, pulse rate should not exceed 40 Hz, to avoid unnecessary injury to the fish.

(7) The zone of potential fish injury is 0.5 meters from the anode. Care should be taken in shallow waters, undercut banks, or where fish can be concentrated because in such areas the fish are more likely to come into close contact with the anode.

(8) Work the monitoring area systematically, moving the anode continuously in a herringbone pattern through the water. Do not electrofish one area for an extended period.

(9) Have crew members carefully observe the condition of the sampled fish. Dark bands on the body and longer recovery times are signs of injury or handling stress. When such signs are noted, the settings for the electrofishing unit may need adjusting. End sampling if injuries occur or abnormally long recovery times persist.

(10) Whenever possible, place a block net below the area being sampled to capture stunned fish that may drift downstream.

[77] National Marine Fisheries Service, *Backpack Electrofishing Guidelines* (December 1998) (http://www.nwr.noaa.gov/1salmon/salmesa/pubs/electrog.pdf).

(11) Record the electrofishing settings in a logbook along with conductivity, temperature, and other variables affecting efficiency. These notes, with observations on fish condition, will improve technique and form the basis for training new operators.

iii. Do not use seining or electrofishing if water temperatures exceed 18 degrees centigrade.

iv. Handle ESA-listed fish with extreme care, keeping fish in water to the maximum extent possible during seining and transfer procedures, to prevent the added stress of out-of-water handling.

v. Transport fish in aerated buckets or tanks. Release fish into a safe release site as quickly as possible, and as near as possible to capture sites.

vi. If a listed fish is injured or killed at any point during the salvage operation, the NOAA Fisheries Law Enforcement Office will be contacted (NOAA Fisheries 2002b).

vii. Do not transfer ESA-listed fish to anyone except NOAA Fisheries or USFWS personnel, unless otherwise approved in writing by them.

viii. Obtain all other Federal, state, and local permits necessary to conduct the capture and release activity.

ix. Allow NOAA Fisheries or USFWS or its designated representative to accompany the capture team during the capture and release activity, and to inspect the team's capture and release records and facilities.

p. <u>Earthwork</u>. Complete earthwork (including drilling, excavation, dredging, filling and compacting) as quickly as possible.

i. <u>Excavation</u>. During excavation, stockpile native streambed materials above the bankfull elevation, where it cannot reenter the stream, for later use. If culvert inlet/outlet protecting riprap is used, it will be class 350 metric or larger and topsoil will be placed over the rock and planted with native woody vegetation.

ii. <u>Drilling and sampling</u>. If drilling, boring, or jacking is used, the following conditions apply.

(1) Isolate drilling operations in wetted stream channels using a steel pile, sleeve or other appropriate isolation method to prevent drilling fluids from contacting water.

(2) If it is necessary to drill through a bridge deck, use containment measures to prevent drilling debris from entering the channel.

(3) If directional drilling is used, the drill, bore or jack hole will span the channel migration zone and any associated wetland.

(4) Sampling and directional drill recovery/recycling pits, and any associated waste or spoils will be completely isolated from surface waters, off-channel habitats and wetlands. All drilling fluids and waste will be recovered and recycled or disposed to prevent entry into flowing water.

(5) If a drill boring conductor breaks and drilling fluid or waste is visible in water or a wetland, all drilling activity will cease pending written approval from NOAA Fisheries to resume drilling.

iii. Site stabilization. Stabilize all disturbed areas, including obliteration of temporary roads, following any break in work unless construction will resume within four days.

iv. Source of materials. Obtain boulders, rock, woody materials and other natural construction materials used for the project outside the riparian buffer area.

q. Stormwater management. Prepare and carry out a stormwater management plan for any project that will produce a new impervious surface or a land cover conversion that slows the entry of water into the soil. Make the plan available for inspection on request by BPA or NOAA Fisheries.

i. Plan contents. The goal is to avoid and minimize adverse effects due to the quantity and quality of stormwater runoff for the life of the project by maintaining pre-project conditions, or by restoring more natural conditions. The plan will meet the following criteria and contain the pertinent elements listed below, and meet requirements of all applicable laws and regulations.

(1) A system of management practices and, if necessary, structural facilities, designed to complete the following functions:

(i) Minimize, disperse and infiltrate stormwater runoff onsite using sheet flow across permeable vegetated areas to the maximum extent possible without causing flooding, erosion impacts, or long-term adverse effects to groundwater.

(ii) Pretreat stormwater from pollution generating surfaces, including bridge decks, before infiltration or discharge into a freshwater system, as necessary to minimize any nonpoint source pollutant (*e.g.,* debris, sediment, nutrients, petroleum hydrocarbons, metals) likely to be present in the volume of runoff predicted from a 6-month, 24-hour storm.

(2) Use permeable pavements for load-bearing surfaces, including multiple-use trails, to the maximum extent feasible based on soil, slope, and traffic conditions.

(3) Install structural facilities outside wetlands or the riparian buffer area[78] whenever feasible; otherwise, provide compensatory mitigation to offset any long-term adverse effects.

(4) For projects that require engineered flow control facilities to meet the stormwater management goal, use a continuous rainfall/runoff

[78] For purposes of this Opinion only, "riparian buffer area" means land: (1) Within 150-feet of any natural water occupied by listed salmonids during any part of the year or designated as critical habitat; (2) within 100 feet of any natural water within 1/4 mile upstream of areas occupied by listed salmonids or designated as critical habitat and that is physically connected by an above-ground channel system such that water, sediment, or woody material delivered to such waters will eventually be delivered to water occupied by listed salmon or designated as critical habitat; and (3) within 50-feet of any natural water upstream of areas occupied by listed salmonids or designated as critical habitat and that is physically connected by an above-ground channel system such that water, sediment, or woody material delivered to such waters will eventually be delivered to water occupied by listed salmon or designated as critical habitat. "Natural water" means all perennial or seasonal waters except water conveyance systems that are artificially constructed and actively maintained for irrigation.

model, where available, to ensure that the duration of post-project discharge matches the pre-developed duration from 50% of the 2-year peak flow up to the 50-year peak flow.

(5) Document completion of the following activities according to a regular schedule for the operation, inspection and maintenance of all structural facilities and conveyance systems, in a log available for inspection on request by BPA and NOAA Fisheries.

(i) Inspect and clean each facility as necessary to ensure that the design capacity is not exceeded, heavy sediment discharges are prevented, and whether improvement in operation and maintenance are needed.

(ii) Promptly repair any deterioration threatening the effectiveness of any facility.

(iii) Post a warning sign on or next to any storm drain inlet that says, as appropriate for the receiving water, "Dump No Waste - Drains to Ground Water, Streams, or Lakes."

(iv) Only dispose of sediment and liquid from any catch basins in an approved facility.

ii. Runoffs discharged into a freshwater system. When stormwater runoff will be discharged directly into fresh surface water or a wetland, or indirectly through a conveyance system, the following requirements apply.

(1) Maintain natural drainage patterns and, whenever possible, ensure that discharges from the project site occur at the natural location.

(2) Use a conveyance system comprised entirely of manufactured elements (*e.g.,* pipes, ditches, outfall protection) that extends to the ordinary high water line of the receiving water.

(3) Stabilize any erodible elements of this system to prevent erosion.

(4) Do not divert surface water from, or increase discharge to, an existing wetland if that will cause a significant adverse effect to wetland hydrology, soils or vegetation.

r. Site rehabilitation. For projects that BPA determines have a significant construction component[79], prepare and carry out a site restoration plan as necessary to ensure that all streambanks, soils and vegetation disturbed by the project are cleaned up and restored as follows. Make the written plan available for inspection on request by BPA or NOAA Fisheries.

i. General considerations.

(1) Rehabilitation goal. The goal of site rehabilitation is renewal of habitat access, water quality, production of habitat elements (*e.g.,* large woody debris), channel conditions, flows, watershed conditions and other ecosystem processes that form and maintain productive fish habitats.

(2) Streambank shaping. Restore damaged streambanks to a natural slope, pattern and profile suitable for establishment of permanent

[79] "Significant construction component" means a component of a project (e.g., instream construction, fish passage, road obliteration and decommissioning) that results in construction effects that can be meaningfully measured, detected, or evaluated.

woody vegetation, unless precluded by pre-project conditions (e.g., a natural rock wall).

(3) Revegetation. Replant each area requiring revegetation prior to or at the beginning of the first growing season following construction. Use a diverse assemblage of species native to the project area or region, including grasses, forbs, shrubs and trees. Do not use noxious or invasive species.

(4) Herbicides. Any herbicide application will follow the conservation measures listed under Section 1.2.9.3, "Vegetation Management by Herbicide Use."

(5) Fertilizer. Do not apply surface fertilizer within 50 feet of any stream channel.

(6) Fencing. Install fencing as necessary to prevent access to revegetated sites by livestock or unauthorized persons.

ii. Plan contents. Include each of the following elements.

(1) Prepare and carry out a site restoration plan as necessary to ensure that all streambanks, soils and vegetation disturbed by the project are cleaned up and restored as follows. Make the written plan available for inspection on request by BPA or NOAA Fisheries.

(2) Baseline information. This information will be obtained from existing sources (*e.g.,* land use plans, watershed analyses, subbasin plans), where available.

(i) A functional assessment of adverse effects, i.e., the location, extent and function of the riparian and aquatic resources that will be adversely affected by construction and operation of the project.

(ii) The location and extent of resources surrounding the restoration site, including historic and existing conditions.

(3) Goals and objectives. Restoration goals and objectives that describe the extent of site restoration necessary to offset adverse effects of the project, by aquatic resource type.

(4) Performance standards. Use these standards to help design the plan and to assess whether the restoration goal is met. While no single criterion is sufficient to measure success, the intent is that these features should be present within reasonable limits of natural and management variation.

(i) Bare soil spaces are small and well dispersed.

(ii) Soil movement, such as active rills or gullies and soil deposition around plants or in small basins, is absent or slight and local.

(iii) If areas with past erosion are present, they are completely stabilized and healed.

(iv) Plant litter is well distributed and effective in protecting the soil with few or no litter dams present.

(v) Native woody and herbaceous vegetation, and germination microsites, are present and well distributed across the site.
(vi) Vegetation structure is resulting in rooting throughout the available soil profile.
(vii) Plants have normal, vigorous growth form, and a high probability of remaining vigorous, healthy and dominant over undesired competing vegetation.
(viii) High impact conditions confined to small areas necessary access or other special management situations.
(ix) Streambanks have less than 5% exposed soils with margins anchored by deeply rooted vegetation or coarse-grained alluvial debris.
(x) Natural site potential vegetation is present.

(5) Work plan. Develop a work plan with sufficient detail to include a description of the following elements, as applicable.
(i) Boundaries for the restoration area.
(ii) Restoration methods, timing, and sequence.
(iii) Water supply source, if necessary.
(iv) Woody native vegetation appropriate to the restoration site.[80] This must be a diverse assemblage of species that are native to the project area or region, including grasses, forbs, shrubs and trees. This may include allowances for natural regeneration from an existing seed bank or planting
(v) A plan to control exotic invasive vegetation.
(vi) Elevation(s) and slope(s) of the restoration area to ensure they conform with required elevation and hydrologic requirements of target plant species.
(vii) Geomorphology and habitat features of stream or other open water.
(viii) Site management and maintenance requirements.

(6) Monitoring and maintenance plan.
(i) A schedule to visit the restoration site the first year after completion and then every other year thereafter, as long as necessary to confirm that the performance standards are achieved.
(ii) During each visit, inspect for and correct any factors that may prevent attainment of performance standards (e.g., low plant survival, invasive species, wildlife damage, drought).
(iii) Keep a written record to document the date of each visit, site conditions and any corrective actions taken.

[80] Use reference sites to select vegetation for the mitigation site whenever feasible. Historic reconstruction, vegetation models, or other ecologically based methods may be used as appropriate.

s. Long-term adverse effects[81]. Prepare and carry out a compensatory mitigation plan as necessary to ensure the proposed action meets the goal of 'no net loss' aquatic functions by offsetting unavoidable long-term adverse effects to streams and other aquatic habitats. Make the plan available for inspection on request by BPA or NOAA Fisheries.

i. Actions of concern. The following actions require a Compensatory Mitigation Plan to offset long-term adverse effects:

(1) Riparian and aquatic habitats displaced by construction of structural stormwater facilities, or scour protection (e.g., a footing facing, head wall, or other protection necessary to prevent scouring or downcutting of a culvert or bridge support).

(2) Other activities that prevent the development of properly functioning conditions through natural habitat processes.

ii. General considerations.

(1) Make mitigation plans compatible with adjacent land uses or, if necessary, use an upland buffer to separate mitigation areas from developed areas or agricultural lands.

(2) Base the level of required mitigation on a functional assessment of adverse effects of the proposed project, and functional replacement (*i.e.,* 'no net loss of function'), whenever feasible, or a minimum one-to-one linear foot or acreage replacement.

(3) Acceptable mitigation includes reestablishment or rehabilitation of natural or historic habitat functions when self-sustaining, natural processes are used to provide the functions. Actions that require construction of permanent structures, active maintenance, creation of habitat functions where they did not historically exist, or that simply preserve existing functions are not authorized, unless otherwise approved in writing by NOAA Fisheries.

(4) Whenever feasible, complete mitigation before, or concurrent with, project construction to reduce temporal loss of aquatic functions and simplify compliance.

(5) When project construction is authorized before mitigation is completed, the applicant will show that a mitigation project site has been secured and appropriate financial assurances in place.

(6) Complete all work necessary to carry out the mitigation plan no later than the first full growing season following the start of project construction, whenever feasible.

(7) If beginning the initial mitigation actions within that time is infeasible, then include other measures that mitigate for the consequences of temporal losses in the mitigation plan.

[81] Long-term adverse effects are unavoidable net effects such as those resulting from replacing a culvert with a bridge. While the bridge will have a positive effect on the overall properly functioning stream condition, the bridge will add impervious surfaces adjacent to the stream, which can result in permanent conditions of increased runoff and reduced site permeability and infiltration. This conservation measure will ensure that such long-term adverse effects causing unavoidable permanent loss will be offset by compensatory mitigation such as planting additional riparian trees and shrubs or restoration of near shore habitats.

(8) Actions to complete a mitigation plan will also meet all applicable terms and conditions for this Opinion, or complete a separate consultation.

iii. Plan contents. Include all pertinent elements of a site rehabilitation plan, outlined above, and the following elements.

(1) Consideration of the following factors during mitigation site selection and plan development.

(i) Watershed considerations related to specific aquatic resource needs of the affected area.

(ii) Existing technology and logistical concerns.

(2) A description of the legal means for protecting mitigation areas, and a copy of any legal instrument relied on to secure that protection.

t. Implementation monitoring. BPA will require the following of each project sponsor as a condition of project funding: Each project sponsor will submit a monitoring report to BPA within 120 days of project completion describing the sponsor's success in meeting the conservation measures, reasonable and prudent measures, and associated terms and conditions of the Opinion. For projects that BPA determines to have a significant construction component[82], annual follow-up site rehabilitation monitoring reports will also be due by December 31 of each year following completion of construction as discussed in "d." below. Each project-level monitoring report will include the following information, as applicable.

i. Project identification.

(1) Project sponsor name, BPA Fish and Wildlife project number, and project name.

(2) Opinion category of activity.

(3) Project location by 5th or 6th field HUC and by latitude and longitude as determined from the appropriate USGS 7-minute quadrangle map.

(4) BPA contract manager.

(5) Starting and ending dates for the habitat improvement work completed.

ii. Photo documentation. Photo documentation of habitat conditions at the project site before, during, and after project completion.[83]

(1) Include general views and close-ups showing details of the project and project area, including pre- and post-construction, for habitat improvement activities.

[82] "Significant construction component" means a component of a project (*e.g.,* instream construction, fish passage, road obliteration and decommissioning) that results in construction effects that can be meaningfully measured, detected, or evaluated.

[83] Relevant habitat conditions may include characteristics of channels, eroding and stable streambanks in the project area, riparian vegetation, water quality, flows at base, bankfull and over-bankfull stages, and other visually discernable wildlife environmental conditions at the project area, and upstream and downstream of the project.

(2) Label each photo with date, time, project name, photographer's name, and documentation of the subject habitat improvement activity.

iii. Other data. Additional project-specific data, as appropriate, for individual projects.

(1) Work cessation. Dates work ceased because of high flows, if any.

(2) Fish screen. Compliance with NOAA Fisheries fish screen criteria.[84]

(3) Pollution and Erosion Control Plan. A summary of pollution and erosion control inspections, including any erosion control failures, contaminant releases, and correction efforts.

(4) Site preparation.

(i) Total cleared area – riparian and upland.

(ii) Total new impervious area.[85]

(5) Isolation of in-water work area, capture and release.

(i) Supervisory fish biologist – name and address.

(ii) Methods of work area isolation and take minimization.

(iii) Stream conditions before, during and within one week after completion of work area isolation.

(iv) Means of fish capture.

(v) Number of fish captured by species.

(vi) Location and condition of all fish released.

(vii) Any incidence of observed injury or mortality of listed species.

(6) Streambank protection.

(i) Type and amount of materials used.

(ii) Project size – one bank or two, width and linear feet.

(7) Road construction, repairs and improvements. The justification for permanent road crossings design (*i.e.,* road realignment, full-span bridge, streambed simulation, or no-slope design culvert).

(8) Site rehabilitation. Photo or other documentation that site rehabilitation performance standards were met.

iv. Site rehabilitation monitoring. In addition to the 120-day implementation report, each project sponsor for a project that BPA determines to have a significant construction component[86] will submit an annual report by December 31 that includes the written record documenting the date of

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[84] NOAA Fisheries *Juvenile Fish Screen Criteria* (revised February 16, 1995) and *Addendum: Juvenile Fish Screen Criteria for Pump Intakes* (May 9, 1996) (guidelines and criteria for migrant fish passage facilities, and new pump intakes and existing inadequate pump intake screens) (http://www.nwr.noaa.gov/1hydrop/hydroweb/ferc.htm). Note: new criteria are currently being drafted by NOAA Fisheries (2003).

[85] Impervious area defined: That part of the action area that is sufficiently compacted or otherwise covered by constructed, non-filtrating surfaces like concrete, pavement or buildings such that runoff is likely to contribute to the storm runoff response of the downstream channel.

[86] "Significant construction component" means a component of a project (e.g., instream construction, fish passage, road obliteration and decommissioning) that results in construction effects that can be meaningfully measured, detected, or evaluated.

each visit to a project rehabilitation site, and the site conditions and any corrective action taken during that visit. Reporting will continue from year to year until BPA certifies that site rehabilitation performance standards have been met.

u. Annual monitoring report. BPA will provide NOAA Fisheries with an annual monitoring report by January 31 of each year that describes BPA's efforts in carrying out the activities under the Opinion. See discussion under Section 1.1.5.4, "Compliance and Reporting Requirements."
v. Annual coordination. BPA will meet annually with NOAA Fisheries to review the monitoring reports and determine if revisions or addenda are necessary to further implementation of the Opinion. See discussion under Section 1.1.5.5, "Annual Review and Revisions to the Opinion."

3. To implement reasonable and prudent measure #3 (stream channel, floodplain, and upland surveys and installation of stream monitoring devices such as streamflow and temperature monitors), the BPA shall ensure the following:

    a. Except for escapement (redd) surveys, no in-water work will occur within 300 feet of spawning areas during anadromous fish spawning and incubation times.
    b. Persons conducting redd surveys will be trained in redd identification, likely redd locations, and methods to minimize the likelihood of stepping on redds or delivering fine sediment to redds (PNF 2001e).
    c. Workers will avoid redds and listed spawning fish while walking within or near stream channels to the extent possible. Avoidance will be accomplished by examining pool tail outs and low gradient riffles for clean gravel and characteristic shapes and flows prior to walking or snorkeling through these areas (PNF 2001e).
    d. If redds or listed spawning fish are observed at any time, workers will step out of the channel and walk around the habitat unit on the bank at a distance from the active channel (PNF 2001e).
    e. Snorkel surveys will follow a statistically valid sampling design or rely on a single pass approach (NMFS 2000b).
    f. Surveyors will coordinate with other local agencies to prevent redundant surveys (NMFS 2000b).
    g. Excavated material from cultural resource test pits will be placed away from stream channels. All material will be replaced back into test pits when testing is completed (NMFS 2000b).
    h. Multiple stream sites will be used for field trips to minimize effects on any given stream or riparian buffer area (NMFS 2000b).
    i. BPA will prepare an annual report of activities, including stream mileage surveyed and inventoried, categorized by method and by WRIA, HUC, or other appropriate spatial information (NMFS 2000b).

4. To implement reasonable and prudent measure #4 (streambank protection), the BPA shall ensure the following:

a. Use of large wood and rock. Whenever possible, use large wood as an integral component of all streambank protection treatments.[87] Avoid or minimize the use of rock, stone and similar materials.
b. Large wood will be intact, hard, and undecayed to partly decaying with untrimmed root wads to provide functional refugia habitat for fish. Use of decayed or fragmented wood found laying on the ground or partially sunken in the ground is not acceptable.
c. Rock may be used instead of wood for the following purposes and structures. The rock will be class 350 metric, or larger, wherever feasible, but may not impair natural stream flows into or out of secondary channels or riparian wetlands. Rock will be used:
   i. As ballast to anchor or stabilize large woody debris components of an approved bank treatment.
   ii. To fill scour holes, as necessary to protect the integrity of the project, if the rock is limited to the depth of the scour hole and does not extend above the channel bed.
   iii. To construct a footing, facing, head wall, or other protection necessary to prevent scouring or downcutting of an existing flow control structure (*e.g.,* a culvert or bridge support).
   iv. To construct a flow-redirection structure as described above.

5. To implement reasonable and prudent measure #5 (installing habitat-forming natural material instream structures), the BPA shall ensure the following:
   a. Installation of LWD will comply with the size requirements outlined in "A Guide to Placing Large Wood in Streams" (ODFW/ODF 1995) and placement guidance in the "Oregon Aquatic Habitat Restoration and Enhancement Guide" (ODFW/ODF 1999) (NMFS 2001f), or Appendix I of the Integrated Streambank Protection Guidelines[88] (WDFW *et al.* 2003). The wood length requirement is at least two times the bankfull stream width (1.5 times the bankfull width for wood with rootwad attached) (ODFW/ODF 1999). The minimum diameter size requirements are based on the bankfull width of the stream as follows (ODFW/ODF 1995):

Bankfull Width (feet)	Minimum Diameter (inches)
0 to 10	10
10 to 20	16
20 to 30	18
Over 30	22

[87] See, *e.g.,* Washington Department of Fish and Wildlife, Washington Department of Transportation, and Washington Department of Ecology, *Integrated Streambank Protection Guidelines*, Appendix I: Anchoring and placement of large woody debris (June 2002) (http://www.wa.gov/wdfw/hab/ahg/ispgdoc.htm); Oregon Department of Forestry and Oregon Department of Fish and Wildlife, *A Guide to Placing Large Wood in Streams*, May 1995
http://www.odf.state.or.us/divisions/protection/forest_practices/RefsList.asp
[88] See Washington Department of Fish and Wildlife, Washington Department of Transportation, and Washington Department of Ecology, *Integrated Streambank Protection Guidelines*, April 2003, Appendix I, Anchoring and Placement of Large Woody Debris (http://www.wa.gov/wdfw/hab/ahg/ispgdoc.htm).

6. To implement reasonable and prudent measure #6 (improving secondary channel habitats), the BPA shall ensure the following:

   a. Projects will be designed to provide fish passage in accordance with NOAA Fisheries "Anadromous Salmonid Passage Facility Guidelines and Criteria" (NOAA Fisheries 2003).
   b. For removal of sediment bars or terraces, no more than 25 cubic yards of sediment may be removed from within 50 feet of the mouth of the stream.
   c. Adequate precautions will be taken to prevent post-construction stranding of juvenile or adult fish.

7. To implement reasonable and prudent measure #7 (riparian and wetland habitat creation, rehabilitation, and enhancement), the BPA shall ensure the following:

   a. Adequate precautions will be taken to prevent stranding of juvenile or adult fish (NOAA Fisheries 2003b).
   b. All passage will be designed in accordance with NOAA Fisheries "Anadromous Salmonid Passage Facility Guidelines and Criteria" (NOAA Fisheries 2003).

8. To implement reasonable and prudent measure #8 (fish passage activities), the BPA shall ensure the following:

   a. Preliminary designs for modifying upstream passage facilities will be developed in an interactive process with NOAA Fisheries, in accordance with "Anadromous Salmonid Passage Facility Guidelines and Criteria" (NOAA Fisheries 2003). The preliminary design will be developed on the basis of synthesis of the required site and biological information listed in NOAA Fisheries 2003. NOAA Fisheries will review fish passage facility designs in the context of how the required site and biological information was integrated into the design. Submittal of all information discussed in the document may not be required in writing for NOAA Fisheries review, however, BPA and the project sponsor will be prepared to describe how the biological and site information listed in the document was included in the development of the preliminary design. NOAA Fisheries will be available to discuss these criteria in general or in the context of a specific site. BPA and the project sponsor will initiate coordination with NOAA Fisheries fish passage specialists early in the development of the preliminary design to allow an iterative, interactive, and cooperative process (NOAA Fisheries 2003).
   b. NOAA Fisheries staff will conduct post-construction evaluations to assure the intended results are accomplished, and that mistakes are not repeated elsewhere. There are three parts to this evaluation: (1) Verification that the fish passage facility is installed in accordance with proper design and construction procedures; (2) measurement of hydraulic conditions to assure that the facility meets these guidelines; and (3) biological evaluations to confirm the hydraulic conditions are resulting in successful passage. Step 1 is always required; steps 2 and 3 are may be waived on a project-by-project basis if it is clear that the hydraulic conditions

are being met (usually applies to smaller facilities). NOAA Fisheries technical staff may assist in developing a hydraulic or biological evaluation plan to fit site-specific conditions and species. These evaluations are not intended to cause extensive retrofits of any given project unless the as-built installation does not reasonably conform to the design guidelines, or an obvious fish passage problem continues to exist (NOAA Fisheries 2003).

c. Operation and maintenance of fish passage structures will be conducted in accordance with the operation and maintenance plan outlined in Section 7 of Form 1 in Appendix A.

9. To implement reasonable and prudent measure #9 (constructing fencing for grazing control), the BPA shall ensure the following:

   a. Fenced enclosures and exclosures will be implemented in conjunction with a prescribed grazing plan that minimizes the impact to riparian areas. The prescribed management plan will follow the criteria, specifications, and operation and maintenance protocols of the National Resource Conservation Service (NRCS) Conservation Practice Standard 528a for prescribed grazing (NRCS 2000g).
   b. Modify grazing practices, such as the season and amount of use, that prevent attainment of salmon habitat quality indicators, as described above. In particular, insure that grazing use does not cause bank instability for more than 5% lineal bank distance (including both banks), or exceed more than 30% or the current year's growth of woody vegetation. Pasture moves will occur before these annual thresholds are reached.
   c. Manage the timing and distribution of livestock to ensure that they do not enter the specific stream reaches used by ESA-listed salmon or steelhead for spawning during times when reproductive adults, eggs, or pre-emergent fry are expected to be present.

10. To implement reasonable and prudent measure #10 (installing off-channel watering facilities), the BPA shall ensure the following:

    a. Off-channel livestock watering facilities will be located to minimize compaction and/or damage to sensitive soils, slopes, vegetation, or fish spawning habitat due to congregating livestock (NMFS 2002).
    b. Wherever feasible, place new livestock water developments and move existing water developments at least 0.5 miles away from riparian areas, unless livestock movement is otherwise limited by terrain.
    c. Ensure that each watering development has a float valve, fenced overflow area, return flow system, or other means, as necessary, to minimize water withdrawal and potential runoff and erosion.
    d. All intake screening projects will be consistent with NOAA Fisheries' Pump Intake Screen Guidelines[89] (NMFS 2002).

[89] NMFS *Addendum: Juvenile Fish Screen Criteria for Pump Intakes* (May 9, 1996) at (http://www.nwr.noaa.gov/1hydrop/hydroweb/ferc.htm). NOTE: new criteria are currently being drafted by NOAA Fisheries (2002).

e. Withdrawals from all new wells or other stock watering sources installed under this activity will not exceed 1 cfs and will be permitted by the appropriate state agency. Project biologists will verify clearance with agency contacts (NMFS 2002).

11. To implement reasonable and prudent measure #11 (hardening fords for livestock crossings of streams), the BPA shall ensure the following:

a. Minimize the number of crossings.
b. Locate crossings to minimize compaction and/or damage to sensitive soils, slopes, or vegetation. Place fords on bedrock or stable substrates whenever possible (NMFS 2002).
c. Do not place crossings in areas where ESA-listed salmon or steelhead spawn or are suspected of spawning, or within 300 feet upstream of such areas if spawning areas may be disturbed.
d. Design and construct or improve essential crossings to accommodate reasonably foreseeable flood risks, including associated bedload and debris, and to prevent the diversion of streamflow out of the channel and down the trail if the crossing fails (NMFS 1999).
e. Stabilize bank cuts, if any, with vegetation and protect approaches and crossings with river rock (not crushed rock) when necessary to prevent erosion (NMFS 1999).
f. Ensure that livestock crossings in and of themselves do not create barriers to the passage of adult and juvenile fish (NMFS 1999).
g. Manage livestock to minimize time spent in the crossing or riparian area.

12. To implement reasonable and prudent measure #12 (implementing upland conservation buffers), the BPA shall ensure the following:

a. Implement these activities in combination with a riparian forest buffer (NRCS measure 391) (NRCS 2000e) wherever trees and/or shrubs can grow, or a riparian herbaceous cover (NRCS measure 390) (NRCS 1998) where analysis of available information (*e.g.,* historical accounts, photographs, or USDA Plant Association Groups) indicates that no trees or shrubs, including willow (*Salix spp.*), existed on the site within historic times. Installation and management of the full range of field and landscape buffers will be encouraged by BPA as necessary to address small but unavoidable pollutant discharges associated with active agricultural operations, catastrophic pollution-associated episodic storm events, and other landscape level concerns.

13. To implement reasonable and prudent measure #13 (implementing conservation cropping systems), the BPA shall ensure the following:

a. Employ conservation tillage and residue management practices that leave 30% or more of the previous crop residue on the soil surface after planting, as feasible, to reduce erosion potential.

b. Employ nutrient management practices to increase the efficiency of fertilizer inputs and decrease the transport of nutrients to ground and surface water. Nutrients will be applied at an agronomic rate.[90]
c. Employ vegetation management practices, including nonchemical vegetation control measures that will reduce losses dues to herbicide contamination during transport, handling, and use, and nonpoint pollution losses after use.[91]
d. Implement these activities in combination with a riparian forest buffer (NRCS measure 391) (NRCS 2000e) wherever trees and/or shrubs can grow, or a riparian herbaceous cover (NRCS measure 390) (NRCS 1998) where analysis of available information (*e.g.,* historical accounts, photographs, or USDA Plant Association Groups) indicates that no trees or shrubs, including willow (*Salix spp.*), existed on the site within historic times. Installation and management of the full range of field and landscape buffers will be encouraged by BPA as necessary to address small but unavoidable pollutant discharges associated with active agricultural operations, catastrophic pollution-associated episodic storm events, and other landscape level concerns.

14. To implement reasonable and prudent measure #14 (soil stabilization *via* planting and seeding), the BPA shall ensure the following:

    a. Implement the applicable conservation measures in sections 1.2.7.1 and 1.2.7.2, above.

15. To implement reasonable and prudent measure #15 (implementing erosion control practices), the BPA shall ensure the following:

    a. Implement these activities in combination with a riparian forest buffer (NRCS measure 391) (NRCS 2000e) wherever trees and/or shrubs can grow, or a riparian herbaceous cover (NRCS measure 390) (NRCS 1998) where analysis of available information (*e.g.,* historical accounts, photographs, or USDA Plant Association Groups) indicates that no trees or shrubs, including willow (*Salix spp.*), existed on the site within historic times. Installation and management of the full range of field and landscape buffers will be encouraged by BPA as necessary to address small but unavoidable pollutant discharges associated with active agricultural operations, catastrophic pollution-associated episodic storm events, and other landscape level concerns.

16. To implement reasonable and prudent measure #16 (converting from instream diversions to groundwater wells for primary water source), the BPA shall ensure the following:

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[90] "Agronomic rate" means a quantity and timing of total nutrient application that does not exceed the requirements of the crop production and harvest or grazing system, as opposed to a nutrient application rate based on production goals that are difficult to define and variable. Calculation of the agronomic rate should take into account the total nitrogen or phosphorus resources for plant nutrition, and any retention of phosphorus in the soil and losses of nitrogen through dentrification and ammonia volatilization.
[91] Take of ESA-listed species caused by any aspect of pesticide use is not included in this HIP consultation and must be evaluated in an individual consultation if it is funded by BPA.

a. All new wells installed under this activity will obtain applicable permits from the appropriate state agency (NMFS 2002).

17. To implement reasonable and prudent measure #17 (installing new or upgrading/maintaining existing fish screens), the BPA shall ensure the following:

    a. All fish screening projects will be consistent with NOAA Fisheries' Juvenile Fish Screen Criteria (NMFS 1995b), and all intake screening projects will be consistent with NOAA Fisheries' Pump Intake Screen Guidelines[92] (NMFS 1996) (NMFS 2002).
    b. All passage will be designed in accordance with NOAA Fisheries "Anadromous Salmonid Passage Facility Guidelines and Criteria" (NOAA Fisheries 2003) including the described interactive design process with NOAA Fisheries Engineering staff.
    c. All fish screens will be sized to match the owner's documented or estimated historic water use.
    d. Operation and maintenance of fish passage structures will be conducted in accordance with the operation and maintenance plan outlined on Form 1 in Appendix A.

18. To implement reasonable and prudent measure #18 (removing, consolidating, or improving irrigation diversion dams), the BPA shall:

    a. The design of the proposed irrigation diversion structure will enable the irrigators to comply with all appropriate state water right agency rules and regulations. No new or replacement diversion structure will be sized to exceed the amount of the irrigators' documented or estimated historic water use (NOAA Fisheries 2002a).
    b. Project design will include the installation of a totalizing flow meter device on all diversion structures for which installation of this device is possible (NOAA Fisheries 2002a).
    c. Diversion structures will be designed and screened to meet NOAA Fisheries' criteria[93] (NMFS 1995b, 1996 and "Anadromous Salmonid Passage Facility Guidelines and Criteria" NOAA Fisheries 2003) including the described interactive design process with NOAA Fisheries Engineering staff.
    d. Operation and maintenance of irrigation diversion structures will be conducted in accordance with the operation and maintenance plan outlined on Form 1 in Appendix A.

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[92] NMFS (National Marine Fisheries Service), *Juvenile Fish Screen Criteria* (revised February 16, 1995) and *Addendum: Juvenile Fish Screen Criteria for Pump Intakes* (May 9, 1996) (guidelines and criteria for migrant fish passage facilities, and new pump intakes and existing inadequate pump intake screens) (http://www.nwr.noaa.gov/1hydrop/hydroweb/ferc.htm). NOTE: new criteria are currently being drafted by NOAA Fisheries (2002).

[93] ibid

19. To implement reasonable and prudent measure #19 (vegetation planting), the BPA shall ensure the following:

   a. Vegetation plans will be prepared that:
      i. Require the use of native species;
      ii. specify seed/plant source, seed/plant mixes, soil preparation, etc., (NPS 2001);
      iii. include vegetation management strategies that are consistent with local native succession and disturbance regimes (USFWS 1999);
      iv. address the abiotic factors contributing to the sites' succession, *i.e.,* weather and disturbance patterns, nutrient cycling, and hydrologic condition; and
      v. specify only certified noxious weed-free seed, hay, straw, mulch, or other vegetation material for site stability and revegetation projects.

20. To implement reasonable and prudent measure #20 (vegetation management by physical control), the BPA shall ensure the following:

   a. For mechanical control that will disturb the soil, an untreated or modified treatment area will be maintained within the immediate riparian buffer area to prevent any potential adverse effects to stream channel or water quality conditions. The width of the untreated riparian buffer area will vary depending on site-specific conditions and type of treatment (NMFS 2001g)
   b. Ground-disturbing mechanical activity will be restricted in established buffer zones (USDA 1997) adjacent to streams, lakes, ponds, wetlands and other identified sensitive habitats based on percent slope. For slopes less than 20%, a buffer width of 35 feet will be used. For slopes over 20% no ground-disturbing mechanical equipment will be used (BPA 2000).
   c. When possible, manual control (*e.g.,* hand pulling, grubbing, cutting) will be used in sensitive areas to avoid adverse effects to listed species or water quality (PNF 2001e).
   d. All noxious weed material will be disposal of in a manner that will prevent its spread. Noxious weeds that have developed seeds will be bagged and burned (PNF 2001e).

21. To implement reasonable and prudent measure #21 (vegetation management by herbicide use), the BPA shall ensure the following:

   a. <u>General</u>
      i. The measures listed below are for terrestrial application of chemicals only, and, are designed to prevent chemicals from entering any surface waters. *Aquatic application of chemicals is not covered by this Opinion.*
      ii. Applicators will only use the herbicides and adjuvants as proposed in this Opinion as follows;
      iii. BPA will use the following factors to determine whether to use herbicides instead of or in combination with other types of vegetation control method(s), and when and how often they will be applied: (1) Physical

growth characteristics of target weeds (rhizomatous vs. tap-rooted, *etc.*); (2) seed longevity and germination; (3) infestation size; (4) relationship of the site to other infestations; (5) relationship of the site to listed and/or proposed species; (6) distance to surface water; (7) accessibility to site for equipment; (8) type and amount of use of the area by people; (9) effectiveness of treatment on the target weed; and (10) cost.

iv. Within the buffers identified in Tables 1-7, 1-8, and 1-9, applicators will time all vegetation management activities described in this Opinion to occur when aquatic ESA species are not likely to be present during spawning and/or sensitive life stages.

v. Product label directions will be followed as required by the Federal Insecticide, Fungicide, and Rodenticide Act, including "mandatory" statements (such as registered uses, maximum use rates, application restrictions, worker safety standards, restricted entry intervals, environmental hazards, weather restrictions, and equipment cleaning) (BPA 2000).

vi. All product label "precautionary" statements such as environmental hazards, physical or chemical hazards, soil and climate application restrictions, wildlife warnings, and threatened and endangered species warnings will be followed (BPA 2000 [modified] and EPA Label Review Manual, 1995 as revised http://www.epa.gov/oppfead1/labeling/lrm/).

vii. Herbicides will only be applied by a licensed applicator (valid for the state where the work is located) and only in accordance with EPA labeling or the restrictions identified in the Opinion, whichever are more restrictive. Applicators will use the herbicide specifically targeted for a particular weed species that will cause the least impact to non-target vegetation (BPA 2000).

viii. Applicators will keep records of each application, the active ingredient, formulation, application rate, date, time, location, *etc.* Records will be available to state and Federal inspectors, and will be supplied to applicable regulatory agencies and land managers as requested (*e.g.,* USDA Forest Service and Washington Department of Natural Resources) (BPA 2000).

ix. Applicators will also supply application information to BPA for the annual NOAA Fisheries reporting and monitoring requirements described in the Reporting, Monitoring, Evaluation, and Adaptive Management portion of this section.

x. Applicators will never leave herbicides or equipment unattended in unrestricted access areas (BPA 2000).

xi. Only the minimum area necessary for the control of noxious weeds will be treated (NMFS 2002a).

xii. *Before application*, applicators will thoroughly review the site to identify and mark, if necessary, the buffer requirements (see Tables 1-7, 1-8, and 1-9) (BPA 2000). The most restrictive buffer for the conditions at the site will apply.

xiii. Applicators will observe restricted entry intervals specified by the herbicide label (BPA 2000).

xiv. No 2,4-D ester formulations of any kind will be used (NMFS 2002a).

xv. Only glyphosate that is factory-formulated *without* a surfactant will be used within 100 feet of any surface waters. See Appendix D for listing of acceptable glyphosate formulations.

xvi. Tank mixing of surfactants or other additives to glyphosate without factory-formulated surfactants for use within 100 feet of any surface waters will be in strict accordance with all tables in this chapter.

xvii. Only triclopyr TEA (acid) (Garlon 3A/Tahoe 3A) formulations of triclopyr will be used. No triclopyr BEE (ester) (Garlon 4) formulations of any kind will be used (NMFS 2002a).

xviii. Only surfactants listed in Table 1-6 will be used for any project within the buffer specified in Tables 1-7, 1-8, and 1-9, specifically: only *surfactants registered and approved for aquatic use* as shown on Table 1-6 will used within 15 feet of any surface waters.

xix. No carrier other than water will be used for tank mixing (NMFS 2002a).

b. Drift and Leach Reduction

i. Applicators will use drift reduction agents, as appropriate and as identified in this Opinion, to reduce the drift hazard when applying herbicides as broadcast or localized foliar treatments (BPA 2000).

ii. Colorants will be used to the extent practicable to ensure proper coverage and targeting.

iii. Herbicides/adjuvants with a groundwater or surface water label advisory will not be used within 100 feet of any surface water.

iv. For basal bark/stem and stump applications, applicators will directly spray the root collar area, sides of the stump, and/or the outer portion of the cut surface, including the cambium, until thoroughly wet, but not to the point of runoff, in order to avoid or minimize deposition to surrounding surfaces. A marker colorant/dye is recommended to establish coverage and prevent plant runoff.

v. Treatment will be delayed if precipitation is forecasted to occur within 24 hours, except for pellet application (NMFS 2002a).

vi. Weather Considerations/Restrictions - Tables 1-7, 1-8, and 1-9 identify BPA's proposed minimum weather and wind speed restrictions (to be used in the absence of more stringent label instructions and restrictions). During application, applicators will monitor weather conditions hourly at sites where spray methods are being used (BPA 2000, NMFS 2002a).

c. Mixing

i. Applicators will prepare spray mixtures in accordance with the label(s) instructions and will not exceed the amount of herbicide per acre specified on the label (BPA 2000).

ii. Applicators will perform mixing at suitable locations with respect to buffer zones and recommended buffer widths (see Table 1-7 re: buffers) (BPA 2000).

iii. Except as indicated by Table 1-7, applicators will mix and load herbicides at least 100 feet from any surface waters and only in locations where accidental spills cannot flow into waters, or contaminate groundwater (BPA 2000, NMFS 2002a).

d. Spills and Misapplication

i. Applicators will conduct regular testing on field calibration and calculations to prevent gross application errors (BPA 2000, NMFS 2002a).

ii. The applicator will develop a Spill Containment and Control Plan (SCCP) prior to herbicide application. The plan will contain notification procedures, specific clean up and disposal instructions for different products, quick response containment and clean up measures that will be available on site, proposed methods for disposal of spilled materials, and employee training for spill containment. All individuals involved, including any contracted applicators, will be instructed on the plan (NMFS 2002a).

iii. In addition to an applicator's SCCP, applicators will report spills and misapplications to EPA in accordance with the BPA's Government Agency Plan (GAP) (See Appendix E). Applicators will report spills and misapplications and clean up according to Federal and applicable state laws and regulations. At a minimum:

(1) Notify BPA within 24 hours of any spill or misapplication.
(2) Contain spill or leak, or halt misapplication.
(3) Isolate area; and request help as appropriate.
(4) As soon as possible, notify the owner of the land and any other potentially affected parties.
(5) Clean up the spill.
(6) Clean up equipment and vehicles.
(7) Dispose of cleanup materials properly.
(8) Follow up with appropriate cleanup documentation (BPA 2000).

iv. Upon notification of a spill or misapplication by an applicator, BPA will immediately notify the nearest NOAA Fisheries field office and provide copies of all subsequent relevant information generated from the event.

e. Handling

i. During transportation, applicators will secure herbicide containers to prevent movement within the vehicle or loss from the vehicle during the operation of the vehicle (BPA 2000).

ii. When spray equipment is not being used, applicators will ensure that all valves and tank covers will be closed during any movement of the vehicle (BPA 2000).

iii. Applicators will firmly secure any portable tanks used for herbicide application to the frame of the vehicle (BPA 2000).

f. Storage of Herbicides, Containers, and Equipment

i. Applicators will follow label requirements for storage (BPA 2000).

ii. Storage of herbicides will be in strict compliance with the relevant regulations of the State in which the herbicides are being stored.

iii. Applicators will inspect storage areas frequently for leakage and clean up spill areas immediately, (BPA 2000).

iv. Applicators will store only minimum amounts of chemicals at field and temporary locations, and will order out no more chemicals than necessary (BPA 2000).

v. Applicators will dispose of unwanted or unusable products promptly and correctly (BPA 2000).

vi. In temporary storage locations, such as the field, applicators will store all chemicals in buildings or vehicles that can be locked up (BPA 2000) and no closer than 300 feet from any surface water.

g. Disposal

i. Applicators will use water-soluble packaging (WSP) when available, to eliminate the need for container disposal (BPA 2000).

ii. Applicators will not burn paper and carton-type containers unless stated as permissible on the label (BPA 2000).

iii. Applicators will dispose of containers or cartons in one of three ways:

(1) Triple rinse containers of liquid herbicides before disposal. The rinse solution will be poured into the mix-tank and used for treatment. Each rinse solution will be equal to at least 10% of the container volume. Dispose of the empty containers as non-contaminated waste, at any legal landfill dump.

(2) Use a rinsing nozzle (instead of triple rinsing). A rinsing nozzle has a sharp point that can puncture a plastic or metal empty herbicide container and flush the container's contents into the mix tank.

(3) Return returnable "mini-bulk" type containers to the distributor for refill (BPA 2000).

iv. Applicators will observe the applicable buffers (see Table 1-7) when washing or rinsing spray tanks near waters (BPA 2000, NMFS 2002a).

v. Applicators will dispose of unwanted or unusable herbicide products as contaminated waste at an approved waste facility (BPA 2000).

vi. Applicators will dispose of contaminated materials (including contaminated soil) resulting from cleanup procedures according to EPA directives (BPA 2000).

vii. Applicators will place any contaminated materials to be transported in watertight containers (BPA 2000).

h. Reporting

i. For the 2002/2003 program years, BPA will prepare and deliver a summary of the previous year's activities on July 15, 2003. For subsequent years, the previous year's report will be prepared and delivered to NOAA Fisheries on March 1. Table 1-10 illustrates the proposed schedule.

ii. The summary of the previous year's activities will, at a minimum, include a table showing: (1) The drainage name/code and description; (2) 6th level hydrologic unit code; (3) upland acres treated; (4) riparian acres treated; (5) accomplished treatment (previous year); (6) proposed treatment (subsequent year); (7) herbicide product name (including mixtures); (8) active ingredient(s) (a.i.) and percent a.i.; (9) type and percent of each adjuvant used; (10) application rate; (11) application method(s); (12) date(s) of treatment; (13) treatment for noxious weeds only; (14) treatment for weed control plus restoration/revegetation; and (15) fish and wildlife species and life stages potentially affected. A copy of the table sent to project sponsors is attached in Appendix C, "BPA-Funded Projects FY2002/03 Herbicide Applications."

iii. BPA will also prepare an annual update report of the BA. The update will identify in separate sections: (1) Any new literature findings brought to the attention of the BPA on the herbicides in use, indicating adverse effects (especially sub-lethal effects) of the use of the herbicides on listed fish or critical habitat; (2) a discussion of the ways adverse effects could be minimized further through modification of the proposed activity, or through additional activities; (3) a description of any changes in the environmental baseline; (4) recommended remedies to address the problems identified through monitoring or literature findings.

iv. By October 1, 2003, and each subsequent year, BPA will present the proposed program for NOAA Fisheries approval of work for the upcoming year that includes the proposed sites, methods of treatment, and site specific information about baseline conditions of the proposed treatment areas (when available), adjustments to the program resulting from the monitoring results of the previous year, and planned monitoring (the 2003 proposed program is included in this Opinion in Table 1-4 and Appendix C). The program of work will be reported in the format described above and by the form in Appendix C along with a written report that will also include the upcoming year's proposed monitoring plan, as described below.

i. Monitoring and Evaluation

i. BPA will monitor and evaluate the effectiveness of the noxious weed/vegetation restoration program on both a site-specific treatment level and on a landscape level.

ii. Site-specific treatment level monitoring will involve assessing the effectiveness of the treatment agent or control method on a specific patch of noxious weeds. Follow-up treatments will occur as staffing and funding allow. Monitoring of physical, cultural, and chemical control methods will be conducted on randomly selected sites within one to two months of treatment through visual observation of target species' relative abundance/site dominance compared to pre-treatment conditions. Non-target plant mortality will also be monitored in riparian areas to determine if mortality of non-target plants is affecting riparian functions in NOAA

Fisheries' Matrix of Pathways and Indicators (NMFS 1996a). Also during 2003/4, in consultation with NOAA Fisheries, BPA will develop a monitoring plan that includes the efforts described above plus a standardized sampling and analytical protocol for the purpose of monitoring potential herbicidal effects on applicable non-target resources as a result of atmospheric drift and deposition, and, lateral and/or vertical movement of the applied chemicals through water and soil. Subsequent results will be used in determining the continuation, modification, and/or termination of a particular weed control/vegetation restoration method. The target year for implementing such a plan would be 2005. Table 1-10 illustrates the proposal for both reporting and monitoring.

iii. Landscape level effectiveness monitoring will be accomplished through the Research, Monitoring and Evaluation (RME) Program being developed for the Federal Columbia River Power System (FCRPS) 2000 Biological Opinion (NOAA Fisheries and Action Agencies 2003). While little detail can be provided at this point, the FCRPS RME, when finalized, will provide a consistent approach for the monitoring and evaluation of the processes currently underway for the protection and restoration of ESA species within the Columbia River basin.

j. Adaptive Management

i. The habitat improvement program is a long-term endeavor that includes control of noxious weeds, removal of unwanted vegetation, and revegetation where and when practicable. However, because there are areas of scientific and management uncertainty, management actions may require refinement or change over time as data from specific effectiveness monitoring is analyzed. With the likely development of new control methods and technology, changes in existing or use of new noxious weed treatments and/or vegetation restoration methods may be authorized and warranted. Any changes to the proposed action, as described in this Opinion, would be analyzed for impacts to listed/proposed species and critical habitat, and consultation would be reinitiated as appropriate.

22. To implement reasonable and prudent measure #22 (road maintenance), the BPA shall ensure the following:

a. Road maintenance will comply with ODOT (1999) practices or the most current version of the Regional Road Maintenance Endangered Species Act Program Guidelines.[94] (NOAA Fisheries 2003b)

b. All fill-associated wood will be removed during sidecast removal (NMFS

[94] Oregon Department of Transportation, *Routine Road Maintenance: Water Quality and Habitat Guide, Best Management Practices*, 21 pp. + appendices (July 1999) (providing guidance on routine road maintenance activity only) (http://www.odot.state.or.us/eshtm/images/4dman.pdf) or, see, Regional Road Maintenance Endangered Species Act Program Guidelines (March 2002) (http://www.metrokc.gov/roadcon/bmp/pdfguide.htm)

2002).

c. Waste material generated from road maintenance activities and slides will be disposed of in stable, non-floodplain sites approved by a geotechnical engineer or other qualified personnel (NMFS 2001g)
d. Soil-disturbing maintenance activities will be conducted during dry conditions to the greatest extent practical. Road maintenance work in riparian areas will follow the appropriate state agency In-Water Work Timing guidelines, where relevant, except where the potential for greater damage to water quality and fish habitat exists if the emergency road maintenance is not performed as soon as possible (NMFS 2001g).
e. Disturbance of existing vegetation in ditches and at stream crossings will be minimized to the greatest extent possible (NMFS 2001g).
f. Ditches and culverts will be promptly cleaned of materials resulting from slides or other debris (NMFS 1999c).
g. Dust-abatement additives and stabilization chemicals (typically magnesium chloride or calcium chloride salts) will be used only where a minimum of 25 feet of well-vegetated ground is present between a stream channel and the road. Application will be avoided during or just before wet weather and at stream crossings or other locations that could result in direct delivery to a water body (typically within 25 feet of a water body or stream channel). Spill containment equipment will be available during chemical dust abatement application (NMFS 2001g).
h. Berms will not be left along the outside edge of roads, unless an outside berm was specifically designed to be a part of the road, and low-energy drainage is provided (PNF 2001, PNF 2001a-e).
i. Roads will be graded and shaped to conserve existing surface material. Road grading and shaping will maintain, not destroy, the designed drainage of the road, unless modification is necessary to improve drainage problems that were not anticipated during the design phase (PNF 2001, PNF 2001a-e).
j. Ditch back slopes will not be undercut to avoid slope destabilization and erosion acceleration (PNF 2001, PNF 2001a-e).
k. When blading and shaping roads, excess material will not be side cast onto the fill. All excess material that cannot be bladed into the surface will be end hauled to an appropriate site. End haul and prohibition of side casting will not be required for organic material like trees, needles, branches, and clean sod; however, fine organics like sod and grass will not be cast into water. Slides and rock failures including fine material of more than approximately ½ yard at one site will be hauled to disposal sites. Fine materials (1-inch minus) from slides, ditch maintenance, or blading may be worked into the road. Scattered clean rocks (1-inch plus) may be raked or bladed off the road except within 300 feet of perennial or 100 feet of intermittent streams (PNF 2001, PNF 2001a-e).
l. Road grading material will not be side cast along roads within one-quarter mile of perennial streams and from roads onto fill slopes having a slope greater than 45% (PNF 2001, PNF 2001a-e).
m. Road maintenance will not be attempted when surface material is saturated with water and erosion problems could result (PNF 2001, PNF 2001a-e).

n. Large woody debris (LWD > 9 m in length and >50 cm in diameter) present on roads will be moved intact to down slope of the road, subject to site-specific considerations. Movement down-slope will be subject to the guidance of a fisheries biologist (PNF 2001, PNF 2001a-e).

o. Unsurfaced roads will be managed to avoid delivery of sediment to streams (*e.g.,* closing during the wet season, surfacing, adding drainage). See http://www.dnr.wa.gov/forestpractices/board/manual/ for guidance.

p. Water drafting.

(1) Water source. Non-stream sources will be used instead of streams whenever feasible. When non-stream sources are unavailable, streams with the greatest flow will be used whenever feasible.

(2) Stream flow. Water drafting/pumping (for dust suppression or other needs) will maintain a continuous surface flow of the stream, without altering the original wetted width. No dams or channel alterations will be made for pumping in streams occupied by listed fish species (USDI/USDA 2002).

(3) Pumps. Pumping will follow the NOAA Fisheries guidelines for screening pump intakes (NMFS 1996).

(4) Adult fish. No water will be drafted from sites where adult salmonids are visibly present to prevent interference with spawning activities. If redds have been identified downstream of drafting sites, a fish biologist will ensure water drafting will not have adverse effects to eggs or emergent alevins.

23. To implement reasonable and prudent measure #23 (bridge, culvert, and ford maintenance, removal, and replacement), the BPA shall ensure the following:

a. All fish passage will be designed in accordance with NOAA Fisheries "Anadromous Salmonid Passage Facility Guidelines and Criteria" (NOAA Fisheries 2003), including the described interactive design process with NOAA Fisheries Engineering staff.

b. Design permanent stream crossings in the following priority[95](NOAA Fisheries 2003b). Explain why a particular design was chosen.

(1) Nothing –realign road to avoid crossing the stream

(2) Bridge – new bridges will span the stream to allow for long-term dynamic channel stability, *i.e.,* no bents, piers or other support structures below bankfull elevation.

(3) Streambed simulation – bottomless arch, embedded culvert, or ford

(4) No-slope design culvert[96]– limit new culverts to 0% slopes.

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[95] For a discussion of crossing design types, see, National Marine Fisheries Service, Southwest Region, *Guidelines for Salmonid Passage at Stream Crossings* (September 2001) (http://swr.nmfs.noaa.gov/hcd/NMFSSCG.pdf) and Washington Department of Fish and Wildlife, *Fish Passage Design at Road Culverts: A Design Manual for Fish Passage at Road Crossings* (March 3, 1999) (http://www.wa.gov/wdfw/hab/engineer/cm/toc.htm).

[96] "No-slope design culvert" means a culvert that is sufficiently large and installed flat to allow the natural movement of bedload to form a stable bed inside the culvert. See, WDFW (Washington Department of Fish and Wildlife), *Design of Road culverts for Fish Passage* (2003) http://www.wa.gov/wdfw/hab/engineer/cm/

(i) New culvert widths will meet or exceed bankfull width.
(ii) To provide for upstream passage of juvenile salmonids, the maximum average water velocity[97] will not exceed 1 foot per second.
(iii) Include suitable grade controls to prevent culvert failure caused by changes in stream elevation.

c. If the crossing will occur near an active spawning area, only full-span bridges or streambed simulation will be used (NOAA Fisheries 2003b).
d. Limit fill width to the minimum necessary to complete the crossing, and do not reduce existing stream width (NOAA Fisheries 2003b).
e. Culvert maintenance. Clean culverts by working from the top of the bank, unless culvert access using work area isolation would result in less habitat disturbance. Remove only the minimum amount of wood, sediment and other natural debris necessary to maintain culvert function without disturbing spawning gravel (NOAA Fisheries 2003b).
   (1) Place all large wood, cobbles, and gravels recovered during cleaning downstream of the culvert.
   (2) Do all routine work in the dry, using work area isolation if necessary.
f. Culverts or bridge abutments will not be filled with vegetation, debris, or mud. Abutments will be properly protected (*e.g.,* rock armored) to prevent future scouring actions and erosion hazards (NMFS 2002).
g. Maintenance schedules will be developed for culvert installations to ensure the culverts remain in proper functioning condition (NMFS 2002).

24. To implement reasonable and prudent measure #24 (road decommissioning), the BPA shall ensure the following:

a. All fill-associated wood will be removed during sidecast removal (NMFS 2002).
b. A fisheries biologist and/or hydrologist will be involved in the design and implementation of each road decommissioning project (NMFS 2000b).
c. Slide and waste material will be disposed in stable, non-floodplain sites. Disposal of slide and waste material within the existing road prism or on adjacent hillslopes will be allowed to restore natural or near-natural contours, if approved by a geotechnical engineer or other qualified personnel (NMFS 2000b).
d. Disturbance of existing vegetation in ditches and at stream crossings will be minimized to the extent necessary to restore hydrologic functions (NMFS 2000b).
e. Culvert removal will be designed to restore the natural drainage pattern (NMFS 1999a).

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[97] "Maximum average water velocity" means the average of water velocity within the barrel of the culvert calculated using the 10% annual exceedance of the daily average flow.

25. To implement reasonable and prudent measure #25 (comprehensive monitoring and reporting program and general considerations), the BPA shall ensure the following:

a. Violation of Habitat Improvement Program Biological Opinion Terms and Conditions. To ensure compliance with the biological opinion terms and conditions, BPA will conduct random site evaluations of activities authorized under the Opinion. Through notification by anonymous complainants, BPA may specifically target an individual activity to determine if it is in compliance with the terms and conditions as authorized under the biological opinion. If BPA determines that a contractor is in violation of the terms and conditions or has deviated from the authorization, BPA will notify the contractor and NOAA Fisheries. BPA may enforce this by withdrawing funding from a project, if the violations are serious or ongoing. If a contractor is in violation of the terms and conditions or has engaged in unauthorized take of a listed species, NOAA Fisheries may implement enforcement actions against the contractor under ESA regulations and procedures.

b. Annual monitoring report. BPA will provide NOAA Fisheries with an annual monitoring report by January 31 of each year that describes BPA's efforts carrying out the activities under the HIP. The report will summarize project level monitoring information by activity and by 5th or 6th field HUC, with special attention to site rehabilitation and streambank protection. The report will also provide an overall assessment of program activity and cumulative effects. BPA will submit the annual report to the Oregon, Washington, and Idaho Offices of NOAA Fisheries at the following addresses:

NOAA Fisheries
State Director – Idaho
10215 West Emerald, Suite 180
Boise, ID 83704
Attn: 2003/00750

NOAA Fisheries
State Director – Portland
525 NE Oregon Street
Portland, OR 97232
Attn: 2003/00750

NOAA Fisheries
State Director – Lacey
510 Desmond Drive SE, Suite 103
Lacey, WA 98503
Attn: 2003/00750

c. The monitoring reports will include:
   i. Activities Authorized:
      (1) List of all the activities authorized under the Opinion in the reporting year, showing the BPA project number, contractor's name, and date of approval.

(2) List of projects authorized under the Opinion by activity (*i.e.,* removal of fish passage barrier, instream restoration).
(3) Discussion of which projects were modified from what was originally authorized under the Opinion and how.
(4) Discussion of which projects BPA determined to include a significant construction component and therefore required a site rehabilitation plan.
(5) Discussion of any compliance actions taken on projects authorized by the Opinion and how they were resolved.

ii. Activities not Authorized:
(1) Discussion of types of habitat improvement activities that did not qualify for authorization under the Opinion and why.

iii. Individual Project Monitoring:
(1) All implementation monitoring reports submitted for the period covered by the annual report.
(2) A list of projects that have implementation monitoring reports past due.

iv. Evaluation of the Habitat Improvement Program Consultation Success
(1) Success of the project(s) to meet the habitat improvement objectives, where monitored.
(2) Failure of the project(s) to meet the habitat improvement objectives, where monitored.
(3) Unforeseen impacts associated with the project(s), both short- and long-term.
(4) Activities less impacting than anticipated in the Opinion.

v. Proposed Opinion Revisions and/or Modifications:
(1) Recommendation as to whether the Opinion should be amended to include additional activities or exclude previously authorized activities.

26. To implement reasonable and prudent measure #26 (implementation of the general conditions applicable to all actions), the BPA shall ensure the following:

a. All applicable regulatory permits and official project authorizations [*e.g.,* National Environmental Policy Act, National Historic Preservation Act, Level I Contaminants Survey, the appropriate state agency's Hydraulic Project Approvals, and permits from the U.S. Army Corps of Engineers (Corps)] will be secured before project implementation. All conditions in these regulatory permits and other official project authorizations will be followed to eliminate or reduce adverse impacts to any endangered, threatened, or sensitive species or their critical habitats (NMFS 2002).
b. All actions that may affect listed resident aquatic and all plant and terrestrial animal species will also undergo consultation with USFWS.
c. Modifications to an approved activity will be reviewed and approved by the project biologist and the cooperators and/or landowner(s) before the work can be carried out or continued. This would include changes requiring modifications of permits, or alterations to the scope, design, or intent of the project (NMFS 2002).

d. Existing roadways or travel paths will be used for access to project sites whenever feasible (NMFS 2002).
e. All garbage from work crews will be removed from the project site daily and disposed of properly. All waste from project activities will be removed from the project site before project completion and disposed of properly (NMFS 2002).

3. MAGNUSON-STEVENS ACT

3.1 Background

The Magnuson-Stevens Fishery Conservation and Management Act (MSA), as amended by the Sustainable Fisheries Act of 1996 (Public Law 104-267), established procedures designed to identify, conserve, and enhance essential fish habitat (EFH) for those species regulated under a Federal fisheries management plan. Pursuant to the MSA:

- Federal agencies must consult with NOAA Fisheries on all actions, or proposed actions, authorized, funded, or undertaken by the agency, that may adversely affect EFH (§305(b)(2)).

- NOAA Fisheries must provide conservation recommendations for any Federal or state action that would adversely affect EFH (§305(b)(4)(A)).

- Federal agencies must provide a detailed response in writing to NOAA Fisheries within 30 days after receiving EFH conservation recommendations. The response must include a description of measures proposed by the agency for avoiding, mitigating, or offsetting the impact of the activity on EFH. In the case of a response that is inconsistent with NOAA Fisheries EFH conservation recommendations, the Federal agency must explain its reasons for not following the recommendations (§305(b)(4)(B)).

EFH means those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity (MSA §3). For the purpose of interpreting this definition of EFH: "Waters" include aquatic areas and their associated physical, chemical, and biological properties that are used by fish and may include aquatic areas historically used by fish where appropriate; "substrate" includes sediment, hard bottom, structures underlying the waters, and associated biological communities; "necessary" means the habitat required to support a sustainable fishery and the managed species' contribution to a healthy ecosystem; "spawning, breeding, feeding, or growth to maturity" covers a species' full life cycle (50 C.F.R. 600.10). Adverse effect means any impact that reduces quality and/or quantity of EFH, and may include direct (*e.g.*, contamination or physical disruption), indirect (*e.g.*, loss of prey or reduction in species fecundity), site-specific or habitat-wide impacts, including individual, cumulative, or synergistic consequences of actions (50 C.F.R. 600.810).

EFH consultation with NOAA Fisheries is required regarding any Federal agency action that may adversely affect EFH, including actions that occur outside EFH, such as certain upstream and upslope activities.

The objectives of this EFH consultation are to determine whether the proposed action would adversely affect designated EFH and to recommend conservation measures to avoid, minimize, or otherwise offset potential adverse effects to EFH.

3.2 Identification of EFH

Pursuant to the MSA, the Pacific Fisheries Management Council (PFMC) has designated EFH for federally managed fisheries within the waters of Washington, Oregon, and California. Designated EFH for groundfish and coastal pelagic species encompasses all waters from the mean high water line, and upriver extent of saltwater intrusion in river mouths, along the coasts of Washington, Oregon and California, seaward to the boundary of the U.S. exclusive economic zone (370.4 km)(PFMC 1998, 1998a). Freshwater EFH for Pacific salmon includes all those streams, lakes, ponds, wetlands, and other water bodies currently, or historically accessible to salmon in Washington, Oregon, Idaho, and California, except areas upstream of certain impassable artificial barriers (as identified by the PFMC 1999), and longstanding, naturally-impassable barriers (*i.e.,* natural waterfalls in existence for several hundred years)(PFMC 1999). In estuarine and marine areas, designated salmon EFH extends from the nearshore and tidal submerged environments within state territorial waters out to the full extent of the exclusive economic zone (370.4 km) offshore of Washington, Oregon, and California north of Point Conception to the Canadian border (PFMC 1999).

Detailed descriptions and identifications of EFH are contained in the fishery management plans for groundfish (PFMC 1998), coastal pelagic species (PFMC 1998a), and Pacific salmon (PFMC 1999). Casillas *et al.* (1998) provides additional detail on the groundfish EFH habitat complexes. NOAA Fisheries has identified seven ground fish habitat complexes (estuarine, rocky shelf, non-rocky shelf, neritic zone, oceanic zone, continental slope/break and canyon) and identified species that may occur in each of those areas. The estuarine complex is pertinent to this consultation.

The estuarine complex includes those waters, substrates and associated biological communities within bays and estuaries of the EEZ, from mean higher high water level (MHHW) or extent of upriver saltwater intrusion to the respective outer boundaries for each bay or estuary as defined in 33 C.F.R. 80.1 (Coast Guard lines of demarcation). Twenty-two species of groundfish, 4 coastal pelagic species and 2 species of Pacific salmon are included in the estuarine complex (Table 3-1).

Table 3-1. Species with Designated Essential Fish Habitat in the Columbia River Basin / Estuary and Coastal Areas[98]

Species	Adults	Spawning/ Mating	Eggs/ Parturition	Larvae	Juveniles/ Small Juveniles	Large Juveniles
Groundfish						
Big skate				NA		NA
California skate	X	X	X	NA	X	NA
Longnose skate				NA		NA
Leopard shark	X	X	X	NA	X	NA
Soupfin shark	X	X	X	NA	X	NA
Spiny dogfish	X		X	NA	X	X
Cabezon	X	X	X	X	X	X
Finescale codling						NA
Kelp greenling	X	X	X	X	X	X
Lingcod	X	X	X	X	X	X
Pacific cod	X	X	X	X	X	NA
Pacific rattail						NA
Pacific whiting (Hake)	X	X	X	X	X	NA
Sablefish					X	
Spotted ratfish	X	X		NA	X	NA
Arrowtooth flounder						NA
Butter sole						NA
Curlfin sole						NA
Dover sole						NA
English sole	X	X	X	X	X	NA
Flathead sole					X	NA
Pacific sanddab	X		X	X	X	NA
Petrale sole						NA
Rex sole	X				X	NA
Rock sole	X	X	X	X	X	NA
Sand sole						NA
Starry flounder	X	X	X	X	X	NA
Aurora rockfish						
Bank rockfish						
Black rockfish	X				X	
Black-and-yellow rockfish						
Blackgill rockfish						
Blue rockfish						

[98] Information from Casillas *et al*. 1998, PFMC 1998, 1998a, and 1999

Table 3-1. Continued

Species	Adults	Spawning/ Mating	Eggs/ Parturition	Larvae	Juveniles/ Small Juveniles	Large Juveniles
Bocaccio				X	X	
Brown rockfish	X	X	X	X	X	NA
Canary rockfish						
Chilipepper						
China rockfish						NA
Copper rockfish	X	X	X	X	X	X
Cowcod						NA
Darkblotched rockfish						
Flag rockfish						
Gopher rockfish						
Grass rockfish						NA
Greenspotted rockfish						NA
Greenstriped rockfish						NA
Longspine thornyhead						NA
Pacific Ocean perch						
Pink rockfish						
Quillback rockfish	X	X	X	X	X	X
Redbanded rockfish						NA
Redstripe rockfish						NA
Rosethorn rockfish						NA
Rosy rockfish						NA
Rougheye rockfish						NA
Sharpchin rockfish						NA
Shortbelly rockfish						
Shortraker rockfish						NA
Shortspine thornyhead						NA
Silverygray rockfish						NA
Speckled rockfish						NA
Splitnose rockfish						NA
Squarespot rockfish						NA
Stripetail rockfish						NA
Tiger rockfish						NA
Vermilion rockfish						NA
Widow rockfish						
Yelloweye rockfish						NA
Yellowmouth rockfish						NA
Yellowtail rockfish						

Table 3-1. Continued

Species	Adults	Spawning/ Mating	Eggs/ Parturition	Larvae	Juveniles/ Small Juveniles	Large Juveniles
Coastal Pelagic						
Northern anchovy	X	X	X	X	X	
Pacific (Chub) mackerel	X					
Jack mackerel	X					
California Market squid	X					
Pacific Salmon						
Chinook salmon	X	X	X	X	X	X
Coho salmon	X	X	X	X	X	X

Table Legend:
X = The EFH for the particular species and life stage occurs within the EFH composite in Oregon.
Blank = The EFH for the particular species and life stage is not currently known to occur within the EFH composite in Oregon, or insufficient information is currently available to identify its EFH.
NA = Not applicable. It is used in two ways: when a species does not have a particular life stage in its life history (gray background), ***or*** when EFH of juveniles is not identified separately for small juvenile and large juvenile stages. For many species, habitats occupied by juveniles differ substantially, depending on the size (or age) of the fish. Frequently, small juveniles are pelagic and large juveniles live on or near the bottom; these life stages are identified separately in the following tables when sufficient information is available to do so. When juvenile habitats do not differ so substantially ***or*** when information is insufficient to identify differences, EFH is identified only for the juvenile stage (small and large juveniles combined), and NA (not applicable) is listed in the column for the large juvenile stage in the tables.

3.3 Proposed Action

For this EFH consultation, the proposed habitat improvement activities and action area are detailed above in Sections 1.2 and 1.3, respectively, of this Opinion. The action area is the Columbia River Basin within the contiguous United States that is also within the range of essential fish habitat (EFH) designated under the MSA (Figure 1-1). The action area relative to both juvenile and adult Columbia Basin anadromous salmonids is that part of their in-water and riparian habitat that would be affected by the proposed habitat improvement actions described in Section 1.2 above. The area is best defined as the farthest upstream point at which smolts enter (or adults exit) the Snake and Upper Columbia rivers and their tributaries to the farthest downstream point at which they exit (or adults enter) the migration corridor. Although the actual upstream extent of the action area varies from subbasin to subbasin, in all cases the action area extends downstream to the farthest point (the Columbia River estuary and nearshore ocean environment) at which listed salmonids would be influenced by the proposed activities under this consultation. This area serves as a migratory corridor for juveniles and adults, spawning, rearing, and growth and development to adulthood for EFH of species listed in Table 3-1 below.

3.4 Effects of the Proposed Action

As detailed Section 2.2 of this Opinion the proposed activities may result in short-term adverse effects to a variety of habitat parameters. The assessment of potential adverse effects from elements of the proposed action on EFH is based on information in Section 2.2 of this Opinion. Most of these potential short-term adverse effects will be avoided through the incorporation of the conservation measures described in this Opinion as part of the proposed action. Potential effects on habitat include:

- Temporary loss of riparian function in areas under construction;
- Short-term increases in turbidity pursuant to the construction activities;
- Potential introduction of pollutants into water bodies during construction; and
- Potential modification of stream morphology in ways that are inadvertently detrimental to fish.

3.5 Conclusion

NOAA Fisheries concludes that the proposed habitat improvement activities would adversely affect the EFH for the groundfish, coastal pelagic, and Pacific salmon species listed in Table 3-1 for the short term. However, most of these potential short-term adverse effects to EFH will be avoided, minimized, or otherwise offset through the incorporation of the conservation measures described in Section 1.2 of this Opinion as part of the proposed action.

3.6 EFH Conservation Recommendations

Pursuant to section 305(b)(4)(A) of the MSA, NOAA Fisheries is required to provide EFH conservation recommendations to Federal agencies regarding actions which may adversely affect EFH. The Terms and Conditions outlined in Section 2.6.3 are generally applicable to designated EFH for the species in Table 3-1, and address potential short-term adverse effects associated with the proposed habitat improvement activities. Consequently, NOAA Fisheries incorporates herein the Terms and Conditions of this Opinion as EFH conservation recommendations.

3.7 Statutory Response Requirement

Pursuant to the MSA (§305(b)(4)(B)) and 50 C.F.R. 600.920(j), Federal agencies are required to provide a detailed written response to NOAA Fisheries' EFH conservation recommendations within 30 days of receipt of these recommendations. The response must include a description of measures proposed to avoid, mitigate, or offset the adverse impacts of the activity on EFH. In the case of a response that is inconsistent with the EFH conservation recommendations, the response must explain the reasons for not following the recommendations, including the scientific justification for any disagreements over the anticipated effects of the proposed action and the measures needed to avoid, minimize, mitigate, or offset such effects.

3.8 Supplemental Consultation

The BPA must reinitiate EFH consultation with NOAA Fisheries if the proposed action is substantially revised in a manner that may adversely affect EFH, or if new information becomes available that affects the basis for NOAA Fisheries' EFH conservation recommendations (50 C.F.R. 600.920(k)).

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APPENDIX A: Consultation Forms for Habitat Improvement Program Biological Opinion

INSTRUCTIONS FOR CONSULTATION FORMS 1 AND 2

FORM 1: Habitat Improvement Program Biological Opinion Consistency Form for BPA-funded Fish and Wildlife Habitat Projects

In order to confirm that a project falls within the parameters of the HIP Opinion, the project sponsor will complete Form 1 in electronic form (including drawings and photographs). The project sponsor will submit the form to BPA NEPA/ESA staff for review. The project sponsor may choose to submit hard copies of Form 1, including drawings and photographs, but this will delay the review.

The BPA NEPA/ESA staff will review the form to determine if the project may be authorized under the HIP Opinion.

If the BPA NEPA/ESA staff determines that proposed project is consistent with the HIP Opinion, BPA staff will document this and place all pertinent forms and documentation in the project file without notification to NOAA Fisheries prior to undertaking the project.

Form 2: "Request for Approval of Minor Deviation From the Categories of Habitat Improvement Activities or Terms and Conditions in the Habitat Improvement Program Biological Opinion" (Appendix A).

If there are minor deviations to the activity description and/or terms and conditions, the project sponsor, in coordination with BPA NEPA/ESA staff, will prepare the "ESA Programmatic Notification to NOAA Fisheries" (See Form 2: "Request for Approval of Minor Deviation From the Categories of Habitat Improvement Activities or Terms and Conditions in the Habitat Improvement Program Biological Opinion" (Appendix A), below). The sponsor and NEPA/ESA staff will state the proposed activity and the nature of the deviation from the activity descriptions and/or terms and conditions in the HIP Opinion on the form. The sponsor and NEPA/ESA staff will also state the justification for the proposed deviation on this form.

The NEPA/ESA staff will send Form 2, along with a copy of Form 1, either electronically or via post, to the attention of the appropriate State Branch Chiefs for the Habitat Conservation Division within NOAA Fisheries.

While the forms are with NOAA Fisheries for review, the BPA project manager and project sponsor may proceed with the contracting and planning process but no ground-disturbing work or irreversible commitments of resources will be made until approval has been received from NOAA Fisheries.

NOAA Fisheries Review Documentation Process for reviewing Form 2 for projects that have minor deviations from the HIP Opinion

Within 30 days of receipt of the forms (either electronic or via post), NOAA Fisheries will provide BPA and the project sponsor with one of the following:
1. a list of additional information needed to make a determination;
2. a letter or e-mail documenting approval of the deviation; or
3. a date when initial review of the deviation is anticipated.

The approval documentation will include (1) statement of Habitat Improvement Program Biological Opinion applicability to the proposed activity, (2) incidental take approval, and (3) approval/denial of the proposed deviations from the terms and conditions of the HIP Opinion.

BPA and the project sponsor will not proceed with the project until NOAA Fisheries have issued the approval documentation for the activity. For activities covered by the HIP Opinion, BPA will include all terms and conditions identified in the documentation as conditions of the contract with the project sponsor.

If NOAA Fisheries determines the proposed activity does not fit within the parameters of the HIP Opinion or the applicant declines to implement the conservation measures of the HIP BA, or RPMs or terms and conditions included in the HIP Opinion, the activity will go through individual consultation as outlined in Section 7 of the ESA.

Form 1: Habitat Improvement Program Biological Opinion Consistency Form for BPA-funded Fish and Wildlife Habitat Projects

To use this form: Provide information for every item by circling, filling in, or attaching info – as appropriate.

Section 1: General Information

Date: __________________
Project Name: _____________________
BPA Fish and Wildlife Project Number: ________________
Project Sponsor:

Name: ___________________________________

Address: ________________________________

City: _________________ State: ___________ Zip: ____________

Telephone: ______________________________

Project Sponsor Biologist (or person filling out this form):

Name: ___________________________________

Address: ________________________________

City: _________________ State: ___________ Zip: ____________

Telephone: ______________________________

Section 2: Project Specific Description and Information

Project Location (include Vicinity map):

Section: _____ Township: _____ Range: _____

Latitude: _____________________ Longitude: _____________________

County: ____________________ Water body: _____________________

Tributary to: _____________________

Watershed/Water Resource Inventory Area (WRIA-Washington State only):

_____________________ HUC: ________________________________

Is the location within the Columbia River Basin, the action area covered by the HIP Opinion?

YES NO

If no, consult BPA NEPA/ESA staff.

Project Description (include drawings and photographs): Include all phases of the proposed project including construction, access (existing or new), staging areas, and maintenance and operation of the project.

Quantify area to be affected by activity:___________

Project start date: _______________

Project end date: _________________

Site-specific description:

A. River mile(s) _________

B. Elevation(s) __________

C. Aspect / Cardinal orientation ________________________________

D. Principal soils/geological characteristics ____________________________________

A. Principal vegetative cover types: Riparian ___________________________________

100-year flood plain____

Upland____

F. Primary habitat problems to be addressed by the proposed activity and specifically how:

Is the proposed activity within the categories of habitat improvement activities addressed in the HIP Opinion?

YES NO

If yes, list the category(ies) of action from the HIP Opinion:

If no, notify BPA NEPA/ESA staff to initiate informal coordination with NOAA Fisheries staff for minor deviations. To qualify, the deviation must be minor and the effects of the deviation must be addressed in the HIP Opinion. Assist BPA NEPA/ESA staff with completing Form 2: "Request for Approval of Minor Deviation From the Categories of Habitat Improvement Activities or Terms and Conditions in the Habitat Improvement Program Biological Opinion" (Appendix A).

If approval is obtained, include copy of Form 2, and letter or e-mail from NOAA Fisheries' staff documenting their approval when submitting Form 1. **If approval is not obtained, you and the BPA staff must initiate the appropriate level of consultation through the normal Section 7 process for this activity.**

<u>Section 3: List of Threatened, Endangered, and Proposed Species and their designated critical habitats in the project vicinity (use GIS database, NOAA Fisheries web site, or attach listed species list from NOAA Fisheries):</u>

Endangered species

Threatened species

Designated critical habitat

Proposed species

Are there listed species or critical habitats present or likely to be present in the action area for this proposed activity?

YES NO

If NO, explain here, then stop and do not fill out the rest of the form. Submit it to BPA NEPA/ESA staff for review and approval.

If YES, continue filling out this form.

<u>Section 4: Effect Determination:</u>

Describe the effects of the proposed activities on the listed species and/or critical habitat present in the action area:

Are all the direct and indirect effects of the proposed activity and its interrelated and interdependent activities on the species and/or critical habitat within the range of effects considered in the HIP Opinion?

YES NO

If no, notify BPA NEPA/ESA staff to initiate individual Section 7 consultation.

<u>Section 5: Terms and Conditions</u>

<u>List Terms and Conditions to be applied to this project (from the HIP Opinion):</u>

Can the project be implemented according to all applicable Terms and Conditions of the HIP Opinion?
YES NO

If no, notify BPA NEPA/ESA staff to initiate informal coordination with NOAA Fisheries staff for *minor*[1] deviations. To qualify, the deviation must be minor and the effects of the deviation must be addressed in the HIP Opinion. Assist BPA NEPA/ESA staff with completing Form 2: "Request for Approval of Minor Deviation From the Categories of Habitat Improvement Activities or Terms and Conditions in the Habitat Improvement Program Biological Opinion" (Appendix A).

If approval is obtained, include copy of Form 2, and letter or e-mail from NOAA Fisheries' staff documenting their approval when submitting Form 1. **If approval is not obtained, you must inform BPA staff to initiate the appropriate level of consultation through the normal Section 7 process for this activity.**

Section 6: Site Rehabilitation Plan

Does the project include a significant construction component[2] that will require a site rehabilitation plan?
YES NO
If yes, include a copy of the plan here. Include a discussion of the following as outlined in the terms and conditions of the Opinion:

- Baseline information
- Goals and objectives
- Performance standards
- Work plan
- Monitoring and maintenance plan

Section 7: Operation and Maintenance Plan

Does the project include structures that will have a high probability for requiring future instream maintenance, or have required previous maintenance?
YES NO
If yes, include an operation and maintenance plan here. Include a discussion of the following:

- State what activities that might affect listed fish are proposed or anticipated.
- Explain the cause of the need for maintenance (i.e., is it due to a one-time event, or is this an ongoing issue that needs to be addressed in a comprehensive manner?).
- Evaluate the need for future maintenance.
- Explain the timing of the activities.
- Who will be responsible for conducting the operations and maintenance?
- What is the source of the funding for the operations and maintenance?

[1]Definition of *minor* deviation: One for which NOAA Fisheries may approve, in writing, the use of an alternative practice. These will be specifically identified in the terms and conditions of the HIP Biological Opinion.

[2] "Significant construction component" means a component of a project (e.g., instream construction, fish passage, road obliteration and decommissioning) that results in construction effects that can be meaningfully measured, detected, or evaluated.

- Explain the anticipated impacts to listed fish from the activities and how these effects will be minimized.
- Are these activities and effects addressed in the Habitat Improvement Program Biological Opinion? If not, individual consultation may be necessary. **If not, you must inform BPA staff to initiate the appropriate level of consultation through the normal Section 7 process for this activity.**

Section 8: BPA NEPA/ESA staff review

I have reviewed this project and determined that it meets all requirements of the HIP Opinion.

Name: ______________________________________
BPA NEPA/ESA staff

Date: _____________________________

FORM 2: REQUEST FOR APPROVAL OF MINOR DEVIATION FROM THE CATEGORIES OF HABITAT IMPROVEMENT ACTIVITIES OR TERMS AND CONDITIONS IN THE HABITAT IMPROVEMENT PROGRAM BIOLOGICAL OPINION

TO: NOAA Fisheries State Branch Chief for Habitat Conservation Division _____

FROM: Bonneville Power Administration, Environment, Fish and Wildlife Group, (503) 230-____

Project NEPA/ESA staff: ______________________________

Date: ____________________ Deadline for Response: _______________________
(30 calendar days from date of receipt)

Project Sponsor: ______________________________________

Activity: ____

Waterway: ____

We request your approval of our determination that the above referenced activity is in compliance with the Habitat Improvement Program Biological Opinion (HIP Opinion) for BPA-funded Fish and Wildlife Habitat Activities, dated ******, and approved by your agency on *****. Enclosed is the Habitat Improvement Program Biological Opinion Consistency Form for BPA-funded Fish and Wildlife Habitat Projects, including drawings and photographs.

Activity description: We request your approval of the following minor deviation/modification to the activity as described in the HIP Opinion.

____

____

Terms and conditions: We request your approval of the following minor deviation(s) from the terms and conditions in the HIP Opinion:

___ Instream work outside of normal in water work window
___Blocking fish passage during construction
___Alternative to minimize soil disturbance and compaction of temporary access within 150 feet of water
___Vehicle staging area less than 150 feet from water
___Alternative to isolation of in-water work area
___Transferring ESA-listed fish to someone other than NOAA Fisheries or USFWS
___Deviation from acceptable compensatory mitigation
___Changes to requirements for flow-redirection structures (barbs, vanes, or bendway weirs)

Detail proposed change: ____

____

____

____

The justification for this exclusion, alteration, and/or modification is as follows:
____
____

We believe that the effects of this deviation fall within the range of effects described in HIP Opinion because:
____.

APPENDIX B
BIOLOGICAL OPINIONS AND NATURAL RESOURCES CONSERVATION SERVICE CONSERVATION PRACTICE STANDARDS REVIEWED FOR THE HABITAT IMPROVEMENT PROGRAM CONSULTATION

1. Planning and Habitat Protection Actions

Stream Channel, Floodplain, and Uplands Surveys/ Installation of Stream Monitoring Devices

NMFS (National Marine Fisheries Service). 2002. Programmatic Biological Opinion: U.S. Fish and Wildlife Service Habitat Restoration Activities (WSB-99-084). Northwest Region, Washington State Habitat Branch. February 7, 2002.

*[1]NMFS (National Marine Fisheries Service). 2000b. Programmatic Biological Opinion. Incidental Take Statement for Forest Service, BIA/Coquille Indian Tribe and BLM Actions Affecting Oregon Coast Coho Salmon and Adoption of the June 4, 1999 Programmatic Conference Opinion on Proposed OC Coho Salmon Critical Habitat as a Biological Opinion for Designated OC Coho Salmon Critical Habitat. June 2, 2000. (OSB2000-0121).

NMFS (National Marine Fisheries Service). 1999d. Programmatic Biological Opinion. ESA Section 7 Consultation for Programmatic Actions in the Willamette, Siuslaw, and Mt. Hood National Forests, and Salem and Eugene Districts of Bureau of Land Management that are Likely to Adversely Affect Upper Willamette River Steelhead and Upper Willamette River Chinook Salmon within the Willamette Province, Oregon. July 28, 1999. OSB1999-0152.

NMFS (National Marine Fisheries Service). 1999. Programmatic Biological Opinion. ESA Section 7 Consultation for Programmatic Actions in the U.S. Forest Service - Siuslaw National Forest, Salem District Bureau of Land Management (BLM), and Eugene District BLM that are Likely to Adversely Affect Oregon Coast Coho Salmon within the Oregon Coast Range Province. June 4, 1999. OSB1999-0012.

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[1] "*" means the document was actually referenced in the Habitat Improvement Program Biological Opinion. The remainder of the documents were reviewed but not used because of redundancy.

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3. Livestock Impact Reduction

<u>*Construct Fencing for Grazing Control*</u>

*NRCS (Natural Resources Conservation Service). 2000g. *Conservation Practice Standard, Prescribed grazing, Code 528a*.

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<u>*Install Off-Channel Watering Facilities*</u>

*NMFS (National Marine Fisheries Service). 2002. Programmatic Biological Opinion: U.S. Fish and Wildlife Service Habitat Restoration Activities (WSB-99-084). Northwest Region, Washington State Habitat Branch. February 7, 2002.

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<u>*Harden Fords for Livestock Crossings of Streams*</u>

*NMFS (National Marine Fisheries Service). 2002. Programmatic Biological Opinion: U.S. Fish and Wildlife Service Habitat Restoration Activities (WSB-99-084). Northwest Region, Washington State Habitat Branch. February 7, 2002.

*NMFS (National Marine Fisheries Service). 1999. Programmatic Biological Opinion. Oregon Conservation Reserve Enhancement Plan. Northwest Region. (OSB1999-0079).

4. Control of Soil Erosion from Upland Farming

<u>*Implement Upland Conservation Buffers*</u>

*NRCS (Natural Resources Conservation Service). 2002a. *Conservation Practice Standard,Windbreak/Shelterbelt Establishment, Code 380.*

*NRCS (Natural Resources Conservation Service). 2001. *Conservation Practice Standard, Vegetative Barriers, Code 601.*

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*NRCS (Natural Resources Conservation Service). 1999b. C*onservation Practice Standard, Filter Strip, Code 393*.

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NRCS (Natural Resources Conservation Service). 1982. *Conservation Practice Standard, Terrace Code 600* (Note: under revision, check Federal Register Notice 129).

<u>*Implement Conservation Cropping Systems*</u>

*NRCS (Natural Resources Conservation Service). 2002b. *Conservation Practice Standard, Stripcroppping, Code 380.*

*NRCS (Natural Resources Conservation Service). 2000. *Conservation Practice Standard, Contour Stripcropping, Code 585*.

*NRCS (Natural Resources Conservation Service). 2000a. *Conservation Practice Standard, Contour Farming, Code 330*.

*NRCS (Natural Resources Conservation Service). 2000c. *Conservation Practice Standard, Residue Management, No Till and Strip Till, Code 329a.*

*NRCS (Natural Resources Conservation Service). 2000e. *Conservation Practice Standard, Riparian Forest Buffer, Code 391*.

*NRCS (Natural Resources Conservation Service). 2000f. *Conservation Practice Standard, Crop Rotation, Code 328*.

*NRCS (Natural Resources Conservation Service). 2000h. *Conservation Practice Standard, Residue Management, Direct Seed, Code 777,* Idaho.

*NRCS (Natural Resources Conservation Service). 1999a. *Conservation Practice Standard, Residue Management, Mulch Till, Code 329b.*

*NRCS (Natural Resources Conservation Service). 1999e. *Conservation Practice Standard, Nutrient Management, Code 590.*

*NRCS (Natural Resources Conservation Service). 1998. *Conservation Practice Standard, Riparian Herbaceous Buffer, Code 390*.

<u>*Soil Stabilization via Planting and Seeding*</u>

*NRCS (Natural Resources Conservation Service). 2002a. *Conservation Practice Standard,Windbreak/Shelterbelt Establishment, Code 380.*

*NRCS (Natural Resources Conservation Service). 2002b. *Conservation Practice Standard, Stripcroppping, Code 380.*

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*NRCS (Natural Resources Conservation Service). 2000c. *Conservation Practice Standard, Residue Management, No Till and Strip Till, Code 329a.*

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*NRCS (Natural Resources Conservation Service). 1999a. *Conservation Practice Standard, Residue Management, Mulch Till, Code 329b.*

*NRCS (Natural Resources Conservation Service). 1999b. C*onservation Practice Standard, Filter Strip, Code 393*.

*NRCS (Natural Resources Conservation Service). 1999d. *Conservation Practice Standard, Field Border, Code386.*

*NRCS (Natural Resources Conservation Service). 1999e. *Conservation Practice Standard, Nutrient Management, Code 590.*

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Implement Erosion Control Practices

*NRCS (Natural Resources Conservation Service). 2002. *Conservation Practice Standard, Critical Area Planting, Code 342.*

*NRCS (Natural Resources Conservation Service). 2001a. *Conservation Practice Standard, Diversion, Code 362,* Washington.

*NRCS (Natural Resources Conservation Service). 2000e. *Conservation Practice Standard, Riparian Forest Buffer, Code 391*.

*NRCS (Natural Resources Conservation Service). 1998. *Conservation Practice Standard, Riparian Herbaceous Buffer, Code 390*.

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5. Irrigation and Water Delivery/Management Actions

Convert Delivery System to Drip or Sprinkler Irrigation

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*NRCS (Natural Resources Conservation Service). 1987. *Conservation Practice Standard, Irrigation System, Sprinkler Code 442* (Note: currently under revision).

Convert Water Conveyance from Open Ditch to Pipeline or Line Leaking Ditches and Canals

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NMFS (National Marine Fisheries Service). 1999. Programmatic Biological Opinion. ESA Section 7 Consultation for Programmatic Actions in the U.S. Forest Service - Siuslaw National Forest, Salem District Bureau of Land Management (BLM), and Eugene District BLM, that are Likely to Adversely Affect Oregon Coast Coho Salmon within the Oregon Coast Range Province. June 4, 1999. OSB1999-0012.

*NMFS (National Marine Fisheries Service). 1999a. Programmatic Biological Opinion. ESA Section 7 Consultation for Programmatic Actions in the U.S. Forest Service - Gifford Pinchot National Forest, Mt. Hood National Forest, Columbia River Gorge National Scenic Area, and Salem District Bureau of Land Management that are Likely to Adversely Affect Lower Columbia River Steelhead, Lower Columbia River Chinook Salmon, Upper Willamette River Chinook Salmon, Columbia River Chum Salmon, Southwestern Washington/Columbia River Cutthroat Trout, and Southwest Washington/Lower Columbia River Coho Salmon. June 3, 1999. (OSB1999-0108).

8. Special Actions

Install/Develop Wildlife Structures

*NMFS (National Marine Fisheries Service). 2002. Programmatic Biological Opinion: U.S. Fish and Wildlife Service Habitat Restoration Activities (WSB-99-084). Northwest Region, Washington State Habitat Branch. February 7, 2002. (WSB-99-084)

Appendix C: BPA-Funded Projects – 6th HUC Project Locations and Descriptions for 2003

Project Name and Location				2003 Proposed Treatment Areas		List All Herbicides for Each Project								
Title/Sponsor	BPA Project Number	Drainage ((x) River Mile if Shown)	6th HUC	Upland Acres *	Riparian Acres **	Product Name	Active Ingredient (AI) and Percent AI	Adjuvant Used	Application Rate (lbs.AI/Ac.)	Application Method	Dates of Treatment	Weed Control Only	Weed Control + Restoration/ Revegetation	ESA Anadromous Fish ESUs Potentially Affected[1]
Burlingame Screens and Ladder – Gardena Farms Irrigation District No. 13 (GFID)														
Burlingame Screens and Ladder – GFID	1996-011-00	Walla Walla River	170701020804		2.5	Glypro/Rodeo	Glyphosate 53.8%	R-11	2.16	Spot w/Hand wand	Apr thru Aug	X		7
O&M includes chemical control for noxious weeds and restoration at about 3 screen/facility sites annually. Each site is approximately 0.8 acre in size and spot treated with hand wands as needed.														
Burlington Bottoms Wildlife Mitigation Project – Oregon Department of Fish and Wildlife														
Burlington Bottoms Wildlife Mitigation Project – Oregon Department of Fish and Wildlife	1991-078-00	Lower Willamette	170900120201		5	Garlon 3A	triclopyr 44%	Super Spread	2.5	Hand wand	Jun thru Sep	X		4, 5, 6
John Day Fish Habitat – Oregon Department of Fish and Wildlife (ODFW)														
John Day Fish Habitat - ODFW	1984-021-00	John Day River	17070201xxx*		55	Weedmaster Rodeo	2,4-D DMA 35.7% dicamba 12.4% glyphosate 53.8%	Hasten	0.09	Spot spray	May thru Jul	X		7
			17170204xxx*		20	Tordon 22K Weedar	picloram 24.4% 2,4-D DMA 64.8%	Hasten	0.09	Spot spray	May thru Jul	X		7
Weed control projects located in these HUCs are undertaken Grant and Wheeler County Boards, respectively. The locations cannot be resolved to the 6th HUC until weed patrol .														
Northeast Oregon Wildlife Project – Nez Perce Tribe														
Northeast Oregon Wildlife Project – Nez Perce Tribe	1996-080-00	Buford Creek	170601061201	20		Curtail	2,4-D DMA 39% clopyralid 5.1	NA for all	1.5	Spot w/hand wand	Jun		X	1, 2, 3
		Tamarack Creek	170601060401		6	Roundup Pro	glyphosate 53.0 %		1.5	ATV tank sprayer	Jun		X	
		Basin Creek	170601060301	15		Curtail	2,4-D DMA 39% clopyralid 5.1		1.5	ATV tank sprayer and spotw/hand wand	May		X	

[1] NOAA Fisheries Listed Fish ESU Key:
1 = Snake River chinook fall run
2 = Snake River chinook spring/summer run
3 = Snake River Basin steelhead
4 = Lower Columbia River chinook
5 = Columbia River chum
6 = Lower Columbia River steelhead
7 = Middle Columbia River steelhead
8 = Upper Columbia River steelhead
9 = Upper Columbia River chinook spring run
10 = Snake River sockeye
11 = Upper Willamette River chinook
12 = Upper Willamette River steelhead

Appendix C continued

Project Name and Location				2003 Proposed Treatment Areas		List All Herbicides for Each Project								
Title/Sponsor	**BPA Project Number**	**Drainage ((x) River Mile if Shown)**	**6th HUC**	**Upland Acres ***	**Riparian Acres ****	**Product Name**	**Active Ingredient (AI) and Percent AI**	**Adjuvant Used**	**Application Rate (lbs.AI/Ac.)**	**Application Method**	**Dates of Treatment**	**Weed Control Only**	**Weed Control + Restoration/ Revegetation**	**ESA Anadromous Fish ESUs Potentially Affected[1]**
Pine Creek Ranch Wildlife Mitigation Project – Confederated Tribes of the Warm Springs Reservation of Oregon (CTWSRO)														
Pine Creek Ranch Wildlife Mitigation Project - CTWSRO	1998-022-00	Lower John Day River	170702040408	90	10	Rodeo Escort Transline Tordon 22K Weedar	glyphosate 53.8% metsulfuron 60% clopyralid 40.9% picloram 24.4% 2,4-D 46.8%	R-11	1-2 0.0625 1 2 2	Spot and broadcast in 12 locations by Jefferson and Wheeler County Weed Boards	May thru Oct	X		7
			170702040407	5		Tordon 22K Weedar	picloram 24.4% 2,4-D 46.8%	R-11	2 2	Spot and broadcast in 2 locations by Wheeler County Weed Board	May thru Oct	X		7
Umatilla River Basin Anadromous Fish Habitat Enhancement Project – Confederated Tribes of the Umatilla Indian Reservation (CTUIR)														
Umatilla River Basin Anadromous Fish Habitat Enhancement Project – CTUIR	1987-100-01	Middle Umatilla River	170701030703	66	64	Ally Banvel Rave Transline	metsulfuron 60% dicamba 48.2% clopyralid 40.9%	R-11 (riparian) Syl-Tac (upland)	0.0113 0.6 0.3588	backpack/handwand	Apr 15 thru Nov 30	X		7
		Upper Umatilla River	170701030106		10	Curtail Rodeo Telar	2,4-D 39% clopyralid 5.1% glyphosate 53.8% chlorsulfuron 75%	R-11 (riparian) Super Spread 90 (upland)	1.38 0.0054 0.0469	backpack/handwand	Apr 15 thru Nov 30	X		7
		Lower Meacham Creek	170701030206	192	82	Curtail Rodeo Telar	2,4-D 39% clopyralid 5.1% glyphosate 53.8% chlorsulfuron 75%	R-11 (riparian) Super Spread 90 (upland)	1.38 0.0054 0.0469	backpack/handwand	Apr 15 thru Nov 30	X		7
		Wildhorse Creek	170701030404		40	Ally Banvel Rave Rodeo	metsulfuron 60% dicamba 48.2% glyphosate 53.8%	R-11 (riparian) Syl-Tac (upland)	0.0375 0.6 0.27	backpack/handwand	Apr 15 thru Nov 30	X		7
		Greasewood Creek	170701030405		15	Ally Rave	metsulfuron 60%	R-11 (riparian) Syl-Tac (upland)	0.0375	backpack/handwand	Apr 15 thru Nov 30	X		7
		Spring Hollow Creek	170701030402		4	Ally Banvel	metsulfuron 60% dicamba 48.2%	R-11 (riparian) Syl-Tac (upland)	0.0375 0.6	backpack/handwand	Apr 15 thru Nov 30	X		7
		Mission Creek	170701030307		3	Transline	clopyralid 40.9%	R-11 (riparian) Syl-Tac (upland)	0.41	backpack/handwand	Apr 15 thru Nov 30	X		7
		Buckaroo Creek	170701030303		15	Roedo	glyphosate 53.8%	R-11 (riparian) Super Spread 90 (upland)	1.08	backpack/handwand	Apr 15 thru Nov 30	X		7
		McKay Creek	170701030507		10	Ally Garlon 3A	metsulfuron 60% triclopyr 44.4%	R-11 (riparian) Syl-Tac (upland)	0.0029 0.0069	backpack/handwand	Apr 15 thru Nov 30	X		Na?

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6 = Lower Columbia River steelhead
7 = Middle Columbia River steelhead
8 = Upper Columbia River steelhead
9 = Upper Columbia River chinook spring run
10 = Snake River sockeye
11 = Upper Willamette River chinook
12 = Upper Willamette River steelhead

Appendix C continued

Project Name and Location				2003 Proposed Treatment Areas		List All Herbicides for Each Project								
Title/Sponsor	BPA Project Number	Drainage ((x) River Mile if Shown)	6th HUC	Upland Acres *	Riparian Acres **	Product Name	Active Ingredient (AI) and Percent AI	Adjuvant Used	Application Rate (lbs.AI/Ac.)	Application Method	Dates of Treatment	Weed Control Only	Weed Control + Restoration/ Revegetation	ESA Anadromous Fish ESUs Potentially Affected[1]
Umatilla Basin Fish Facilities Operations and Maintenance – Westland Irrigation District														
Umatilla Basin Fish Facilities Operations and Maintenance – Westland Irrigation District	1983-436-00	Umatilla River	170701030307		12	Oust Telar Weedar Roundup Original	Sulfometuron methyl Chlorsulfuron 2,4-D DMA 64.8% Glyphosate 41.0%	NA NA R-11 R-11	0.5 oz. 1.0 oz. 2 2	Spot spray and broadcast	May thru Jul	X	X	7
Walla Walla River Basin Anadromous Fish Habitat Enhancement Project– Confederated Tribes of the Umatilla Indian Reservation (CTUIR)														
Walla Walla River Basin Anadromous Fish Habitat Enhancement Project - CTUIR	1996-046-01	Blue Creek (2)	170701020203	1.4	1	Weedar Rodeo	2,4-D 64.8% Glyphosate 53.8%	Super Spread	1.0 2.0	Hand Wand	Apr thru Sep	X		7
		Couse Creek (4)	170701020105	34	1	Weedar Rodeo	2,4-D 64.8% Glyphosate 53.8%	Super Spread	1.0 2.0	Boom/Hand Wand	Apr thru Sep	X		7
		Couse Creek (7)	170701020105	20	16	Weedar Rodeo	2,4-D 64.8% Glyphosate 53.8%	Super Spread	1.0 2.0	Boom/Hand Wand	Apr thru Sep	X		7
		Petit Creek (3)	70701020307	3	2	Weedar Rodeo	2,4-D 64.8% Glyphosate 53.8%	Super Spread	1.0 2.0	Hand Wand	Apr thru Sep	X		7
		Walla Walla River (25)	170701020102	11	1	Weedar	2,4-D 64.8%	Super Spread	1.0	Boom/Hand Wand	Apr thru Sep	X		7
		Walla Walla River (49)	170701020106	18	0	Weedar	2,4-D 64.8%	Super Spread	1.0	Boom/Hand Wand	Apr thru Sep	X		7
		Walla Walla River (49)	170701020106	4	2	Weedar Rodeo	2,4-D 64.8% Glyphosate 53.8%	Super Spread	1.0 2.0	Hand Wand	Apr thru Sep	X		7
North Fork John Day River Habitat Enhancement Project– Confederated Tribes of the Umatilla Indian Reservation (CTUIR)														
North Fork John Day River Habitat Inhancement Project - CTUIR		North Fork John Day River	17070202xxx	120		Weedar Rodeo	2,4-D 64.8% Glyphosate 53.8%	Super Spread	1.0 2.0	Boom/Hand Wand	May thru Sep	X		7
Yakima Phase II Screens Operations and Maintenance – Washington Department of Fish and Wildlife (WDFW)														
Yakima Phase II Screens Operations and Maintenance WDFW	1992-009-00	Yakima River	17030001xxxx * 17030002xxxx 17030003xxxx	1	1	Roundup Original	Glyphosate 41%	R-11	2.0	Spot w/Hand wand	Apr thru Sep		X	7

The 70-plus screens/facilities are all located within the Yakima River Subbasin. Due to the number of locations within this project, the 6th HUC level cannot be resolved.
O&M includes chemical control for noxious weeds and restoration at about 20 screen/facility sites annually. Each site is less than 0.1 acre in size and spot treated with hand wands as needed. Overall information on this project can be found at the link below.
http://www.efw.bpa.gov/Environment/EW/PROPOSALS/AIWP/2001/CD/projects/199107500.htm#5

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Appendix C continued

Project Name and Location				2003 Proposed Treatment Areas		List All Herbicides for Each Project								
Title/Sponsor	BPA Project Number	Drainage ((x) River Mile if Shown)	6th HUC	Upland Acres *	Riparian Acres **	Product Name	Active Ingredient (AI) and Percent AI	Adjuvant Used	Application Rate (lbs.AI/Ac.)	Application Method	Dates of Treatment	Weed Control Only	Weed Control + Restoration/ Revegetation	ESA Anadromous Fish ESUs Potentially Affected[1]
Tualatin River National Wildlife Refuge Additions – USDI - Fish and Wildlife Service (USFWS)														
Tualatin River National Wildlife Refuge Additions - USFWS	2000-016-00	Tualatin River (25)	170900100501	6.5		Sponsor to select from next column prior to application.	2,4-D (DMA) chlorsulfuron dicamba glyphosate triclopyr(TEA)	Agri-Dex Hasten	Max rate not to exceed BA	ATV tank sprayer	Sep	X		11, 12
Yakama Nation Wetlands and Riparian Restoration														
Yakama Nation Wetlands and Riparian Restoration	1992-062-00	Mid-Toppenish Creek	170300030801	30		Redeem R&P	clopyralid 12.1% triclopyr TEA 33%	Superspread	1.30	Tractor sprayer	Oct		X	7
		Mid-Toppenish Creek	170300030801	9.3		Curtail	2,4-D 39% clopyralid 5.1%	Superspread	1.47	ATV tank sprayer	Oct		X	7
Amazon Basin/Eugene Wetlands Phase 2 – The Nature Conservancy (TNC)														
Amazon Basin/Eugene Wetlands (TNC)	1992-059-00	Upper Amazon Creek	170900030107	5	1	Rodeo	Glyphosate 53.0	NA	1.5	Spot/Hand Wand	Jun thru Sep		X	11

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Appendix D: Glyphosate Product Brands and Selective Characteristics

GLYPHOSATE PRODUCT BRANDS AND SELECTIVE CHARACTERISTICS							Toxicity (96-hr LC_{50}) rainbow unless noted	EPA Aquatic Toxicity Rating	Labeled Uses Applicable to This Document					Glyphosate Type for HIP Consultation
Product	EPA Reg. No.	Manufacturer	Percent AI	CAS	Formulated with Surfactant	CAS			Aquatic	Wetlands	Forestry/ROW	Habitat Restoration	Conservation Reserve Program (CRP)	
Accord Concentrate	62719-324	Dow Agrosciences	53.8	38641-94-0	unk	unk	60 mg/L	III		Yes	Yes/Yes			II
Accord SP	62719-322	Dow Agrosciences	41.0	38641-94-0	Yes	unk	60 mg/L	III			Yes/Yes			II
Aqua Master	524-343	Monsanto	53.8	38641-94-0	No		>1000 mg/L	IV	Yes	Yes	Yes/Yes	Yes		I
Aqua Neat	71368-21	Nufarm	53.8	38641-94-0	No		>1000 mg/L	IV	Yes	Yes	Yes/Yes	Yes	Yes	I
Aqua Neat Aquatic	228-365-4581	Cerexagri	53.8	38641-94-0	No		11 mg/L (coho)	III	Yes	Yes	Yes/Yes	Yes		I
Aqua Star	42750-59	Albaugh/Agri Star	53.8	38641-94-0	No		unk	unk	Yes	Yes	Yes/Yes	Yes		I
Buccaneer	524-445-55467	Tenkoz	41.0	1071-83-6	Yes	61791-83-6	8.2 mg/L	II			Yes/Yes	Yes	Yes	II
Clearout 41	70829-2	CPT	41.0	38641-94-0	unk	unk	unk	unk			Yes/Yes	Yes	Yes	II
Clearout 41 Plus	70829-3	CPT	41.0	38641-94-0	Yes	unk	unk	unk				Yes	Yes	II
Cornerstone	42750-60-1381	Agriliance	41.0	38641-94-0	Yes	61791-83-6	2.1 mg/L (coho)	II			Yes/Yes	Yes	Yes	II
Cornerstone Plus	524-454-1381	Agriliance	41.0	38641-94-0	unk	unk	42 mg/L	III			Yes/Yes	Yes	Yes	II
Credit	71368-20	Nufarm	41.0	38641-94-0	Yes	61791-83-6	2.1 mg/L (coho)	II			Yes/Yes	Yes	Yes	II
Credit Duo	71368-25	Nufarm	37.54 3.42	38641-94-0 114370-14-8	unk	unk	unk	unk			Yes/Yes	Yes	Yes	II
Debit TMF	71368-21	Nufarm	53.8	38641-94-0	No		>1000 mg/L	IV						I
Eagre	352-609-1812	Griffin	53.8	38641-94-0	No		>1000 mg/L	IV	Yes	Yes	Yes/Yes	Yes		I
Foresters’	228-381	Riverdale Chemical	53.8	38641-94-0	No		>1000 mg/L	IV		Yes	Yes/Yes	Yes		I
Forest Star	42750-61	Albaugh/Agristar	41.0	38641-94-0	Yes	unk	unk	unk			Yes/No			II
Gly 4	42750-60-72693	Universal Crop	41.0	38641-94-0	Yes	61791-26-2	8.2 mg/L	II			Yes/Yes	Yes	Yes	II
Gly 4 Plus	42750-61-72693	Universal Crop	41.0	38641-94-0	Yes	61791-26-2	18.6 mg/L	III			Yes/Yes	Yes	Yes	II
Gly Star 5	42750-59	Albaugh/Agri Star	53.8	38641-94-0	Yes	unk	unk	unk				Yes	Yes	II
Gly Star Original	42750-60	Albaugh/Agri Star	41.0	38641-94-0	Yes	61791-26-2	unk	unk			Yes/Yes	Yes	Yes	II
Gly Star Plus	42750-61	Albaugh/Agri Star	41.0	38641-94-0	Yes	unk	unk	unk				Yes	Yes	II
Gly-Flo	51036-312	Micro Flo	41.0	1071-83-6	Yes	61791-83-6	20 mg/L (chinook)	III			Yes/Yes	Yes	Yes	II
Glyfos	4787-31	Cheminova	41.0	38641-94-0	Yes	61791-26-2	8.2 mg/L	II			Yes/Yes	Yes	Yes	II
Glyfos Aquatic	4787-34	Cheminova	53.8	1071-83-6	No		95 mg/L	III	Yes	Yes	Yes/Yes	Yes		I
Glyfos Pro	67760-57	Cheminova	41.0	38641-94-0	Yes	61791-26-2	95 mg/L	III			Yes/Yes	Yes		II
Glyfos X-TRA	4787-23	Cheminova	41.0	38641-94-0	Yes	61791-26-2	18.6 mg/L	III			Yes/Yes	Yes	Yes	II
GlyphoMate 41	2217-847	PBI/Gordon	41.0	38641-94-0	Yes	unk	unk	unk	Yes	Yes	Yes/Yes	Yes	Yes	II
Glyphomax	62719-323	Dow Agrosciences	41.0	38641-94-0	No		109 mg/L	IV			Yes/Yes	Yes	Yes	I
Glyphomax Plus	62719-322	Dow Agrosciences	41.0	38641-94-0	Yes	unk	109 mg/L	IV			Yes/Yes	Yes	Yes	II
Glyphosate	352-607	Dupont	41.0	38641-94-0	Yes	61791-83-6	8.2 mg/L	II			Yes/Yes	Yes	Yes	II
Glyphosate 4	72167-23-73220	FarmSaver.com	41.0	38641-94-0	Yes	unk	>100 mg/L	IV				Yes	Yes	II
Glyphosate Original	352-607-1812	Griffin	41.0	38641-94-0	Yes	unk	8.2 mg/L	II			Yes/Yes	Yes	Yes	II
Glyphosate VMF	352-609	Dupont	53.8	38641-94-0	No		>1000 mg/L	IV	Yes	Yes	Yes/Yes	Yes		I
Glypro	62719-324	Dow Agrosciences	53.8	38641-94-0	No		60 mg/L	III	Yes	Yes	Yes/Yes	Yes		I
Glypro Plus	62719-322	Dow Agrosciences	41.0	38641-94-0	Yes	unk	109 mg/L	IV			Yes/Yes	Yes		II
Honcho	524-445	Monsanto	41.0	38641-94-0	Yes	61791-26-2	8.2 mg/L	II			Yes/Yes	Yes	Yes	II
Honcho Plus	524-454	Monsanto	41.0	38641-94-0	Yes	unk	42 mg/L	III			Yes/Yes	Yes	Yes	II
Mad Dog Original	71368-20-554	AGSCO, Inc.	41.0	38641-94-0	Yes	61791-83-6	8.2 mg/L	II				Yes	Yes	II
Mad Dog I Original	51036-312-554	AGSCO, Inc.	41.0	1071-83-6	Yes	61791-83-6	20 mg/L (chinook)	III			Yes/Yes	Yes	Yes	II
Mirage	524-445-34704	Platte Chemical	41.0	1071-83-6	Yes	61791-83-6	8.2 mg/L	II			Yes/Yes	Yes	Yes	II
Mirage Plus	524-454-34704	Platte Chemical	41.0	38641-94-0	unk	unk	42 mg/L	III			Yes/Yes	Yes	Yes	II
Pondmaster	2217-850	PBI/Gordon	18.0	38641-94-0	Yes	unk	unk	unk	Yes	Yes	Yes/Yes	Yes		II
Pronto Big N’ Tuff	4787-23-2217	PBI/Gordon	41.0	38641-94-0	Yes	unk	unk	unk			Yes/Yes	Yes	Yes	II

Appendix D (Continued) Glyphosate Product Brands and Selective Characteristics

GLYPHOSATE							Toxicity (96-hr LC_{50}) rainbow unless noted	EPA Aquatic Toxicity Rating	Labeled Uses Applicable to This Document					Glyphosate Type for This BA
Product	EPA Reg. No.	Manufacturer	Percent AI	CAS	Formulated with Surfactant	CAS			Aquatic	Wetlands	Forestry/ROW	Habitat Restoration	Conservation Reserve Program (CRP)	
Pronto Farm and Ranch	2217-852	PBI/Gordon	32.3	38641-94-0	Yes	unk	unk	unk			Yes/Yes	Yes		II
Protocol	524-326	Monsanto	41.5	1071-83-6	No		>1000 mg/L	IV			Yes/Yes	Yes	Yes	I
Rattler	524-445-5905	Helena Chemical	41.0	1071-83-6	Yes	61791-26-2	8.2 mg/L	II			Yes/Yes	Yes	Yes	II
Razor	228-366	Riverdale Chemical	41.0	38641-94-0	Yes	61791-83-6	2.1 mg/L (coho)	II			Yes/Yes	Yes	Yes	II
Razor Pro	228-366	Riverdale Chemical	41.0	38641-94-0	Yes	61791-83-6	2.1 mg/L (coho)	II			Yes/Yes	Yes	Yes	II
Razor SPI (blue)	228-366	Riverdale Chemical	41.0	38641-94-0	Yes	61791-83-6	2.1 mg/L (coho)	II			Yes/Yes	Yes	Yes	II
Rodeo	62719-324	Dow Agrosciences	53.8	38641-94-0	No		60 mg/L	III	Yes	Yes	Yes/Yes	Yes		I
Roundup Custom	524-343	Monsanto	53.8	38641-94-0	No		>1000 mg/L	IV			Yes/Yes	Yes	Yes	I
Roundup Original	524-445	Monsanto	41.0	38641-94-0	Yes	61791-26-2	8.2 mg/L	II			Yes/Yes	Yes	Yes	II
Roundup Original II	524-454	Monsanto	41.0	38641-94-0	unk	unk	42 mg/L	III			Yes/Yes	Yes	Yes	II
Roundup Original RT	524-454	Monsanto	41.0	1071-83-6	Yes	61791-26-2	8.2 mg/L	II					Yes	II
Roundup Pro	524-475	Monsanto	41.0	38641-94-0	Yes	unk	5.4 mg/L	II			Yes/Yes	Yes		II
Roundup Pro Concentrate	524-529	Monsanto	50.2	38641-94-0	unk	unk	5.4 mg/L	II			Yes/Yes	Yes		II
Roundup Pro Dry	524-505	Monsanto	71.4	114370-14-8	Yes	unk	3.0 mg/L	II			Yes/Yes	Yes		II
Roundup Ultra Dry	524-504	Monsanto	71.4	114370-14-8	Yes	unk	3.0 mg/L	II				Yes	Yes	II
Roundup Ultra Max	524-512	Monsanto	50.2	38641-94-0	Yes	unk	5.4 mg/L	II				Yes	Yes	II
Roundup Ultra Max RT	524-512	Monsanto	50.2	38641-94-0	Yes	unk	5.4 mg/L	II				Yes	Yes	II
Roundup Weather Max	524-537	Monsanto	48.8	70901-12-1	Yes	unk	5.2 mg/L (bluegill)	II				Yes	Yes	II
Touchdown	100-1117	Syngenta	28.3	103607	Yes	veg polymer	130 mg/L	IV				Yes	Yes	II
Touchdown 5	10182-429	Zeneca	48.6	81591-81-3	unk	unk	stated toxic	unk					Yes	II
Touchdown CF	100-1157	Syngenta	28.3	103607	Yes (2)	unk	130 mg/L	IV					Yes	II
Touchdown Pro	100-1121	Syngenta	28.3	103607	Yes	7664-41-7	130 mg/L	IV			Yes/Yes	Yes		II
Supersate	524-445-34704	Platte Chemical	41.0	38641-94-0	Yes	61791-26-2	8.2 mg/L				Yes/Yes	Yes	Yes	II

All information collected directly from manufacturer's labels and the accompanying MSDS for the registered product shown in the "EPA Reg. No." column.

Glyphosate CAS:	1071-83-6	N-(phosphonomethyl)glycine isopropylamine salt; ($C_3H_8NO_5P$)
	38641-94-0	N-(phosphonomethyl)glycine, compound with 2-propanamine (1:1); ($C_6H_{17}N_2O_5P$)
	70901-12-1	Potassium Salt of N-(phosphonomethyl)glycine
	114370-14-8	Ammonium Salt of N-(phosphonomethyl)glycine
	103607(EPA PC)	Diammonium Salt of N-(phosphonomethyl)glycine
	81591-81-3	Trimethylsulfonium salt of N-(phosphonomethyl)glycine (*Sulfosate*)

Surfactant CAS:	61791-26-2	Ethoxylated tallowamines; (R-N(CH_2CH_2O)H_m(CH_2CH_2O)H_n)
	61791-83-6	Ethoxylated tallowamines; (?)
	7664-41-7	Ammonia; (NH_3)

EPA Toxicity Ratings:	IV	Practically Non-Toxic	>100.0 mg/L
(Most sensitive	III	Slightly Toxic	>10.0 – 100.0 mg/L
aquatic species,	II	Moderately Toxic	>1.0 – 10.0 mg/L
generally based on	I	Highly Toxic	0.1 – 1.0 mg/L
96-hour LC_{50})	I	Very Highly Toxic	<0.1 mg/L

APPENDIX E
BONNEVILLE PESTICIDE APPLICATOR CERTIFICATION PLAN

BONNEVILLE POWER ADMINISTRATION PESTICIDE APPLICATOR CERTIFICATION PLAN

INTRODUCTION

The Bonneville Power Administration (BPA), Department of Energy (DOE), operates and maintains a regional electrical system covering five States (Oregon, Washington, Idaho, Montana, and Wyoming) in the Pacific Northwest. As routine maintenance activities, BPA provides for inspection and treatment of in-service wood structures, and manages vegetation on rights-of-way and at electrical substations to protect the reliability of the electrical system, provide safe and efficient work areas, and protect and enhance the environment. These activities are not limited to, but may include, the application of wood preservatives to retard agents of wood decay, and application of herbicides to manage undesirable plant species. When pesticides are used, applicators will be certified in the right-of-way certification category and/or the wood treatment category.

Section 3 of the Federal Insecticide, Fungicide, and Rodenticide Act, as amended (FIFRA) (PL 92-516) (7 U.S.C. 136B) directs the Administrator of the United States Environmental Protection Agency, (EPA) to classify the various uses of pesticides as either "General Use" or "Restricted Use." "Restricted Use" pesticides may only be applied by "certified" applicators, or those working under the direct supervision of a certified applicator. Accordingly, the Administrator of EPA is directed to establish standards for the certification of applicators of Restricted Use pesticides and is authorized to approve State and/or Federal Certification Plans, (FIFRA, Section 4), (Federal Agency Certification of Federal Employees to Apply Restricted Use Pesticides, FR 42(161):41907-41908, August 19, 1977).

Only applicators of Restricted Use pesticides are required to be certified under FIFRA. However, three of the five States in the BPA service area require certification of applicators applying General Use pesticides with motorized equipment. BPA has adopted this requirement in its plan in accord with the EPA requirement that Federal agencies adhere to State substantive standards affecting pesticide use as a condition of approval for Federal Agency Certification Plans, (FR 42(161):4108; August 19, 1977.

Therefore, this document has been prepared in support of application to the EPA by BPA for approval of a Federal Certification Plan for Federal Employees, to certify those employees of BPA who use or supervise the use of both Restricted Use and General Use pesticides, with the exception of General Use pesticides applied by non-motorized equipment. BPA certification will only be granted to BPA employees, and will only be valid in performance of their official duties.

I. RESPONSIBILITY AND AUTHORITIES FOR ADMINISTRATION OF THE PLAN

A. Departmental (DOE) Responsibility and Authority

Overall responsibility for the development, implementation , and surveillance of this Plan rests with the BPA under the guidance of the DOE. Responsibilities will be consistent with existing DOE policies as discussed below.

The DOE environmental policy provides for conduct of all operations in an environmentally safe and sound manner with paramount concern for protection of the environment and the public, and for coordination of DOE's compliance activities at the Headquarters Level. Mandatory Standards specifically include compliance with FIFRA and all relevant implementing regulations (U.S. DOE Orders No. 5480.4 (5/14/84)) for all DOE and DOE contractor operations. This Order also provides authority for independent overview to assess compliance, and corrective action and follow-up when non-compliance is noted. Heads of Field Organizations (e.g., BPA Power Administrator) are directed to assure compliance.

Environmental Protection, Safety, and Health Protection Information Reporting Requirements are specified in DOE Order 5484.1 (2/24/81). This Order provides that ". . . notification of occurrences involving DOE and DOE contractor operations be made to the responsible authority; that all occurrences be investigated; that reports be submitted to responsible DOE officials; that management take responsible action and that there be consistency in the treatment of such occurrences . . . . " This order would support the record keeping and reporting for pesticide use activities as detailed later in this proposed plan.

Enforcement of the provisions of this proposed plan is supported by DOE Order 5482.1A (8/13/81). The order describes procedures for implementing an Environmental Protection, Safety, and Health Protection Appraisal Program, and details factors to be used in performing an appraisal. Requirements of this Order have been incorporated into the BPA Environmental Appraisal Program (see below).

Compliance with the DOE policies and procedures outlined above constitutes the agency regulatory framework which both allows for and supports implementation of the provisions of this proposed plan by the BPA.

B. <u>BPA's Responsibility and Authority</u>

In compliance with the DOE policies outlined above, BPA will be responsible for the administration of this proposed plan. Administration will consist of development, implementation, and surveillance and funding of pesticide use training, certification, and record keeping and reporting as provided below. These procedures will be implemented upon approval of this plan, and are consistent with BPA policies and responsibilities listed below.

The BPA Environmental Manual, Chapter 955, Pesticides, states that BPA employees applying pesticides will comply with FIFRA and applicable State standards. The Chapter further designates responsibilities within the organization for various aspects of pesticide use and management. Specific responsibilities for various aspects of pesticide use and management are reiterated and emphasized again in the BPA Right-of Way Management Standards and in BPA Environmental Standard and Procedures.

Specific procedures and instructions involving application, safety, transportation, storage, and disposal of pesticides, spill clean up, residue monitoring, and other aspects of pesticide use are contained in the Transmission Line Maintenance Standards, Procedures, Instructions, and Informations (SPIF's). Responsibilities designated in these documents would not change upon approval of the plan, with the exception that BPA pesticide applicators would obtain Federal certification in lieu of State certification, and procedures for becoming certified would change in conformance with this plan.

C. BPA/State Regulator Interaction

1. Cooperation in Abating Environmental Pollution

BPA will cooperate with the Administrator, EPA, and State, interstate, and local agencies in the prevention, control, and abatement of environmental pollution caused by pesticide use. Report of instances of misuse or falsification of records by non-BPA personnel (i.e., contractor applicators) will be sent to the appropriate State or EPA regional official for enforcement. BPA will cooperate with the State(s) or EPA in any subsequent enforcement action undertaken.

2. Compliance with Standards and Regulations

In accordance with guidelines as may be issued by the EPA Administrator, BPA shall comply with more stringent State substantive standards and limitations and with Federal regulations and guidelines which affect pesticide use.

3. Environmental Assessments and/or Impact Statements

Environmental Assessments (EA) and/or Environmental Impact Statements (EIS) may support some right-of-way vegetation management programs that involve the use of pesticides. EIS's and EA's are available to States.

4. Adherence to State Standards

BPA will cooperate with individual States by adhering to substantive standards which exceed or are additional to those established in this plan in compliance with Executive Order 12088. BPA is responsible for all in-service wood structure maintenance and vegetation management program activities within its service area, and for establishment of policy, planning, and funding of policy, planning, and funding of right-of-way maintenance and vegetation management programs.

5. Resolution of BPA/State Discrepancy

If a state should decide that a given substantive standard is more stringent than, or is additional to, standards established in this plan, it should notify BPA and request compliance.

BPA will forward all such notifications to the EPA Administrator immediately and, as soon as possible thereafter, forward its opinion as to whether the standard is substantive or administrative in nature. BPA agrees that the EPA administrator will undertake liaison between the affected parties and mediate such conflicts in cases of disagreement between BPA and a State.

6. Use of State Pesticide Applicator Certification Plan

BPA personnel with pesticide application responsibilities which are not adequately addressed by this plan, or where economic or other criteria make it inefficient to use the proposed BPA Pesticide Applicator Certification Plan, shall comply instead with an EPA Approved State Pesticide Applicator Certification Plan. A State certification will be valid only for that State in which certification is granted.

II. PROVISIONS OF THE PLAN

Provisions of this plan include: (a) training and certification of pesticide applicators: (b) enforcement of pesticide misuses and/or falsification of records; (c) right-of-entry for review of records; and (d) pesticide use record keeping. The Vice President for Transmission Field Services, will be responsible for implementing and monitoring all provisions of the plan.

A. Training and Certification

BPA will certify applicators, of both General and Restricted Use pesticides, except those BPA applicators who are applying general use pesticides by non-motorized equipment.[1]* Certification will be in accordance with the EPA Standards of Competency detailed in 40CFR 171.4, with competency to be determined by a written examination. If BPA employees require training prior to the examination, educational materials and/or training courses will be provided. Specific procedures are discussed in Section IV, Standards for Certification.

B. Enforcement of Pesticide Misuse and/or Falsification of Records

Misuse of a pesticide for the intent and purpose of this Plan shall consist of any of the following:

1. Use of a pesticide not in accordance with labeling, except as allowed by Section 2 (ee) of FIFRA.

2. Use of any pesticide which is under an experimental use permit contrary to the provisions of such permit.

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[1] This exemption is consistent with Oregon State Standard (ORS 634.116 (15)(b) and Washington State Standard (RCW 17.21.220).

3. Use of a pesticide not in accordance with substantive State standards.

4. Use of a pesticide not in accordance with all BPA Standards, Procedures, Instructions, or Informations (SPIF's) and with Environmental Standard and Procedures (ESP's).

Falsification of records for the intent and purpose of this plan shall consist of failure to maintain or falsification of any part of those records required by Section II.D. of this plan.

Either misuse of a pesticide or falsification of records will result in both: (1) denial, suspension, or revocation of certification as appropriate; and (2) additional administrative disciplinary actions. disciplinary actions shall be in accordance with the provisions of the Federal Insecticide, Fungicide, and Rodenticide Act. (FIFRA 171.7.b.1.ii.B), DOE regulations regarding Conduct of Employees (FR 44(82)"24696-24709, April 26, 1979) and Bonneville Manual Section 400/751A, Personnel-Disciplinary Action. Disciplinary action will be the responsibility of the employee's supervisor, who will in turn request that the Vice President for Transmission Field Services deny, suspend, or revoke certification.

Instances or misuse of a pesticide or falsification of records by BPA employees who are State or EPA certified will be reviewed under the same provisions as those for BPA certified applicators. As appropriate, BPA will administratively deny, suspend, or revoke these BPA employees' privileges to apply pesticides on BPA facilities. Since BPA cannot deny, suspend, or revoke a State or EPA issued certificate, except for use on BPA facilities, BPA will report the incident accompanied with a report of its internal actions and findings to the appropriate certifying authority. BPA will cooperate with the State or EPA any subsequent actions undertaken.

Instances of misuse or falsification of records by non-BPA employees (i.e., contractor applicators) will be forwarded to the appropriate State and/or EPA Regional Office. BPA will cooperate with the State(s) or EPA in any subsequent enforcement action undertaken.

C. Provisions for Right-of-Entry Consent

BPA will provide for entry for appropriate Federal and State pesticide enforcement and certification authorities to BPA offices, facilities, all lands owned or leased, or rights-of-way controlled or under the jurisdiction of BPA during normal working hours, or at other times, if given advance notification for the purposes of reviewing BPA certified pesticide applicator's vegetation management methods and activities, and to observe the use and application of pesticides, to inspect and/or sample any pesticide, record, device, container, product, apparatus, or equipment used in pesticide use management programs, and to inspect and/or sample any pesticide treated areas, rights-of-way, or lands where pesticides have been used, applied, or disposed.

D. Pesticide Use Record Keeping

BPA will require all BPA certified applicators to keep routine operational records of pesticide use including kinds, amounts, uses, dates, and places of application for both general and restricted use pesticides and to retain such records for at least 2 years. Records for herbicide application will be kept on BPA Form 1416 ((Appendix A), and records for wood treatment will be kept on BPA Form 1007 (Appendix B). Records will be retained in the appropriate BPA Regional Office. Such records will be available to appropriate EPA or State officials for review upon request, (see also Section II. C., Provisions for Right-of-Etry Consent).

III. REPORTING

A. BPA will submit annual reports on the certification of applicators and activities related to restricted use pesticides to the administrator of EPA as specific in 40 CFR, Section 171.7(d). Annual reports will be submitted by March 1 of each year for the fiscal year preceding. A copy of the 1996 Annual Report is attached (Appendix C).

B. Other reports may be requested and shall be made available to meet specific needs on a case-by-case basis.

IV. STANDARDS FOR CERTIFICATION

A. Who Will Be Certified

BPA employees who use or supervise the use of any pesticide either General or Restricted Use within the conduct of their official duties to BPA rights-of-way, substations, or other facilities except those applying general use pesticides by non-motorized equipment will be identified by the Regional Field Services Manager, Regional Field Services Specialist, Linemen Foreman III or Substation Chief Operator to the Vice President for Transmission Field Resources, as requiring certification. For the intent and purposes of this Plan, the term "supervise" shall mean direct supervision as defined in CFR 171.6. BPA will further require the physical presence of the supervisor or a licensed applicator within line of sight or hearing distance of the employee.

BPA personnel for whom BPA certification is not efficient or responsive to the needs of the Administration may alternatively be certified by an EPA Approves State Pesticide Applicator Certification Plan. However, State certification will be valid only in the State granting certification. (See also Section I.C.6.).

All contractors or non-BPA employees will be required to comply with applicable State certification programs.

B. Categories for Certification

BPA will certify its employees only as commercial applicators in two categories:

Right-of-Way
Wood Treatment

The BPA plan adopts the EPA Right-of-Way category as defined at 40 CFR 171.3 (b) (6) and accompanying standards of competency at 40 CFR 171.4 (c) (6).

EPA has not established a specific wood treatment category. Therefore, the BPA plan has developed a wood treatment category and accompanying standards of competency. These are contained at "C. Definition of Wood Treatment category", below).

There are presently 150 applicators certified in the right-of-way category. There are anticipated to be 100 applicators certified in the wood treatment category.

Any future requests for approval of additional categories or subcategories will be made in writing to the Administrator of EPA in conformance with 40 CFR 171.7(d)(1)(ii).

C. Definition of Wood Treatment category

Wood treatment. This category includes commercial applicators using or supervising the use of Restricted Use pesticides to treat and preserve wood products.

Wood treatment standards of competency.

Applicators shall demonstrate practical knowledge of the following:

1. Wood Properties
   a. Durability
   b. Shrinkage, checking and other defects (i.e., splits, knowts, crookedness)
   c. Treatability (permeability)

2. Biological Agents of Decay

   a. Fungi
   b. Insects
   c. Woodpeckers

3. Types of Preservatives

   a. Oil-borne preservatives (creosote)
   b. Waterborne preservatives (arsenicals)
   c. Fumigants
   d. Pentachlorophenol
   e. Copper or zinc napthenate

4. Preservative Treatment processes

d. Pentachlorophenol
e. Copper or zinc napthenate

4. Preservative Treatment processes

a. Pressure (American Wood Preservation Association standards)
b. Non-pressure

5. Handling and Installation of Treated Wood Products

a. Storage, handling, installation of fixtures
b. Remedial Preservative treatment

6. In-Service Pole Inspection

a. Inspection methods
b. Inspection tools and devices

7. In-Service Pole Treatment

a. Groundline decay control
b. Above groundline internal void treatment
c. Fumigation (above and below ground)

8. Safety and Environment
a. Adverse environmental effects of preservatives and treated wood structures
b. Proper handling of treated wood
c. Proper handling of remedial treatments (i.e. following labels)
d. Disposal of preservatives and treated wood products.
e. Preservative-health related issues and environment issues
f. Consumer Information Sheets

D. BPA Annual Certification Process

The Vice President for Transmission Field Services, will be responsible for the annual certification of BPA applicators. Applicators will be certified each year by passing an examination. Certification will be valid for one year. Those BPA employees eligible for certification will receive written notification of their scores and a pocket-sized, plasticized "license" or certificate, signed by the Manager, Pollution Prevention & Abatement, as delegated by the Vice President for Transmission Field Services. The certificate will contain an identifying number, the name of the applicator, category or categories of certification, date issued, and expiration date (Appendix D attached). BPA certification will be valid on facilities and rights-of-way maintained by BPA throughout all States in the BPA service area.

The annual examination for certification will cover all topics identified in 40 CFR 171.1, including general standards of competency and specific standards of competency for the two categories covered by this plan. Annual examinations will be written and consist of three parts: Part I will cover Laws and Regulations (25 questions), Part II will cover Substation and Right-of-Way Vegetation Management (25 questions), and Part III will cover Wood Treatment and Right-of-Way Vegetation Management (25 questions). A score of 70 percent must be obtained on each test to pass the examination. At least two separate examinations will be maintained and will be administered randomly. Examinations will be reviewed and updated each year and will be maintained, administered, and evaluated with all reasonable security precautions. No provisions will be made for those who cannot read, since all BPA employees must demonstrate reading proficiency as a condition of employment or in the performance of official duties.

BPA employees may apply for annual certification only by passing the BPA examinations, and attending BPA or State certified pesticide use training within the one year certification period. Certification training and examinations will emphasize knowledge of the most current vegetation management and wood treatment issues, techniques, alternatives, and regulatory requirements. Examination questions will be updated each year to emphasize changes in technology and use requirements. A copy of the current examination is attached (Appendix E).

To facilitate continuing education in responsible pesticide use for BPA employees, the Manager, Pollution Prevention & Abatement will continue to make available publications, training films or aids, or training courses as appropriate. Training materials will be made available which will address the certification categories. A list of current training materials and recent training course agendas is attached (Appendix F). Employees or their supervisors may request training or training materials as necessary.

97cert.doc

ENVIRONMENTAL PROTECTION AGENCY

[OPP–42064C; FRL–5741–9]

Department of Energy Plan for Certification of Pesticide Applicators

AGENCY: Environmental Protection Agency (EPA).

ACTION: Notice of Approval of Certification Plan.

SUMMARY: On June 23, 1997, EPA announced its intention to approve a revised Department of Energy (DOE) plan for the certification of pesticide applicators. The revised DOE plan was similar to the original plan in only covering applicators in the Bonneville Power Administration. The revised plan retained the original certification category of right-of-way pest control and added a new category of wood treatment. The revised plan replaced the original 3–year recertification interval with a 1 year recertification interval. No comments were received on EPA's proposal to approve the revised DOE certification plan. Notice is hereby given of EPA's granting final approval of the revised DOE plan.

ADDRESSES: Copies of the DOE revised plan are available for viewing at the following locations during normal business hours:

1. U.S. Environmental Protection Agency, Office of Pesticide Programs, Crystal Mall #2, 1921 Jefferson Davis Highway, Rm. 1121, Arlington, VA 22202. Contact: John R. MacDonald, (703) 305–7370.
2. U.S. Department of Energy, Bonneville Power Administration, 905 Northeast Eleventh, Stop EP-5, Fifth Floor, Portland, OR 97232. Contact: James Meyer, (503) 230–5038.
3. Select U.S. Department of Energy installations. Contact: James Meyer at aforementioned location for list of locations.

FOR FURTHER INFORMATION CONTACT: By mail: John R. MacDonald (7506C), Office of Pesticide Programs, Environmental Protection Agency, 401 M St., SW., Washington, DC 20460. Office location and telephone number: Crystal Mall #2, 1921 Jefferson Davis Highway, Rm. 1121, Arlington, VA, Telephone: (703) 305–7370.

SUPPLEMENTARY INFORMATION: In the **Federal Register** of October 7, 1988, notice was published announcing the final approval of a DOE pesticide applicator certification plan. On June 23, 1997 (62 FR 33862) (FRL–5717–3), EPA announced its intention to approve a revised DOE certification plan. The revised DOE certification plan added a new wood treatment category and retained the existing right-of-way category. The revised certification plan also established an annual recertification period to replace the current 3–year period. The revised certification plan will continue to base certification and recertification on the taking and passing of a written examination. The revised DOE certification plan will continue to cover only employees of the Bonneville Power Administration. The DOE estimates that there will be 100 applicators certified in the new wood treatment category. There are presently approximately 150 applicators certified in the right-of-way category, whose certification will be unaffected by this action.

No comments were received on EPA's notice of intention to approve the revised DOE certification plan. Therefore, EPA approves the revised DOE certification plan.

List of Subjects

Environmental protection.

Dated: September 9, 1997.

Lynn R. Goldman,

Assistant Administrator for Prevention, Pesticides and Toxic Substances.

[FR Doc. 97-25337 Filed 9-23-97; 8:45 am]

BILLING CODE 6560-50-F

APPENDIX F
DETAILED EFFECTS AND RISK ASSESSMENT FOR HERBICIDE USE

A. Evaluation Criteria

For the HIP consultation, BPA has assessed the scope and effects of noxious weed control under the Fish and Wildlife Program at the project, watershed, and subbasin level. Appendix C to the main document contains a detailed listing of all herbicide applications proposed to be funded by BPA under the Fish and Wildlife Program in 2003, including locations at the 6th field HUC level. Most of these applications will be conducted on lands purchased by BPA for fish and wildlife mitigation and managed by a number of different entities spread throughout the Columbia River Basin.

The potential effects of noxious weed control must be considered in the context of performing weed control versus the possible effects and consequences of not conducting weed control. Lack of noxious weed control could result in increased spread of undesirable non-native species. The spread of noxious weeds and non-native species usually signals the decline of ecological condition in watersheds. Noxious weeds can outcompete native species, which can result in adverse effects to terrestrial and riparian/aquatic habitats.

Refer to Table F-1 for a list of the herbicides proposed to be used under this HIP consultation and generalized environmental toxicological profile and physical characteristics on each of the herbicides.

Table F-1 Summary of Herbicide Ecological Toxicities and Physical Characteristics

Herbicide	Acute Toxicity				Physical Properties[4,5]			Off-site Movement Potential[4,5]	
	Mammals[1]	Avian[1]	Aquatic[1]	Microorganisms[2,3]	Persistence	Solubility (mg/l)	Adsorption (K(oc))	Groundwater Leaching	Surface Water Runoff
2,4-D	Moderately Toxic to Practically Non-toxic Depending on Formulation and Species	Slightly Toxic to Practically Non-toxic Depending on Formulation and Species	Highly Toxic to Practically Non-toxic Depending on Formulation and Species	Bees: Practically Non-toxic	Moderate: <1 - >21	$3.39x10^4$	19 - 109	Moderate	Low
Chlorsulfuron	Practically Non-toxic	Practically Non-toxic	Practically Non-toxic	Bees: Practically Non-toxic	Moderate: 40 days	7000	40	High	Low
Clopyralid	Practically Non-toxic	Slightly Toxic	Practically Non-toxic	Bees: Practically Non-toxic	Moderate: 40 days	300,000	6	High	Low
Dicamba	Slightly Toxic	Practically Non-toxic	Practically Non-toxic to Aquatic Invertebrates; Slightly Toxic to Fish and Amphibians	Bees: Practically Non-toxic Earthworm: Low	Low: 14 days	400,000	2	High	Low
Glyphosate	Practically Non-toxic	Practically Non-toxic	Moderately Toxic	Bees: Practically Non-toxic	Moderate: 47 days	900,000	24,000	Low	High
Metsulfuron-Methyl	Practically Non-toxic	Practically Non-toxic	Practically Non-toxic	Bees: Practically Non-toxic	Moderate: 30 days	9500	35	High	Moderate
Picloram	Practically Non-toxic	Practically Non-toxic	Moderately Toxic.	Bees: Practically Non-toxic	Moderate: 90 days	200,000	16	High	Low
Sulfometuron-Methyl	Slightly Toxic	Practically Non-toxic	Slightly Toxic	Bees: Practically Non-toxic	Low: 20 days	70	78	Moderate	Moderate
Triclopyr TEA BEE	 Practically Non-toxic Practically Non-toxic	 Slightly Toxic Slightly Toxic	 Practically Non-toxic Highly Toxic	 Bees: Practically Non-toxic Earthworm: Practically Non-toxic	 Moderate: 46 days Moderate: 46 days	 2,100,000 23	 20 780	 High Low	 Low High

[1] See individual herbicide references in BPA 2000 References.
[2] Tew, James E, Protecting Honeybees from Pesticides, Alabama Cooperative Extension System, ANR-1088, April 1998
[3] Townsend, Lee, et al., Earthworms: Thatch-Busters, University of Kentucky, January 1994
[4] Mahler, Robert L., et al., Pesticides and Their Movement in Soil and Water, University of Idaho, Quality Water For Idaho CIS 865, September 1998
[5] Vogue, P.A., et al., Oregon State University Extension, Pesticide Properties Database, July 1994

Aquatic Levels of Concern Assessment

As part of their aquatic analysis for herbicide application, risk quotients were previously developed by the BLM for 2,4-D, chlorsulfuron, clopyralid, metsulfuron methyl, picloram, and sulfometuron methyl; herbicides that BPA proposes to use to treat noxious weeds under the Fish and Wildlife Program during 2003 (see Table F-2). The risk quotient is calculated from a no adverse affect level (safety factor) divided by an "Expected Environmental Concentration" (EEC). The EEC is derived from a direct application of the active ingredient to a one-acre pond that is one foot deep, using the maximum application rate BPA is proposing to use. The EEC is expressed in parts per million (ppm) (USDI-BLM 2001, 2002a and 2002b).

BPA also developed generic estimated environmental concentrations (GEEC2) for dicamba, glyphosate and triclopyr. The GENEEC2 output tables for these three herbicides are contained in Appendix F-1. The GEEC is calculated using EPA's GENEEC modeling software and simulates an application of herbicide near a water body. The GEEC or EEC (referred to hereon as EEC) is an extreme level that is unlikely to occur during implementation and should be viewed as a worst-case situation.

The risk quotient provides a reference from which a possible worst-case situation can be assessed. If the risk quotient is greater than 10, the level of concern is categorized as "Low." If the risk quotient is between one and 10, the level of concern is "Moderate." If the risk quotient is less than one, the level of concern is "High." Appendix F-2 shows the worksheet used for assessing levels of concern associated with herbicide applications for aquatic species.

Table F-2 Aquatic Level of Concern Assessment of Herbicides Proposed for use by BPA

Active Ingredient	Product Name	Application Rates lb. or oz. ai/ac (Maximum)	EEC (ppm)	Toxicity 96-hour LC_{50} (mg/L) Rainbow Trout	Safety Factor 1/20 LC_{50} (mg/L)[1]	Risk Quotient (1/20 LC_{50}/EEC) and Level of Concern[1]	Soil Half Life (Range in Days)
2,4-D amine	Weedar 64	1.0 lb.	0.367	250	12.5	34.6 Low	10[2] (2 - 16)
Chlorsulfuron	Telar DF	3.0 oz.	0.052	250	12.5	240 Low	35[3]
Clopyralid	Transline	0.3 lb.	0.110	104	5.2	47.3 Low	40[2] (12 - 70)
Dicamba	Banvel	8.0 lbs.	0.532[4]	35	1.75	3.3 Moderate	20[3]
Glyphosate 1 Glyphosate 2	Many Many	Many Many	0.014[4] 0.014[4]	60 2.1 (coho)	3 0.11	214 Low 7.9 Moderate	47[2] (21 - 60)
Metsulfuron methyl	Escort	2.0 oz.	0.046	150	7.5	163 Low	120[3]
Picloram	Tordon	0.50 lb.	0.184	13	0.65	3.5 Moderate	90[2] (24 - 277)
Sulfometuron methyl	Oust	1.0 oz.	0.023	148	7.4	321.7 Low	20-28[2]
Triclopyr	Garlon 3A	2.5 lbs.	0.159[4]	240[4]	12	75.5 Low	46[3]

[1] Refer to Appendix F-2 for the worksheet used for assessing levels of concern associated with herbicide applications for aquatic species.
[2] Soil half-lives for herbicides are from USDI-BLM (1991) Table 4-6. They are the most representative values reported in days, followed by the range of days. Those that are considered non-persistent, are those with a half-life <30 days; moderately persistent are those with a half-life of 30 to 100 days; persistent are those with a half-life >100 days.
[3] BPA Fact Sheets http://www.efw.bpa.gov/portal/Organizations/Government/Federal/Dept_of_Energy/BPA/Environment/PPA/ROWMaintenance/ROWMain2.htm
[4] EEC calculated using EPA's GENEEC2 model http://www.epa.gov/oppefed1/models/water/geneec2_description.htm

The analyses prepared for the herbicides proposed for use by BPA have been adapted from many sources. The sources, in nearly every case, have summarized data from the Syracuse Environmental Research Associates (SERA) risk assessment maintained by the USDA-Forest Service. These documents should be referred to for additional assessment information. Internet links are provided in the References section beginning on page F-30 of this document.

Individual Herbicide and Surfactant Assessments

2,4-D (From USDI-BLM 2002b)

Off-Site Movement

2,4-D has only limited potential to contaminate ground water. 2,4-D ranges from being mobile to highly mobile in sand, silt, loam, clay loam, and sandy loam. However, it is unlikely to be a ground-water contaminant due to the rapid degradation of 2,4-D in most soils and rapid uptake by plants. Most reported 2,4-D ground-water contamination has been associated with spills or other large sources of 2,4-D releases.

The aquatic macrophytes appear to be the most sensitive to concentration of 2,4-D in water, with LC_{50} values for the inhibition of chlorophyll levels at about 0.3 mg/L. This inhibitory concentration is about a factor of 150 above the central estimate of ambient levels of 2,4-D in watersheds that are completely treated with 2,4-D at 1 lb a.i./acre (i.e., 0.0002 mg/L). This ambient concentration is also a factor of over 200 below the LC_{50} for any fish species (i.e., 0.452 mg/L) or aquatic invertebrate (0.440 mg/L). Thus, even if local differences in topography, climate, or other factors were to result in an order of magnitude difference in ambient concentration of 2,4-D in water, there is no indication that mortality in any aquatic species would be observed or plausible. The relatively modest differences in application rates likely to be used by the BPA project sponsors (i.e., up to 1.0 lb a.i./acre) are inconsequential to the risk characterization. Thus, under any foreseeable set of conditions, no impact is anticipated to occur to any aquatic species from the general use of 2,4-D in a watershed.

Soil Contamination

For this assessment, the parameters in the Groundwater Loading Effects of Agricultural Management Systems (GLEAMS) model (Knisel et al. 1992) were selected to minimize the adsorption of the herbicides to organic matter and maximize their potential for loss through runoff or percolation. Only one soil type, a loamy, very fine sand, was modeled. The modeling scenario used simulated terrain that sloped downhill from the site of herbicide application. Ground-based broadcast and directed application were simulated by specifying the proportion of the herbicide applied to plants. A high proportion of the herbicide applied using directed application techniques would be specifically aimed at the plant. The flexible orientation of the nozzle makes it possible to selectively treat the target plant. When the target plant has a large canopy, the plant will intercept most of the herbicide. Therefore, it is assumed that directed application results in 70 - 90% of the herbicide being applied to plants. The fixed orientation of the nozzles would result in broadcast application being more likely to apply herbicide to bare soils. This is especially true if the target plant has not developed a large canopy. For broadcast applications it is assumed that between 50 and 70% of the herbicide applied is actually applied to plants. It is unlikely that broadcast or directed techniques would be used to treat newly emerged plants as they would not provide a sufficient leaf area for a lethal dose of the herbicide to be translocated to the meristematic regions of the plant. Therefore, it is unlikely that herbicides would be applied in situations where there is a substantial amount of bare soil when compared with plant cover.

For both the dimethylamine salt and esters of 2,4-D, the greatest concentrations occurred in the uppermost layer of the soil (0 - 1 cm deep) immediately after application. At modeled application rates near to or greater than the maximum anticipated application rate of 2 lbs a.i./acre, soil levels of 2,4-D - either immediately after application or after 1- to 2-inch rain falls - did not exceed 10 mg/kg in the upper 1 cm, were below 1 mg/kg in 1- to 8-cm soil levels, and were less than 0.04 mg/kg in the 8-15 cm soil layer.

Aquatic Species

In aquatic species, the ester formulations of 2,4-D are approximately 200-1000 times more toxic to fish and aquatic invertebrates than the amine formulations, when toxicity is measured by acute (24 to 96 hour) LC_{50} values. BPA is proposing, therefore, to use only the 2,4-D amine formulations for chemical treatment.

Examining the 2,4-D amine salt form, the results support a generally non-toxic classification (for fish). However, studies have shown that toxicities of two amine salts to fathead minnows (*Pimephales promelas*) did not change after aging test solutions 21 days. Fry and fingerlings were found to be considerably more sensitive than eggs to two amine salts of 2,4-D, although still not to toxic levels. In fathead minnows, tests with the dimethylamine of 2,4- yielded 96-hour LC_{50}s ranging from 320-6300 mg/L for fingerlings and swim-up fry, compared with over 1,400 mg/L for the egg stage (USFWS 1980); in chinook salmon, 96-hour LC_{50} exceeded 100 mg/L (USGS 2003). With rainbow trout, tests of the dodecyl/tetradodecyl amine salt against several life stages yielded LC_{50}s (mg/L) of 3.2 for fingerlings, 1.4 for swim-up fry, 7.7 for yolk-sac fry, and 47 for eggs (USFWS 1980). For chinook salmon in the fingerling stage, tests of the dodecyl/tetradodecyl amine salt yielded a 96-hour LC_{50} of 4.8 mg/L and at the yolk-sac stage, a 96-hour LC_{50} yielded 2.9 mg/L (USGS 2003).

Aquatic Sub-Lethal Effects

Most of the potential sub-lethal effects from exposure to 2,4-D have not been investigated in regards to toxicological endpoints that are generally considered important to the overall health and fitness of salmonids. Exposure to 2,4-D has been reported to cause changes in schooling behavior, red blood cells, reduced growth, impaired ability to capture prey, and physiological stress (HSDB web site; Gomez 1998; Cox 1999). Sublethal effects for the 2,4-D amine salt form include the reduction in the ability of rainbow trout to capture food at 5 mg/l (Cox 1999). 2,4-D can combine with other pesticides and have a synergistic effect, resulting in increased toxicity. Combining 2,4-D with picloram damages the cells of catfish (*Ictalurus spp.*) gills, although neither individual herbicide has been found to cause this damage (Cox 1999). Little et al. (1990) examined behavior of rainbow trout exposed for 96 hours to sublethal concentration of 2,4-D amine, and observed inhibited spontaneous swimming activity and swimming stamina.

Terrestrial Species

2,4-D ranges from being practically nontoxic to moderately toxic to birds and mammals. 2,4-D is relatively nontoxic to honey bees. Proposed application rates are not expected to result in significant adverse effects to terrestrial species (e.g., exposure, inhalation, or lethal dose). 2,4-D shows little tendency to bio-accumulate and does not have long-term persistence in food chains and subsequent toxic effects to listed species and prey species. No chronic wildlife dosing of listed species would occur, because the herbicides degrade relatively rapidly and sites are normally treated only once in a given year.

Plants

2,4-D is used to control broadleaf weeds, grasses, and other monocots, woody plants, aquatic weeds, and non-flowering plants. 2,4-D is a plant-growth regulator that stimulates nucleic acid and protein synthesis and affects enzyme activity, respiration, and cell division. It is absorbed by plant leaves, stems, and roots and moves throughout the plant. It accumulates in growing tips.

For direct spray or drift, the relevant exposure metameter[1] is the application rate or functional rate of deposition expressed in units of toxicant weight per unit area (e.g., lb/acre). In some respects, the product labels for 2,4-D (CDMS 2003) provide useful information on effective levels of application and suggest differences in species or life-stage sensitivity. For example, the maximum broadcast application rate, about 2 lbs a.i./acre, is effective against most species and life stages of terrestrial plants, except grasses. Conversely, application levels of 0.5 to 1 lb a.i./acre are likely to damage broadleaf vegetation but less likely to impact other species of vegetation.

Chlorsulfuron (From NOAA Fisheries 2002)

Chlorsulfuron is 2-chloro-N-[[(4-methoxy-6-methyl-1,3,5-triazin-2-yl)amino]carbonyl] benzenesulfonamide, which is chemically similar to metsulfuron methyl. The formulation proposed for use by the BPA is 75% chlorsulfuron and 25% inert ingredients (equivalent to Telar). Telar is used for the control of broadleaf weeds and some annual grasses on noncrop lands. Telar is applied to young, actively growing weeds and works by preventing the production of an essential amino acid. This in turn inhibits cell division in root tips and shoots. The registered application rate is 0.25 to 3.0 ounces of active ingredient per acre. Telar is susceptible to off-target movement through runoff when applied to highly compacted surfaces or frozen ground (Information Ventures 1995b).

Chlorsulfuron is active in the soil, and is readily absorbed from the soil by plants. Adsorption is slightly greater in soils with high organic matter content, but chlorsulfuron tends to leach in all permeable soils and those where pH is greater than 6.0. Soil microorganisms break down this chemical, and the soil half-life varies from one to 3 months, with the rate of decay being slower in alkaline soils (pH 7.3). It is also degraded more rapidly at higher temperatures and in moist environments (Information Ventures 1995b).

Chlorsulfuron does not bioaccumulate in fish. The only aquatic toxicity information available indicates that less than 50% of rainbow trout and daphnia died when trout were exposed to 250 mg/l for 96 hours, and daphnia were exposed to 370 mg/l for 48 hours (Ahrens 1994). No information is available on sublethal effects on fish, or effects on aquatic plants.

[1] the measurement or transformation of the measurement used in evaluating biological tests, i.e. bioassays

Clopyralid (From USDI-BLM 2002b)

Off-Site Movement

The potential for clopyralid to be transported to streams via ground water is minimal because relatively rapid degradation in the soil prevents leaching, as observed in a number of field studies. A number of field lysimeter studies and the long-term field study by Rice et al. (1997) indicate that leaching and subsequent contamination of ground water are likely to be minimal. This conclusion is also consistent with a short-term monitoring study of clopyralid in surface water after aerial application (Leitch and Fagg 1985).

Using GLEAMS, two types of soils were modeled: clay (high runoff potential) and sand (low runoff potential). Two erosion parameter files and two hydrology parameter files are used, one each for clay and sand. Both sets of files specify a 10-acre (435,600 sq. ft.) area that is 50 feet wide and 8712 feet long - e.g., a right-of-way. For estimating runoff to water, it is assumed that a body of water runs along the length of the right-of-way and that the slope toward the water is 20 percent. Because of the general rather than site-specific nature of this exposure assessment, only a single overland profile was used. Additional parameters specified in this file are consistent with a clay or sand with little resistance to runoff. The most sensitive hydrological parameters affecting runoff are organic carbon and runoff curve numbers, both of which are directly related to runoff. As with the parameters used in the pesticide file, the parameters used in these files should lead to relatively high but reasonable estimates of pesticide runoff for each soil type.

Using GLEAMS model runs, the estimated concentrations of hexachlorobenzene in water associated with a clopyralid application rate of 0.1 lb a.i./acre in areas with clay and sand soil were calculated. At an annual rainfall rate of 25 inches, the estimated concentration of hexachlorobenzene in water associated with runoff from clay is 0.00526 picograms/L or about $5x10^{-13}$ mg/L. After 20 years of annual applications, the modeled concentration is 0.003169 picograms/L or about $3x10^{-12}$ mg/L. At this rainfall rate (25 inches/year), no runoff from sand is anticipated.

Soil Contamination

Clopyralid does not bind tightly to soil and thus would seem to have a high potential for leaching. While there is little doubt that clopyralid will leach under conditions that favor leaching - i.e., sandy soil, a sparse microbial population, and high rainfall - the potential for leaching or runoff is functionally reduced by the relatively rapid degradation of clopyralid in soil.

Aquatic Species

Clopyralid also has a very low level of toxic risk to aquatic species based on field studies. With application at the rate of 1 lb a.i./acre, the observed contamination in water was about 50 times lower than the lowest reported LC_{50} for aquatic animals (.0021 mg a.i./L). As stated in the literature: "The weight of evidence suggests that no adverse effects in....aquatic animals are plausible using typical or even very conservative worst case exposure assumptions."

For fish, only 96-hour toxicity bioassays are available. The lowest reported LC_{50} for clopyralid was 103 mg a.i./L (Dow Chemical 1980). The macroinvertebrate *Daphnia magna* has a reported LC_{50} of 232 mg a.i./L.

Aquatic Sub-Lethal Effects

Most of the potential sub-lethal effects from exposure to clopyralid have not been investigated in regards to toxicological endpoints that are generally considered important to the overall health and fitness of salmonids. For fish, only 96-hour toxicity bioassays are available.

Clopyralid shows little tendency to bio-accumulate and does not have long-term persistence in food chains and subsequent toxic effects to listed species and prey species. No chronic wildlife dosing of listed species would occur, because the herbicide would degrade relatively rapidly and clopyralid would only be used to treat a site once in a given year.

Plants

Clopyralid is a plant growth regulator and acts a synthetic auxin or hormone, altering the plant's metabolism and growth characteristics, causing a proliferation of abnormal growth that interferes with the transport of nutrients throughout the plant. This, in turn, can result in gross signs of damage and the death of the affected plant. The phytotoxicity of clopyralid is relatively specific to broadleaf plants because clopyralid is rapidly absorbed across leaf surfaces but much less readily absorbed by the roots of plants. For the same reason, clopyralid is much more toxic/effective in post-emergent treatments (i.e., foliar application) rather than pre-emergent treatment (i.e., application to soil).

Dicamba (From NMFS 2002a)

Dicamba is a 3,6-dichloro-2-methoxybenzoic acid, commonly known as Banvel®, Banex®, Trooper®, or it may be sold under a number of other brand names. It is a member of the benzoic acid chemical family. Benzoic acid herbicides are similar in mode of action and structure to the phenoxy herbicides, such as 2,4-D. Like phenoxy herbicides, dicamba mimics a plant growth hormone, affecting cell division (Cox 1994). Dicamba is registered by the EPA as a General Use Pesticide (GUP) and can be applied as a pre- and post-emergent herbicide to leaves or soil for annual or perennial broadleaf control in grain crops and grasslands. It may also be used for brush, vine and bracken control on pastureland. The registered use rate is 0.25 to 8.0 pounds per acre, and the method of application is ground or aerial broadcast, band treatment, basal bark treatment, cut surface treatment, spot treatment or wiper. Leaves and roots absorb Dicamba, and it moves through the plant. Accumulation may occur in leaf tips. (Extonet website at: http://ace.orst.edu/cgi-bin/mfs/01/pips, USDA-Forest Service 2001).

Commercially produced dicamba contains one or more inert ingredients. The percentages and types of inert ingredients depend on the company creating the product. One dicamba product, Dimethylamine salt of dicamba, makes up 48.2% of the product, dimethylamine salts of related acids make up 12% of the product, and the remaining 39.8% of the ingredients are classified as 'Trade Secrets or Non-Hazardous" on the Material Safety Data Sheet (MSDS) for the product (http://www.horizononline.com/MSDS.Sheets/48.txt).

Dicamba is categorized by the EPA as "slightly toxic" to fish, and "practically non-toxic" to aquatic organisms. The LC_{50} (96-hour) for technical dicamba is 135 mg/1 in rainbow trout (Oncorhynchus mykiss) and bluegill sunfish (Lepomis microchirus). The LC_{50} (48-hour) for dicamba is 35 mg/1 in rainbow trout (USDA-Forest Service 2001, Extonet website). It is important to note that although dicamba is "slightly toxic" to fish, there are variations in study results with reference to salmonids. One study found that there were no effects on yearling coho salmon (Oncorhynchus kisutch) at concentrations up to 100 ppm. However, yearling coho were killed by much smaller doses (0.25 ppm) during a seawater challenge test that simulated their migration from river to ocean (Cox 1994). Little is known about sublethal effects on fish.

Dicamba does not bind to soil particles. Microbes appear to be the primary source of chemical breakdown the soil. In sterilized soil, over 90% of applied dicamba was recovered after 4 weeks, suggesting that microbes were responsible for the decomposition (toxnet HSDB website). Sunlight does not appear to play a major role in breakdown, as with many other herbicides. Volatilization of dicamba from soil surfaces may not be an important process, although some volatilization can occur from plant surfaces. The principal soil metabolite appears to be 3,6-dichlorosalicylic acid (Extonet website).

Another study evaluated the relationships between microbial biomass and how the herbicides dicamba and 2,4-D (acid form) degrade. The hypothesis was that size of microbial biomass would be a strong predictor of pesticide degradation capacity. Herbicides were applied to similar soils collected from five different land use types (home lawn, cornfield, upland hardwood forest, wetland forest, and aquifer material). Herbicide residue, microbial biomass indicators carbon and nitrogen, and organic material amount were all positively correlated with the dissipation of dicamba and 2,4-D (Voos 1995).

The half-life of dicamba in soil has been observed to vary from 4 to 555 days with the typical half-life being 1 to 4 weeks (Ahrens 1994), classifying dicamba as "moderately persistent" in soil. However, the rate of biodegradation declines when soil moisture is above 50% or soil is sterile. In humid areas, leaching of dicamba out of the soil takes 3-12 weeks. (toxnet HSDB website).

Dicamba is highly soluble in water and therefore can be highly mobile in the soil depending on soil type and carbon content. It was found that absorption is strongest in soils with lower PH levels (4.0 - 6.0) (Kearney et al. 1975).

Evaluation of soil persistence in different soil types was undertaken by Smith (1984), who studied, under laboratory conditions, (14)C-dicamba at an application rate of 1 kg/ha on clay loam, a heavy clay loam, and a sandy loam at 85 field capacity, at 20 degrees Fahrenheit. The times for 50% of the applied dicamba to be degraded were approximately 16 days in both the clay loam and sandy loam, and about 50 days in the heavy clay.

Donald et al (2001) studied various pesticide residues in prairie wetland areas. The wetland sites were on or near pesticide use areas, with control sites for comparison. The authors found similar detection frequencies and concentrations of dicamba and 2,4-D in all sampling sites, concluding that atmospheric transport via volatilization and/or evapotranspiration with rainfall redistribution were mechanisms responsible for the occurrence of herbicide residues in pristine wetlands.

In water, microbial degradation appears to be the most important dicamba removal process. Scifres et al (1973) found that in nonsterile water, 16% of applied dicamba disappeared after 133 days while only 5% disappeared in sterile water, suggesting the importance of microbial decomposition in water. Photolysis may contribute to the removal of dicamba from water, while aquatic hydrolysis, volatilization, adsorption to sediment, and bioconcentration are not expected to be significant (toxnet HSDB website).

In their Pesticide Fact Sheet (USDA-Forest Service 2001), the US Forest Service recommends special precautions for application of dicamba. Dicamba should generally be applied during active plant growth periods, with spot and basal bark periodic application during dormancy. However, no application should be conducted if snow or water prevents application directly to the ground. Drift control is recommended, as well. Precautions should be taken not to apply dicamba where it may move down into the soil or be washed along the soil surface towards desirable plants (e.g., riparian vegetation). Application should not occur when air currents would carry spray towards desirable plants. Buffer zones should be left between the area to be treated and any desirable plants. Applications should not occur near desirable plants on days when temperatures may exceed 85 degrees F. Aerial applications should be avoided when desirable plants are growing near the areas to be treated. Fine sprays should be avoided. The Forest Service warns that dicamba must be kept out of lakes, streams, ponds, irrigation ditches, and domestic water sources (USDA-Forest Service 2001). BPA has adopted all of these precautions as described in Chapter 2.

Dicamba can be combined with a phenoxyalkanoic acid such as 2,4-D (Weed Master) or a glyphosate (Fallow Master) for weed control on rangeland and non-agricultural land, such as fencerows and roadways. These "two-way" herbicides remain highly soluble and subject to drift. The toxicity to fish of dicamba-containing herbicides may be increased by the products used with them. In 1992, the deaths of 40 fish in Douglas County, Oregon were linked to Weed Master.

Glyphosate

Background

Monsanto's glyphosate formula patent expired about two years ago. Since then, other manufacturers have begun formulating their own glyphosate products, or buying directly from Monsanto and repackaging/reformulating. Glyphosate is used more than any other herbicide in the U.S., as well as in the world, and the market is highly competitive. The main market is for use with "Roundup Ready" crops. These crops have been genetically altered for resistance to glyphosate. Farmers can therefore apply glyphosate to the growing crop for weed control. To gain an edge on this competition, manufacturers will often add an inert ingredient like a surfactant to claim greater efficacy over another's products. Even for those glyphosate products formulated without a surfactant, a surfactant is required for penetrating the cuticle or cambium for most weed and woody vegetation control. Appendix D to the HIP BA clearly shows the relationship between the aquatic toxicities of the various products. For the purpose of this Opinion, the products have been classified as either Type 1 or Type 2. BPA is proposing to use only Type 1 glyphosate products in riparian areas while restricting use of Type 2 glyphosate to upland areas.

Glyphosate is a nonselective herbicide used to control grasses, herbaceous plants including deep-rooted perennial broadleaf weeds, brush and certain woody plants. The registered use rate is 0.3 to 4.0 pounds of active ingredient per acre, and may be applied by aerial spraying; spraying from as truck, backpack or hand-held sprayer; wipe application; frill treatment; or cut stump treatment. It is absorbed by leaves and moves rapidly through the plant, acting to prevent production of an essential amino acid that inhibits plant growth. In some plants, glyphosate is metabolized or broken down, while other plants do not break it down.
Glyphosate itself is an acid, but it is commonly used in salt form (isopropylamine salt). It may also be available in acidic or trimethylsulfonium salt forms. It is generally distributed as a water-soluble concentrate formulated with or without a surfactant. See Appendix D to the HIP BA for a list of products and the type of glyphosate formulation.

Environmental Fate

Glyphosate is classified as moderately persistent in soil, with an estimated average half-life of 47 days. Field half-lives range from 1 - 174 days. It is strongly adsorbed to most soil types, including types with low organic and clay content. Therefore, even though it is also highly soluble in water, it has a low potential for runoff (except as adsorbed to colloidal matter) and leaching. One study estimated that 2% of the applied chemical was lost to runoff.
Microbes appear to be the primary pathway for degradation of glyphosate (biodegradation), while volatilization or photodegradation (photolysis) losses are negligible (Extoxnet website). Under laboratory conditions, glyphosate has been rapidly and completely biodegraded by soil microorganisms under both aerobic and anaerobic conditions. In one study, after 28 days under aerobic conditions, 45-55% of the glyphosate was mineralized in treatments to Ray silt loam soil, Lintonia sandy loam soil, and Drummer silty clay loam soil. Norfolk sandy loam mineralized glyphosate at a much slower, but still significant, rate. Under anaerobic conditions, 37.3% of glyphosate incubated with Ray silt loam soil (toxnet HSDB website). Data indicate half-life values of 1.85 and 2.06 days in Kickapoo sandy loam and Dupo silt loam, respectively (USEPA 1993).
Although glyphosate has a low propensity for leaching, it can enter water bodies by other means, such as overspray, drift, and erosion of contaminated soil. Once in water, glyphosate is strongly adsorbed to any suspended organic or mineral matter and is then broken down primarily by microbes. Sediment adsorption and/or biodegradation represent the major dissipation process in aquatic systems. Half-lives in pond water range from 12 days to 10 weeks (Extoxnet website).

Evidence from studies suggests that glyphosate levels first rise and then fall to a very low, or even undetectable level, in aquatic systems. After glyphosate was sprayed over two streams in

rainy British Columbia, levels in the streams rose dramatically after the first rain event, 27 hours post-application, and fell to undetectable levels 96 hours post-application. The highest glyphosate residues were found in sediments, indicating the strong adsorption characteristics of this herbicide. Residues persisted for the entire 171-day monitoring period. It was found that suspended sediment is not a major mechanism for glyphosate transport in rivers (toxnet HSDB website).
Questions have been raised about the role photodegradation plays once glyphosate is in a water body, particularly when laboratory versus field conditions are involved. The EPA states in the Registration Eligibility Document (1993) that glyphosate is stable to photodegradation in pH 5, 7, and 9 buffered solutions under natural sunlight.

Aquatic Species

Appendix D to the HIP BA lists common commercially produced glyphosate products. This list also shows whether the product has been formulated with or without a surfactant, and the products' relative toxicities. As summarized and reviewed by U.S. EPA (1993b, RED) as well as Smit and Oehme (1992), glyphosate is relatively non-toxic to fish, with 24- to 96-hour LC50 values ranging from approximately 10 mg/L at a relatively acidic pH (approx. 6) to >200 mg/L and at alkaline pH (approx. 10). Much higher LC50 values (>1000 mg/L) have been reported for glyphosate in some species as indicated in Appendix D.

Aquatic Sub-Lethal Effects

Glyphosate is relatively non-toxic to fish. Glyphosate has the most complete information available of any of the nine herbicides (included in Risk Assessments) on effects to listed fish and is least likely to have any sub-lethal effects.

There is a very low potential for the compound to build up in the tissues of aquatic invertebrates or other aquatic organisms (Extoxnet website). In one study of bioaccumulation and persistence, glyphosate was applied to two hardwood communities in the Oregon coastal forest, and none of the 10 coho salmon fingerlings from streams in the forest analyzed had detectable levels of the herbicide or its metabolite aminomethylphosphonic acid, although levels were detectable in stream water for three days and in sediment throughout the 55-day monitoring period (toxnet HSDB website).

In resident freshwater fish, toxicity appears to increase with increasing temperature and pH. As reported in the Handbook of Acute Toxicity of Chemicals to Fish and Aquatic Invertebrates (USFWS 1980), glyphosate was twice as toxic to rainbow trout at 17 degree Celsius than at 7 degrees. With bluegills, toxicity was twice as high at 27 degrees Celsius compared to 17 degrees Celsius. Toxicity was also 2 to 4 times greater to bluegills and rainbow trout at a pH level of 7.5 to 9.5 than at pH 6.5 (pH of 7.0 is considered "neutral water").

Metsulfuron (From NOAA Fisheries 2002)

Metsulfuron Methyl is methyl 2-[[[[(4-methoxy-6-methyl-1,3,5-triazin-2-yl)amino]carbonyl]amino]sulfonyl]benzoate. Escort is the formulation proposed for use in the HIP consultation. Escort is used for the control of brush and certain woody plants, annual and perennial broadleaf weeds, and annual grasses. Metsulfuron methyl is absorbed through the roots and foliage of plants and inhibits cell division in the roots and shoots, so should be applied before or during active growth periods (Information Ventures 1995e).

Metsulfuron methyl is active in the soil and is absorbed from the soil by plants. The rate of absorption varies with the amount of organic matter, soil texture, and pH. Adsorption to clay is low. Metsulfuron methyl remains unchanged in the soil for varying lengths of time, depending on soil texture, pH, and organic matter content, and half-life varies from 1 to 6 weeks (average 30 days) (Ahrens 1994). Soil microorganisms and chemical hydrolysis break down this chemical into nontoxic and nonherbicidal products. Metsulfuron methyl dissolves easily in water, and has the potential to contaminate ground water at very low concentrations. The half-life of metsulfuron methyl in water, when exposed to sunlight, is 1 to 8 days.

Metsulfuron methyl does not bioaccumulate in fish, and is considered by EPA to be "practically nontoxic" to fish (Information Ventures 1995e). The 96 hour LC_{50} for rainbow trout is >150 mg/L, and the 48 hour LC_{50} for daphnia is >12.5 mg/L (Ahrens 1994). Outright mortality is not likely to occur in fish exposed to metsulfuron methyl concentrations less than or equal to1000 mg/L, however, numerous sublethal effects are reported below this concentration. Kreamer (1996) tested the toxicity of metsulfuron methyl to rainbow trout eggs and fry, and found no significant effect of 90-day exposures to concentrations up to 150 mg/L on hatch rate, first day of swim up, survival, abnormalities, or weight of surviving fingerlings. Concentrations greater than 8 mg/L resulted in small but significant decreases in the first day of hatching and length of surviving fry. Muska and Hall (1982) observed no mortality in rainbow trout exposed to metsulfuron methyl at concentrations up to 150 mg/L during a 96-hour exposure period. At 24 hours, 3 fish exposed to 150 mg/L exhibited erratic swimming, rapid breathing and were lying on the bottom of the test container. Two of the fish recovered completely by 48 hours; while the third fish was affected throughout the entire study. Hall (1994) reported no mortality of rainbow trout exposed to 1000 mg/L for 96 hours, while three fish died when exposed to 100 mg/L. Hall (1984) reported sublethal effects such as swimming at the surface, lethargy, erratic swimming, rapid respiration, and laying on the bottom from exposure to 100 mg/L for 96 hours. Hall (1984) reported a No Observable Effect Concentration (NOEC) of 4.5 mg/L based on the first day of hatching and length of fingerlings at 90 days. Aquatic invertebrates do not appear to be sensitive to metsulfuron methyl, with acute LC_{50} values for immobility of 720 mg/L and an NOEC for reproduction of 150 mg/L (SERA 2000).

There appears to be substantial variation in the toxicity of metsulfuron methyl to algal species with reported EC_{50} values ranging from about 0.01 to about 1 mg/L. (SERA 2000). The response of algal species exposed to metsulfuron methyl varies, causing either decreased or increased growth, depending on the species tested and pH. Given probable exposure levels, peak water concentrations of approximately 0.003-0.006 mg/L can be anticipated under worst case conditions, and concentrations on the order of 0.001 mg/L or more could be anticipated under a variety of conditions when rainfall rates equal 25-50 inches per year (SERA 2000). These concentrations are far below the level where lethal or sublethal effects are reported for rainbow trout.

Picloram (From USDI-BLM 2002b)

Off-Site Movement

Off-site movement and picloram concentration in ambient water can be estimated using the Groundwater Loading Effects of Agricultural Management Systems (GLEAMS) model (Knisel et al. 1992). The basic exposure scenario used for the modeling involved picloram being applied along a ten-acre right-of-way that is 50 feet wide and 8,712 feet long. It was also assumed that a body of water runs along the length of the right-of-way and that the slope toward the water is 10 percent. Two types of soils were modeled: clay (high runoff potential) and sand (low runoff potential). Annual rainfall rates ranging from 5 to 250 inches were used to reflect the variability of regional rainfall rates base on statistics from the U.S. Weather Service (1998) for 152 cities in 45 states covering the period from 1961 to 1990. Average annual rainfall ranged from a low of 0.3 inches (lower range for Yuma, Arizona) to 172.2 inches (upper range for Yakutat, Alaska) with an average annual rainfall of 27.69 inches. For both clay and sand, the specific model parameters were selected to yield central estimates of pesticide runoff and percolation.

Based on the result of the GLEAMS modeling, contamination of ground or surface water from clay or sand is not likely in areas with annual rainfall of less than 50 inches. Because of the general rather than site-specific nature of the GLEAMS modeling, however, some loss could occur in arid areas during unusually severe rainfalls, at least at sites with high runoff or leaching potential.

Estimates of the modeled concentrations of picloram in a one meter deep pond at an annual rainfall rate of 250 inches were conducted for clay and sandy soils. The estimates are based on an application rate of 1 lb a.i./acre, a dissipation halftime of 15 days (USDA-Forest Service 1989), and the assumptions that picloram in runoff is transported directly to the pond - i.e., the potential effect of a buffer zone is ignored. Under these conditions, peak levels in water range between about 0.012 mg/L (sand) to 0.025 mg/L (clay). The modeled rates are significantly higher than is proposed for use in the HIP consultation (0.125-0.5 lb a.i./acre), and no application of picloram is authorized within 100 feet of any surface water.

For this risk assessment, the longer-term estimate of the concentration of picloram in ambient water associated with an application rate of 1 lb a.i./acre is taken as 0.025 mg/L. While used as a central estimate, this value is conservative in that it is based on the peak level modeled from GLEAMS - i.e., clay soil at a rainfall rate of 250 inches per year - and is about a factor of 10 higher than the maximum concentration of picloram in ambient water monitored by the USGS.

Soil Contamination

Picloram is extremely mobile in soil. Ismail and Kalihasan (1997) have found that picloram moves rapidly out of the top 5 cm of soil with halftimes of about 4 to 10 days. Somewhat longer halftimes of 13 days to 23 days have been reported by Krzyszowka et al. (1994) who also noted that picloram is degraded more rapidly under anaerobic than aerobic conditions and also degrades more rapidly at lower application rates.

The off-site movement of picloram is governed by the binding of picloram to soil, the persistence of picloram in soil, as well as site-specific topographic, climatic, and hydrological conditions. While generic exposure models such as GLEAMS cannot reflect all of the potential site-specific and situation variability, such models are useful identifying conditions under which off-site transfer through runoff is likely to be most important. In order to encompass a wide range of plausible conditions, three types of soil were modeled using GLEAMS: clay, loam, and sand. Model parameters were selected to yield upper estimates of runoff from clay and central estimates of runoff from loam and sand. The physical conditions of the application of picloram were identical to those used in the ten-acre right-of-way picloram application discussed above under *Off-Site Movement.*

The results of the GLEAMS modeling show that the proportion of the applied amount in runoff following varying amounts of rain one day after application will be highest for clay soils and least for sandy soils. In very sandy and porous soils, percolation into the soil column rather than runoff will predominate even at relatively high rainfall rates. Particularly in areas with a relatively shallow water table, percolation could be associated with the contamination of ambient water. This could impact non-target vegetation. At the other extreme, clay soils are likely to be associated with the highest levels of runoff but relatively little percolation into the soil column. Loamy soil is likely to be associated with less runoff than clay but more runoff than sand. For any given soil type, the proportion of runoff will be directly related to the amount of rainfall.

For this risk assessment, rainfall rates between 1 and 2 inches were used to characterize risk. For clay soil, the proportion of runoff was 0.001 to 0.004% of the application amount. For loam, the proportion of runoff was 0.0003 to 0.002% of the applied amount. For sand, no runoff would be anticipated after rainfalls of 1 to 2 inches. The central estimate for runoff was taken as 0.001% of the applied amount. This is the lower limit for clay following a one-inch rainfall and near the upper limit for loam following a two-inch rainfall. The range was taken from 0.0003% (loam after a one inch rainfall) to 0.004% (clay after a two inch rainfall).

Aquatic Species

The acute and chronic toxicity of picloram to aquatic animals has been assayed in various species of trout and *Daphnia magna*, a small aquatic invertebrate. Acute (96-hour) LC_{50} values for trout range from about 5 mg/L to about 20 mg/L. In *Daphnia*, the reported acute (48-hours) LC_{50} value is 68.3 (63-75) mg/L. Chronic studies using reproductive or developmental parameters for trout and daphnia report no-effect levels of 0.55 mg/L (trout) and 11.8 mg/L (*Daphnia*) and adverse effects levels of 0.88 mg/L (trout) and 18.1 mg/L (*Daphnia*). Thus, it appears that fish, or at least trout, are more sensitive than daphids to both the acute and chronic effects of picloram. Based on standard bioassay in aquatic algae, the lowest effect level for the potassium salt of picloram (EC_{25} for growth inhibition *S. capricornutum*) is 52.6 mg/L with a corresponding No Observable Adverse Effect Level (NOAEL) of 13.1 mg/L. Thus, based on comparable toxicologic endpoints, it appears that trout are more sensitive to the toxicity of picloram than algae or aquatic invertebrates.

Long term water concentrations associated with the normal application of picloram at an application rate of 1 lb a.i./acre are likely to be in the range of 0.01 to 0.06 mg/L in areas with substantial rainfall or as the result of applications in which some initial incidental contamination of water occurs. All of these concentrations are substantially below concentrations that have been shown to impact aquatic plants or animals. At the highest plausible application rate, the upper estimate of the range of longer-term water concentrations would be very close to the concentration of 0.1 mg/L, which causes inhibition of flowering in two aquatic plant species. Even at the highest estimated concentrations, however, no effects would be anticipated in aquatic animals and substantial mortality would not be anticipated in aquatic plants.

Aquatic Sub-Lethal Effects

Most of the potential sub-lethal effects for picloram have not been investigated in regard to toxicological endpoints that are generally considered important to the overall health and fitness of salmonids (e.g., growth, life history, mortality, reproduction, adaptability to environment, migration, disease, predation, population viability). A study of lake trout found that picloram reduced fry survival, weight, and length at the lowest concentration tested, 0.04 ppm (Woodward 1976). In a simulated field study, Mayes (1984) found that concentrations greater than 0.61 mg/l decreased growth. Tests with the early life-stages of rainbow trout showed that picloram concentrations of 0.9 ppm reduced the length and weight of rainbow trout larvae, and concentrations of 2 ppm reduced survival of the larvae (Mayes et al. 1987). Young coho salmon exposed to 5 ppm of Tordon 22K for 6 days suffered “extensive degenerative changes” in the liver and wrinkling of cells in the gills (EPA 1979).

Plants

Picloram is an herbicide and the most likely damage to non-target species will involve terrestrial plants. As is the case with any herbicide, the likelihood of damage to non-target plant species is related directly to the difference between the sensitivity of target species - which dictates the application rate - and the sensitivity of the potential non-target species. Although picloram is more toxic to broadleaf plants than to grains or grasses, direct spray at applications rates between 0.3 and 1.5 lb a.i./acre are like to damage all groups of terrestrial plants, although the most severe damage would probably be apparent in broadleaf plants. With picloram, both broadleaf and non-broadleaf plants could be adversely affected by off-site drift over a relatively narrow band - i.e., about 100 feet. Some sensitive broadleaf species could be affected by off-site drift at a much greater distance.

Sulfometuron Methyl (From USDI-BLM 2002b)

Off-Site Movement

No significant transport of sulfometuron methyl by soil erosion is likely except under conditions where wind erosion of soil could occur, such as under arid conditions in flat sandy or otherwise fine soil with a sparse covering of vegetation. The transport of sulfometuron methyl by wind erosion of soil can lead to overt signs of damage in non-target vegetation according to a reported incident in the literature.

Soil Contamination

The persistence of sulfometuron methyl in soil is highly variable. Dissipation half-times of 10 - 20 days are expected in moist fields. In arid fields, however, dissipation half-times of 100 - 2002 days are expected. Inadvertent contamination of soil with sulfometuron methyl generally will take from a few to several months to recover. Under some extreme conditions, recovery could occur within a matter of weeks; however, under other conditions, recovery might take more than one year and possible several years.

Aquatic Species

The SERA assessment concludes that “there is no evidence that concentrations of sulfometuron methyl in the range of those likely to be found in ambient water after any plausible application program or those that might occur after a spill will cause adverse (lethal) effects in fish or aquatic invertebrates.” The SERA assessment reached this conclusion based on a review of potential lethal effects of the active ingredient on aquatic species, including rainbow trout. The assessment does not address potential sub-lethal effects that might reduce the survival or fecundity of listed fish, or effects of inert ingredients on listed fish. Consequently, potential sub-lethal effects of sulfometuron methyl on listed fish, and potential lethal or sub-lethal effects of Oust on listed fish and other aquatic organisms are largely unknown.

Notwithstanding these limitations, no lethal effects of sulfometuron methyl can be anticipated in aquatic animals from the use of this compound at concentrations from proposed applications. Although sulfometuron methyl does not appear to kill fish or zooplankton (daphnia), the SERA assessment concludes that “under normal and anticipated conditions of use, it is plausible that sulfometuron methyl contamination of water will cause adverse effects (i.e., reduction in growth and biomass) in sensitive aquatic macrophytes and algal species.

Lethal effects in fish are not likely to be observed at a concentration less than or equal to 150 mg/L. The lowest concentration at which mortality was observed in any species of fish is 1.25 mg/L. At this level, mortality was observed in one out of 10 bluegill sunfish. No mortality, however, was observed in 10 bluegills exposed to 12.5 mg/L (Muska and Hall 1980). Based on assays of flathead minnow hatch, larval survival, or larval growth over 30-day exposure periods, no adverse effects would be expected at concentrations up to 1.17 mg sulfometuron methyl/L.

Aquatic Sub-Lethal Effects

No studies are reported in the SERA assessment for sub-lethal effects of Oust for listed fish, but certain sub-lethal effects were reported for daphnia and flathead minnow.

Sulfometuron methyl shows little tendency to bio-accumulate and does not have long-term persistence in food chains and subsequent toxic effects to listed species and prey species. No chronic wildlife dosing of listed species would occur, as the herbicide degrades relatively rapidly.

Plants

Drake (1990) assayed the toxicity of sulfometuron methyl to several non-target as well as target dicots and monocots. At an application rate of 0.01 kg/ha (0.00892 lbs a.i./acre) sulfometuron methyl is highly toxic to seedlings of several broadleaves and grasses, either pre-emergence or post-emergence. Moreover, adverse effects were observed in most plants tested at application rates of 0.001 kg/ha (0.000892 lbs. a.i./acre). This application rate is less than what BPA is proposing to use (0.0014-0.024 lbs a.i./acre). This study predominated in both the dose-response assessment for the effect of sulfometuron methyl on terrestrial plants as well as the risk characterization for the potential ecological effects of sulfometuron methyl applications.

In terms of a hazard identification, it is noteworthy that some target species, such as leafy spurge (Beck et al. 1993) and certain species of pine (Barnes et al. 1990), are much less sensitive than a number of non-target dicots and monocots (Drake 1990) to the effects of sulfometuron methyl. Concern for the sensitivity of non-target plants species is further increased by field reports of substantial and prolonged damage to crops or ornamentals after the application of sulfometuron methyl in both an arid region, presumably due to the transport of soil contaminated with sulfometuron methyl by wind, and in a region with heavy rainfall, presumably due to the wash-off of sulfometuron methyl contaminated soil.

Triclopyr [From Herger-Feinstein SDEIS (USDA-Forest Service 2001), as summarized from the Triclopyr Risk Assessment (SERA 1996)]

(Note: While this section discusses the effects of both triclopyr BEE and TEA formulations, BPA proposes to use only the products containing triclopyr TEA, such as Garlon 3A.)

Soil Contamination

The behavior of triclopyr TEA, triclopyr BEE, and triclopyr formulations has been extensively studied in soil (Deubert and Corte-Real 1986, Johnson and Lavy 1994, Lee et al. 1986, Neary et al. 1988, Newton et al. 1990, Norris et al. 1987, Norris et al. 1987, Pusino et al. 1994, Stephenson et al. 1990). Based on soil column studies, triclopyr BEE is more mobile in sand than triclopyr TEA but neither form of triclopyr is very mobile in loamy soil. Residues of triclopyr were found only in the top 10 cm of loam after 54 days. Most (85%) of triclopyr metabolized to 3,5,6- trichloro-2-pyridinol with some formation (10%) of 2-methoxy-3,5,6-trichloropyridine. In sand, 65% of the applied triclopyr TEA leached through a 40 cm column after 54 days. All triclopyr BEE leached through a 40 cm sand column by day 34 (Lee et al. 1986). For triclopyr

TEA, soil adsorption decreases with decreasing organic matter and increasing pH (Pusino et al. 1994).

Comparable halftimes have been reported for triclopyr in soil after applications of Garlon 3A (10-39 days, ke = 0.07-0.02 days^{-}1) (Deubert and Corte-Real 1986) and Garlon 4 (approximately 14 days in clay or sand, ke = 0.05 day^{-}1) (Stephenson et al. 1990). Soil halftimes of approximately 10 days at 2 or 20 cm (silty loam soil) and approximately 39 days at 60 cm (silty clay loam) have been reported for soil preparations containing triclopyr (salt or formulation not specified) at initial levels of 2.5 ppm (Johnson and Lavy 1994).

Long-term field studies (i.e., those conducted over approximately 1 year) have found very little indication that triclopyr will leach substantially either laterally or vertically in loamy soil (Norris et al. 1987, Newton et al. 1990). These studies have also reported somewhat longer soil halftimes for triclopyr, approximately 60-80 days, than the laboratory studies summarized above.

Some of the apparent discrepancies in soil halftime as well as the apparent similarity of triclopyr salt and triclopyr BEE may be partly due to the use of a simple exponential model for calculating the halftime. This is suggested by the results of Newton et al. (1990), who examined triclopyr soil residues after aerial application of triclopyr triethylamine salt (2.2 and 4.4 kg/ha) or triclopyr BEE (1.65-3.3 kg/ha) to Oregon brushfields on clay loam soils. In this study, soil samples were analyzed at various depths after 37, 79, 153, and 325 days. Both forms of triclopyr tended to stay in the top 15 cm (6 inches) of soil. While Newton et al. (1990) do not present a formal kinetic analysis, the reported soil residue data (Newton et al. 1990) yield similar halftimes for both triclopyr amine (73 and 63 days) and triclopyr BEE (75 and 82 days). At both application rates, the kinetic data on the triclopyr salt fit an exponential decline model (p=O.006 and 0.02). For triclopyr BEE, however, the model gave a very poor fit (p=0.12 and 0.4), and visual inspection of the data suggests two first order processes, an initial rapid decay between day 34 and day 79, followed by a much slower decay.

For this risk assessment, maximum soil residues were taken from levels reported in various field studies and expressed as mg/kg soil (ppm) per lb a.i. applied. As noted in the field studies by both Newton et al. (1990) and Norris et al. (1987) these maximum residues do not necessarily occur and probably will not occur at day 0 (i.e., the day of application). Soil residues will probably increase after application due to wash off or litter fall. In this respect, none of the available field studies may provide estimates of true maximum values. For this reason, the highest levels of both triclopyr salt and triclopyr BEE will be used. For both of these forms, the highest rate is approximately 0.3 mg/kg per Ib a.i. applied (Norris et al. 1987 for triclopyr isopropylamine and Newton et al. 1990 for triclopyr BEE). Both of these levels apply to about the top 6 inches of soil.

The available data on soil persistence suggests that a first order model is appropriate for triclopyr salt, with approximately 80 days as a conservative estimate of a halftime. This would apply to loam or clay soils, with more rapid dissipation being likely in sandy soils. For triclopyr BEE, the reported halftime of approximately 14 days given by Stephenson et al. (1990) for Garlon 4 in both sand and clay seems to be a reasonable approximation for an initial rate of decay. Based on the results of Newton et al. (1990), much lower decay rates over more prolonged periods are plausible.

Aquatic Species

The toxicity of triclopyr to fish and aquatic invertebrates is relatively well characterized. Some aquatic macrophytes may be more sensitive than aquatic animals to triclopyr, but the available data, while sparse, do not suggest that algae are particularly sensitive to triclopyr. There is a major difference in the potential hazards posed by Garlon 3A (TEA) and Garlon 4 to aquatic species. The difference can be attributed almost completely to differences in the inherent toxic potency of triclopyr TEA and triclopyr BEE as well as an apparent antagonism of the toxicity of triclopyr by the TEA components of Garlon 3A.

The exposure assessment used for aquatic organisms was almost the same as the exposure assessment used for terrestrial organisms. For a standing body of water, an initial contamination rate of 11.25 mg/cm/(L*lbs/acre) was used. This yields estimates of 0.7 mg/L for a small pond and 0.05 mg/L for a lake at an application rate of 1 lb/acre. As noted in section 4.2.1.4, these levels also correspond closely to anticipated levels in oversprayed streams. For estimating the effects of longer-term exposure, the estimated concentrations in water were estimated from the rate of 0.001 mg/L per lb a.i./acre.

Wan et al. (1989) conducted the most extensive comparative study on the toxicity of these agents. This publication summarizes a series of static bioassays on several species of salmonids that were conducted over a 4-month period in 1986 and a 2-month period in 1987. The 96-hour LC_{50} values for triclopyr TEA, triclopyr BEE, Garlon 3A, and Garlon 4 are summarized in Table F-3. This table also presents the expected LC_{50} values for Garlon 3A and Garlon 4 based on the concentrations and toxicities of triclopyr TEA and triclopyr BEE, respectively, in these formations. Wan et al. (1989) also present LC_{50} values at 24, 38, 72, and 96 hours. Since no strong time/response relationship is apparent, the shorter-term results are not discussed further.

There are no remarkable differences among species in terms of sensitivity to the various agents covered in this risk assessment. Wan et al. (1989) do not provide confidence intervals on the LC_{50} values; however, given that the acute bioassays were conducted at different times over a prolonged period and the differences in LC_{50} values among species are relatively slight, this lack of information does not represent a significant data gap. Nonetheless, there is a substantial difference between the toxicity of triclopyr TEA and the toxicity of triclopyr BEE, and the difference is reflected in the toxicities of the Garlon formulations. As indicated in Table F-3, triclopyr BEE is more toxic than triclopyr TEA, in terms of acid equivalents, by factors ranging from approximately 10 (rainbow trout, 1-0.1) to 30 (chum salmon, 1-0.03). Because the bioassays were conducted at different times, this range of differences may not be significant; however, the magnitude of the difference is substantial and reasonably consistent across species.

The results of Wan et al (1987) appear to be expressed in terms of the formulation. The expected LC_{50} values for these formulations, given in the fourth column of Table F-3, are simply the reported LC_{50} values for the active agent divided by the proportion of the agent in the formulation (see footnote in Table F-3 for details). Garlon 4 is more toxic than Garlon 3A by a factor of about 200 (150-230). This difference in toxicity is substantially greater than the difference in toxicity between triclopyr BEE and triclopyr TEA. As indicated in the last column of Table F-3, this increased difference appears to be attributable to the less than expected toxicity of Garlon 3A, based on the level of triclopyr TEA in this formulation. The level of triclopyr BEE in Garlon 4 appears to account for practically all of the toxicity of Garlon 4 (i.e., the ratios of observed to predicted LC_{50} values do not vary remarkably from unity for Garlon 4). Although Garlon 4 contains kerosene, the toxicity of kerosene to aquatic species is approximately 100-1,000 fold less than triclopyr BEE LC_{50} values of approximately 200-3,000 mg/L (CHEMBANK 1995)], supporting the observation that the toxicity of Garlon 4 can be completely accounted for by the toxicity of triclopyr BEE.

Table F-3 Acute Toxicity of Triclopyr and Related Compounds to Various Species of Salmonids

Test Compound	Species	A 96-hour LC_{50} Values (mg/L)	B Expected LC_{50} Values (mg/L)	AB (mg/L)
Garlon 3A	coho	463	26	18
	chum	267	21	13
	sockeye	311	21	15
	rainbow	420	21	20
	chinook	275	27	10
Garlon 4	coho	2.1	1.6	1.3
	chum	1.7	0.5	3.4
	sockeye	1.4	0.6	2.3
	rainbow	2.7	1.8	1.5
	chinook	2.7	1.8	1.5
	pink	1.2	0.8	1.5
Triclopyr Acid (not amine salt	coho	9.6	N/A	NA
	chum	7.5		
	sockeye	7.5		
	rainbow	7.5		
	chinook	9.7		
	pink	5.3		
Triclopyr BEE	coho	1.0	13	0.08
	chum	0.3	10	0.03
	sockeye	0.4	10	0.04
	rainbow	1.1	10	0.1
	chinook	1.1	13	0.08
	pink	0.5	7.4	0.06

[a]Source: Wan et al. (1987). All bioassays conducted at 8-14ºC, 10 fish/concentration. Static with aeration. LC_{50} based on measured, rather than, nominal concentrations. Photo-period and lighting conditions not specified.

[b]For Garlon 4, the observed LC_{50} of triclopyr BEE divided by the proportion of Garlon 4, 0.616, which consists of triclopyr BEE. For Garlon 3A, the observed LC_{50} of triclopyr TEA divided by the proportion of Garlon 3A, 0.360, which consists of triclopyr TEA. For triclopyr BEE, the observed LC_{50} of triclopyr TEA divided by the proportion of triclopyr BEE, 0.72, which consists of triclopyr acid.

The Wan et al. (1987) study is supported by more recent flow-through toxicity assays on Garlon 4 with reported LC_{50} values for salmonids of 0.79-1.76 mg/L (Kreutzweiser et al. 1994) and 0.84 mg/L (Johansen and Geen 1990). Kreutzweiser et al. (1994) report a strong time-response relationship between exposure periods of 1-24 hours. This is not inconsistent with the results of Wan et al. (1989) but simply indicates that increasing body burdens occur during the first 24 hours of exposure.

Johansen and Geen (1990) examined the sublethal effects of Garlon 4 on salmonids (rainbow trout) using flow-through systems. At concentrations of 0.32-0.43 mg/L, about a factor of 2 below the 96-hour LC_{50} determined by these investigators, fish were lethargic. At levels of 0.1 mg/L, fish were hypersensitive over 4-day periods of exposure. This is reasonably consistent with the threshold for behavioral changes in rainbow trout for Garlon 4 of 0.6 mg/L (Morgan et al. 1991). The corresponding threshold for behavioral changes to fish exposed to Garlon 3A was 200 mg/L (Morgan et al. 1991), and is consistent with the relative acute lethal potencies of these two agents. The limited acute toxicity data on non-salmonid species suggest that these species are about as sensitive to the various forms of triclopyr as salmonids.

Subchronic toxicity data are available only on the triethylamine salt of triclopyr. At 140 mg/L, approximately 0.25 of the LC_{50} in salmonids, over an exposure period of 28 days, the survival of fathead minnows (embryo-larval stages) was significantly reduced, compared with control animals (Mayesetal. 1984).

For this risk assessment, a level of 0.6 mg/L was taken as a functional NOEL for Garlon 4 exposures. That is, no frank toxic effects should be apparent in fish. Based on the time course data of Kreutzweiser et al. (1994) and the earlier work of Wan (Wan et al. 1987), acute exposures to Garlon 4 at levels of 1 mg/L for 24 hours or 20 mg/L for 1 hour would be associated with substantial mortality.

For Garlon 3A, an acute NOEL of 200 mg/L could be taken based on the threshold for behavioral changes (Morgan et al. 1991) but this value is too close to lethal levels reported by other investigators. A judgmental estimate of 50 mg/L over a 1-day exposure period was used as the estimated NOEL for fish. This is below the lower limit of any reported LC_{50} values. Substantial lethality could be expected in some fish species at concentrations >200 mg/L.

Aquatic Invertebrates

Information regarding the toxicity to aquatic invertebrates of various forms of triclopyr as well as the commercial formulations is presented in the SERA Final Report. The available LC_{50} values, while not as extensive as those for fish, suggest that most invertebrates are somewhat less sensitive than fish to the various forms of triclopyr. Some families of invertebrates (Ephemeroptera, Plecoptera, Trichoptera, Odonata) are much more resistant than fish to Garlon 4 (Kreutzweiser et al. 1992). Given this pattern, and the limited levels of exposure in streams, the dose-response assessment for fish was used to encompass effects on invertebrates. Special considerations, such as the induction of invertebrate drift in streams, are discussed in the risk characterization.

Aquatic Plants

The only available information regarding the toxicity of triclopyr to aquatic algae is the study by Peterson et al. (1994). Assaying toxicity as an inhibition of carbon fixation, these investigators noted no or relatively little inhibition at concentrations of triclopyr TEA of 2.6 mg/L. Data regarding the effects of Garlon formulations on algae were not located in the literature.

One study has been encountered on the effect of Garlon 3A on aquatic macrophytes. This laboratory study was designed to determine the efficacy of Garlon 3A for the control of Eurasian water milfoil, an aquatic macrophyte, and involved levels of 0.25-2.5 mg a.i./L (as Garlon 3A) over time periods of 2-48 hours. Very little effect at any concentration was seen for exposure periods <6 hours. At 0.25 mg/L, effective control was associated with exposure periods of 24 (partially effective) to 72 (very effective) hours (Netherland and Getsinger 1992). These results are substantially below exposure levels associated with toxicity in fish or aquatic invertebrates.

Summary

At plausible levels of acute exposure in standing water and streams, 0.07-0.5 mg/L, Garlon 3A is not likely to have any effect on fish, aquatic invertebrates, and most algae. Some sensitive macrophytes might be affected. Currently, information is available only on Eurasian water milfoil. This species is adversely affected if water concentrations remain above 0.25 mg/L for more than 24 hours. Such concentrations are not plausible in streams but could be maintained in small standing bodies of water.

Adjuvants

BPA developed generic estimated environmental concentrations (GEEC2) for the adjuvants BPA is proposing to use (with the exception of marker dyes). The GENEEC2 output tables are contained in Appendix F-1. The GEEC is calculated using EPA's GENEEC modeling software and simulates an application of herbicide near a water body. The GEEC or EEC (referred to hereon as EEC) is an extreme level that is unlikely to occur during implementation and should be viewed as a worst-case situation. The risk quotient provides a reference from which a possible worst-case situation can be assessed. If the risk quotient is greater than 10, the level of concern is categorized as "Low". If the risk quotient is between one and 10, the level of concern is "Moderate". If the risk quotient is less than one, the level of concern is "High". Table F-4 shows the EECs that were developed. Appendix F-2 shows the worksheet used for assessing levels of concern associated with herbicide applications for aquatic species.

Table F-4 Aquatic Level of Concern Assessment for Adjuvants Proposed for use by BPA

Product	Application Rates lb. or oz. ai/ac (Maximum)	EEC[1] (ppm)	Toxicity 96-hour LC_{50} (mg/L) Rainbow Trout	Safety Factor[2] 1/20 LC_{50} (mg/L)[1]	Risk Quotient[2] (1/20 LC_{50}/EEC) and Level of Concern[1]	Aquatic Level of Concern[2]
Activator 90®	4	0.291	12.7 (Guppy)	0.635	2	Moderate
Agri-Dex®	3	0.218	271	13.550	62	Low
Entry II®	4	0.291	4.2	0.210	<1	High
Hasten®	3	0.218	73.8	3.690	17	Low
LI 700®	3	0.218	17.2	0,860	4	Moderate
R-11®	3	0.218	5.6	0.280	1	Moderate
Super Spread®	2	0.146	53	2.650	18	Low
Syl-Tac®	4	0.291	18	0.900	3	Moderate
Generic POEA	8	0.582	2.1	0.105	<1	Hugh
41-A®	0.5	0.036	1000	50.000	>100	Low
Valid®	1	0.073	10	0.500	7	Moderate

1 Refer to Appendix F-1 for the GENEEC assumptions and worksheets (EEC calculated using EPA's GENEEC2 model http://www.epa.gov/oppefed1/models/water/geneec2_description.htm)

2 Refer to Appendix F-2 for the worksheet used for assessing levels of concern associated with herbicide applications for aquatic species.

Color Markers

The colorants BPA proposes to use are listed in Table 2-4. Due to the lack of any aquatic risk information, an effects analysis could not be undertaken. BPA is proposing to use the identified colorants as follows. For riparian areas, the available markers that are agriculturally registered, food grade, colorants will be used. For upland areas, BPA proposes to use registered non-crop colorants. The amount of colorant tank-mixed during herbicide application is relatively insignificant; however, BPA as stated above, will only use food-grade colorants within riparian areas.

Surfactants

Surfactants have come under intense scrutiny in past few years. There is still relatively minor information relative to aquatic toxicities. BPA is proposing to only use those surfactants where some information has been developed.

In a study (Cabarrus, 2002) completed at Washington State University in conjunction with herbicidal control of Spartina in and around Willapa Bay, Washington, four surfactants were analyzed for toxicity to juvenile rainbow trout using static 96-hour median lethal toxicity testing protocols. The LC_{50}s were 271 mg/L for Agri-Dex, 73.8 mg/L for Hasten, 17.2 mg/L for LI 700, and 5.62 mg/L for R-11.The Monsanto material safety data sheet for Entry

II, composed primarily of ethoxylated tallow amine, reports a 96-hour LC_{50} of 4.2 mg/L (Monsanto, 2000).

Another study (Stocker, et al, 2002) calculated the 96-hour LC_{50} to bluegill sunfish for 19 surfactants. For modified (methylated) seed oils equivalent to Super Spread MSO, the LC_{50} was reported at 53.1 mg/L. For polysiloxane/organo-silicone based surfactants, equivalent to Syl-Tac, the LC_{50} was reported between 18.1 mg/L and 29.7 mg/L. Loveland Industries, manufacturer of Activator 90, reports on their material safety data sheet a 96-hour LC_{50} for the *Guppy* at 12.7 mg/L and a 96-hour no effect level of 5.8 mg/L (Loveland, 2000). Generic POEA (polyoxyethyleneamine and other similar chemical mixtures) is commonly accepted to have 96-hour LC_{50}s of 2.1 mg/L and 8.2 mg/L for coho and rainbow, respectively (refer to Table 4-2 for manufacturers reported LC_{50}s.

Of the surfactants listed above, Activator 90, Agri-Dex, Hasten, LI-700, and R-11 are EPA-registered for aquatic use in California and/or Washington.

Drift Retardants

Drift retardants are used to control (maximize) droplet size during spraying operations. Again, there is little to report on the toxicology of drift retardants. BPA was able to identify two drift retardants that contained relevant information on the manufacturer's material safety data sheet.

Sanitek Products reports a fathead minnow 96-hour LC_{50} of >1000 mg/L for 41-A drift retardant. 41-A is a chemical mixture of 27% polyacrylamide polymer, 3% polysaccharide polymer, and 70% inerts (Sanitek, 1997). Loveland Industries reports a rainbow trout 96-hour LC_{50} of >10 mg/L for Valid drift retardant. Valid is a chemical mixture of lecithin, emulsifiers, and glycols.

Effects to Aquatic Species

Other than illustrated above, there is very little information regarding the lethal effects and even less information on the sublethal characteristics of these particular substances. Information required to address the sublethal endpoints mentioned earlier in this chapter is basically non-existent. BPA has chosen to propose the products that have at least a little information, and what shortcoming that may seem, the information is only important if these substances were to enter water. BPA has performed GENEEC modeling (Appendix F-1) on these substances using extremely assumed scenarios and physical characteristics in developing ECCs and aquatic levels of concern (Table F-4) in order to help make a decision on where and how to use these extremely valuable tools (Tables 2-4 and 2-7). Based on this information, and within the parameters proposed for use, there should be no effects to aquatic species.

B. Direct and Indirect Effects of Herbicide Use

Effects to Listed Fish

No effect from harassment is expected to occur to listed fish from chemical noxious weed control activities. BPA's proposed use of chemicals to control noxious weeds is designed to have no adverse toxic effect on fish. Only ground-based application methods and spot treatment of noxious weeds with herbicides rated low or moderate for aquatic level of concern will be authorized for use within riparian areas (see conservation measures in Section 2.2.8.3 and Tables 2-5, 2-6 and 2-7). Fuel and herbicide transportation, storage, and emergency spill plans will be implemented to reduce the risk of an accidental spill of fuel or chemicals. A catastrophic spill of fuels or chemicals reaching waters with listed species would have the potential for significant adverse effects; however, a low probability is expected for such an occurrence.

Herbicide volatilization and drift are the primary mechanisms of off-target movement of herbicides. Off-target movement can result in unintended injury to desirable plant species, contamination of surface waters, and contamination of ecologically sensitive areas. Volatilization will be minimized with the use of nonvolatile herbicide formulations (2,4-D amines are much less volatile than 2,4-D esters, for example) and avoiding application of herbicides during hot days. Herbicide drift will be minimized with the use of nozzles with larger orifices that produce larger spray droplets, using drift control agents, and spraying during calm conditions. Ground application minimizes drift because spray nozzles can be in close proximity to target species and to the ground.

Application of herbicides according to the EPA label and identified conservation measures is not expected to result in mortality to listed fish. However, there is some uncertainty about the effectiveness of the conservation measures and the amount of chemical expected to reach the water. While the amounts are expected to be very low, we cannot conclude with certainty that the levels of chemicals that will reach streams with listed fish will be zero; therefore there may be some sub-lethal effects. Most of the potential sub-lethal effects from the herbicides and adjuvants proposed for use have not been investigated in regards to toxicological endpoints that are generally considered important to the overall health and fitness of salmonids and other fish that are listed below:

- Direct and indirect mortality at any life history stage.
- An increase or decrease in growth.
- Changes in reproductive behavior.
- A reduction in the number of eggs produced, eggs fertilized, or eggs hatched.
- Developmental abnormalities, including behavioral deficits or physical deformities.
- Reduced ability to osmoregulate or adapt to salinity gradients.
- Reduced ability to tolerate shift in other environmental variables (e.g., temperature or increased stress).
- An increased susceptibility to disease.
- An increased susceptibility to predation.
- Changes in migratory behavior.

The information available on the sub-lethal effects of the proposed herbicides and adjuvants is discussed above for each chemical. The consequences of these sublethal effects may be the loss of physiological or behavioral functions that can adversely affect the survival, reproductive success, or migratory behavior of individual fish. Information on sub-lethal effects of glyphosate (Rodeo) is available for many of the above endpoints, and of those reported, glyphosate appears to have the lowest risk for sub-lethal effects to listed fish.

Effects to Habitat

Conservation measures and requirements for noxious weed control are identified in Section 2.2.8.3 of the HIP BA. Only target-specific ground-based applications of herbicides are proposed within both riparian and upland areas. The implementation of the conservation measures and buffer restrictions listed in Tables 2-5, 2-6 and 2-7 will reduce adverse effects to non-target species during ground-based applications to a very minimum.

Water quality indicators: temperature, sediment, and chemical contamination – Changes in water temperature resulting from herbicide use to control noxious weeds would be negligible to non-existent. Noxious weeds provide little to no shade to streams, and the risk for adverse effects to non-target vegetation is low with backpack or hand operated sprayers. Removal of solid stands of vegetation by chemical treatment may result in short-term, insignificant increases in surface erosion that will diminish as vegetation reoccupies the treated site. No large-scale changes in land cover conversions or stand structure (e.g. timber to grass, shrubs to grass) will result from chemical noxious weed control as proposed in this HIP consultation. Chemical control is expected to result in a low risk of water contamination because of the buffers that will be used along riparian areas and the implementation of the conservation measures for ground based herbicide application within riparian areas and along live waters, as outlined in Section 2.2.8.3. Only aquatic-approved herbicides and surfactants will be used within 15 feet of live waters or on soils over shallow water tables (i.e. supersaturated soils). Implementation of hazardous materials (fuel and herbicide) transportation, storage, and emergency spill plans will result in a low risk of hazardous material contamination (fuels and herbicides) of ground water and surface water.

Habitat access indicators: physical barriers – Chemical control of vegetation would not create physical barriers to anadromous fish.

Habitat element indicators: substrate, large woody debris, pool frequency and quality, off-channel habitat, and refugia – Chemical control of noxious weeds would not affect these habitat element indicators. The herbicides BPA proposes to use would not affect large trees that will provide large woody debris.

Channel condition and dynamics indicators: width/depth ratio, streambank condition, floodplain conductivity – Ground based herbicide application would result in reduction of noxious weeds within riparian areas and along streambanks. No adverse impacts to streambank stability are expected. A reduction of noxious weeds in riparian areas and along streambanks will benefit native plant species and result in improved streambank stability and riparian condition in the long term. There would be no effect to the other indicators.

Flow/hydrology indicators: peak/base flows, drainage network increase – Chemical control of noxious weeds is expected to result in no measurable effect to peak/base flow or water yield of watersheds.

Watershed condition indicators: road density and location, disturbance history, and riparian reserves – No new roads or disturbances will result from the use of chemicals to control noxious weeds. Noxious weed infestations are a threat to overall watershed ecological condition. Long-term beneficial effects from the reduction of noxious weeds encroaching on and invading riparian areas, wetlands, and streams and subsequent increases in desirable vegetation (e.g. native species) will result in improved watershed conditions.

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APPENDIX F-1

GENEEC2 Scenario, Assumptions, and Output Worksheets

The GENEEC scenario in all cases consisted of aerial application, very fine spray mist with 24% drift, zero buffers to the water body on a rainy day. For herbicides, maximum application rates were used for one application per year. For adjuvants, maximum application rates were used for four applications per year, ninety days apart.

For herbicides, chemical half-lives as reported in literature were used. For adjuvants, it was assumed a soil half-life of fourteen days, a water half-life of 28 days, and a solubility of 10,000 ppm.

The output values of the peak GEEC were used. The output values are in expressed in parts per billion and were converted to parts per million for use with the risk quotient calculations.

Documentation of GENEEC and downloadable software can be found at:
http://www.epa.gov/oppefed1/models/water/geneec2_description.htm

DICAMBA

RUN No. 11 FOR dicamba ON water * INPUT VALUES *

RATE (#/AC) ONE(MULT)	No.APPS & INTERVAL		SOIL Koc	SOLUBIL (PPM)	APPL TYPE (%DRIFT)	NO-SPRAY (FT)	INCORP (IN)
8.000(8.000)	1	1	2.2	6500.0	AERL_A(24.1)	.0	.0

FIELD AND STANDARD POND HALFLIFE VALUES (DAYS)

METABOLIC (FIELD)	DAYS UNTIL RAIN/RUNOFF	HYDROLYSIS (POND)	PHOTOLYSIS (POND-EFF)	METABOLIC (POND)	COMBINED (POND)
.00	0	N/A	9.00- 1116.00	18.00	17.71

GENERIC EECs (IN MICROGRAMS/LITER (PPB)) Version 2.0 Aug 1, 2001

PEAK GEEC	MAX 4 DAY AVG GEEC	MAX 21 DAY AVG GEEC	MAX 60 DAY AVG GEEC	MAX 90 DAY AVG GEEC
531.51	516.42	433.92	302.79	238.23

GLYPHOSATE

```
RUN No.   3 FOR glyphosate       ON   water         * INPUT VALUES *
--------------------------------------------------------------------
 RATE (#/AC)   No.APPS &   SOIL  SOLUBIL   APPL TYPE NO-SPRAY INCORP
  ONE(MULT)    INTERVAL    Koc   (PPM )    (%DRIFT)   (FT)     (IN)
--------------------------------------------------------------------
1.500(  1.500)   1   1   24000.011600.0   AERL_A( 24.1)     .0    .0

FIELD AND STANDARD POND HALFLIFE VALUES (DAYS)
--------------------------------------------------------------------
METABOLIC  DAYS UNTIL  HYDROLYSIS   PHOTOLYSIS   METABOLIC  COMBINED
 (FIELD)   RAIN/RUNOFF   (POND)     (POND-EFF)    (POND)     (POND)
--------------------------------------------------------------------
  47.00         0          N/A       .00-     .00    94.00     94.00

GENERIC EECs (IN MICROGRAMS/LITER (PPB))     Version 2.0 Aug 1, 2001
--------------------------------------------------------------------
    PEAK      MAX 4 DAY     MAX 21 DAY    MAX 60 DAY    MAX 90 DAY
    GEEC      AVG GEEC       AVG GEEC      AVG GEEC      AVG GEEC
--------------------------------------------------------------------
    13.95       13.15           8.70          4.34          3.05
```

TRICLOPYR (TEA)

RUN No. 2 FOR triclopyr (TEA) ON water * INPUT VALUES *

RATE (#/AC) ONE(MULT)	No.APPS & INTERVAL		SOIL Koc	SOLUBIL (PPM)	APPL TYPE (%DRIFT)	NO-SPRAY (FT)	INCORP (IN)
2.500(2.500)	1	1	20.0	*******	AERL_A(24.1)	.0	.0

FIELD AND STANDARD POND HALFLIFE VALUES (DAYS)

METABOLIC (FIELD)	DAYS UNTIL RAIN/RUNOFF	HYDROLYSIS (POND)	PHOTOLYSIS (POND-EFF)	METABOLIC (POND)	COMBINED (POND)
46.00	0	N/A	15.00- 1860.00	3.60	3.59

GENERIC EECs (IN MICROGRAMS/LITER (PPB)) Version 2.0 Aug 1, 2001

PEAK GEEC	MAX 4 DAY AVG GEEC	MAX 21 DAY AVG GEEC	MAX 60 DAY AVG GEEC	MAX 90 DAY AVG GEEC
159.39	138.96	68.52	26.83	17.92

Run for Generic 4 Pound Application Rate

Activator 90, Entry II, Syl-Tac

```
RUN No.   4 FOR activator90      ON   water        * INPUT VALUES *
   --------------------------------------------------------------------
    RATE (#/AC)    No.APPS &   SOIL  SOLUBIL   APPL TYPE NO-SPRAY INCORP
     ONE(MULT)     INTERVAL    Koc   (PPM )    (%DRIFT)   (FT)     (IN)
   --------------------------------------------------------------------
  4.000(  4.047)   4  90        .010000.0   AERL_A( 24.1)     .0    .0

   FIELD AND STANDARD POND HALFLIFE VALUES (DAYS)
   --------------------------------------------------------------------
   METABOLIC  DAYS UNTIL  HYDROLYSIS   PHOTOLYSIS   METABOLIC  COMBINED
    (FIELD)   RAIN/RUNOFF   (POND)     (POND-EFF)    (POND)     (POND)
   --------------------------------------------------------------------
     14.00        0           N/A       .00-     .00    28.00     28.00

   GENERIC EECs (IN MICROGRAMS/LITER (PPB))     Version 2.0 Aug 1, 2001
   --------------------------------------------------------------------
      PEAK      MAX 4 DAY     MAX 21 DAY    MAX 60 DAY    MAX 90 DAY
      GEEC      AVG GEEC       AVG GEEC      AVG GEEC      AVG GEEC
   --------------------------------------------------------------------
     290.99      285.88         255.62        200.78        169.35
```

Run for Generic 3 Pound Application Rate

Agri-Dex, Hasten, LI 700, R-11

```
  RUN No.   5 FOR Agri-Dex         ON   water        * INPUT VALUES *
  --------------------------------------------------------------------
   RATE (#/AC)   No.APPS &   SOIL  SOLUBIL   APPL TYPE NO-SPRAY INCORP
    ONE(MULT)    INTERVAL    Koc   (PPM )    (%DRIFT)   (FT)     (IN)
  --------------------------------------------------------------------
 3.000(  3.035)   4  90        .010000.0   AERL_A( 24.1)     .0    .0

  FIELD AND STANDARD POND HALFLIFE VALUES (DAYS)
  --------------------------------------------------------------------
  METABOLIC  DAYS UNTIL  HYDROLYSIS   PHOTOLYSIS   METABOLIC  COMBINED
   (FIELD)   RAIN/RUNOFF   (POND)     (POND-EFF)    (POND)     (POND)
  --------------------------------------------------------------------
    14.00        0           N/A       .00-     .00    28.00     28.00

  GENERIC EECs (IN MICROGRAMS/LITER (PPB))     Version 2.0 Aug 1, 2001
  --------------------------------------------------------------------
      PEAK      MAX 4 DAY     MAX 21 DAY    MAX 60 DAY    MAX 90 DAY
      GEEC      AVG GEEC       AVG GEEC      AVG GEEC      AVG GEEC
  --------------------------------------------------------------------
     218.24      214.41         191.71        150.59        127.01
```

Run for Generic 2 Pound Application Rate

Super Spread MSO

```
RUN No.   6 FOR SuperSpread      ON   water         * INPUT VALUES *
--------------------------------------------------------------------
 RATE (#/AC)   No.APPS &   SOIL  SOLUBIL   APPL TYPE NO-SPRAY INCORP
  ONE(MULT)    INTERVAL    Koc   (PPM )    (%DRIFT)   (FT)     (IN)
--------------------------------------------------------------------
2.000(  2.023)   4  90        .010000.0   AERL_A( 24.1)     .0    .0

FIELD AND STANDARD POND HALFLIFE VALUES (DAYS)
--------------------------------------------------------------------
METABOLIC  DAYS UNTIL  HYDROLYSIS   PHOTOLYSIS   METABOLIC  COMBINED
 (FIELD)   RAIN/RUNOFF   (POND)     (POND-EFF)    (POND)     (POND)
--------------------------------------------------------------------
  14.00        0          N/A       .00-     .00    28.00     28.00

GENERIC EECs (IN MICROGRAMS/LITER (PPB))     Version 2.0 Aug 1, 2001
--------------------------------------------------------------------
    PEAK      MAX 4 DAY     MAX 21 DAY    MAX 60 DAY    MAX 90 DAY
    GEEC      AVG GEEC       AVG GEEC      AVG GEEC      AVG GEEC
--------------------------------------------------------------------
   145.49      142.94        127.81        100.39          84.68
```

Run for Generic 8 Pound Application Rate

Generic POEA

```
RUN No.   7 FOR POEA             ON   water         * INPUT VALUES *
--------------------------------------------------------------------
 RATE (#/AC)   No.APPS &   SOIL  SOLUBIL   APPL TYPE NO-SPRAY INCORP
  ONE(MULT)    INTERVAL    Koc   (PPM )    (%DRIFT)   (FT)     (IN)
--------------------------------------------------------------------
8.000(  8.094)   4  90        .010000.0   AERL_A( 24.1)     .0    .0

FIELD AND STANDARD POND HALFLIFE VALUES (DAYS)
--------------------------------------------------------------------
METABOLIC  DAYS UNTIL  HYDROLYSIS   PHOTOLYSIS   METABOLIC  COMBINED
 (FIELD)   RAIN/RUNOFF   (POND)     (POND-EFF)    (POND)     (POND)
--------------------------------------------------------------------
  14.00        0          N/A       .00-     .00    28.00     28.00

GENERIC EECs (IN MICROGRAMS/LITER (PPB))     Version 2.0 Aug 1, 2001
--------------------------------------------------------------------
   PEAK      MAX 4 DAY     MAX 21 DAY    MAX 60 DAY    MAX 90 DAY
   GEEC      AVG GEEC       AVG GEEC      AVG GEEC      AVG GEEC
--------------------------------------------------------------------
   581.97      571.76        511.23        401.57        338.70
```

Run for Generic 0.5 Pound Application Rate

41-A

```
RUN No.   8 FOR 41A              ON   water         * INPUT VALUES *
--------------------------------------------------------------------
 RATE (#/AC)   No.APPS &   SOIL  SOLUBIL   APPL TYPE NO-SPRAY INCORP
  ONE(MULT)    INTERVAL    Koc   (PPM )    (%DRIFT)   (FT)     (IN)
--------------------------------------------------------------------
.500(   .506)   4  90        .010000.0   AERL_A( 24.1)     .0    .0

FIELD AND STANDARD POND HALFLIFE VALUES (DAYS)
--------------------------------------------------------------------
METABOLIC  DAYS UNTIL  HYDROLYSIS   PHOTOLYSIS   METABOLIC  COMBINED
 (FIELD)   RAIN/RUNOFF   (POND)      (POND-EFF)    (POND)     (POND)
--------------------------------------------------------------------
  14.00        0          N/A        .00-     .00    28.00     28.00

GENERIC EECs (IN MICROGRAMS/LITER (PPB))     Version 2.0 Aug 1, 2001
--------------------------------------------------------------------
    PEAK      MAX 4 DAY     MAX 21 DAY    MAX 60 DAY    MAX 90 DAY
    GEEC      AVG GEEC       AVG GEEC      AVG GEEC      AVG GEEC
--------------------------------------------------------------------
    36.37       35.74          31.95         25.10         21.17
```

Run for Generic 1 Pound Application Rate

Valid

```
RUN No.   9 FOR Valid            ON   water          * INPUT VALUES *
--------------------------------------------------------------------
 RATE (#/AC)   No.APPS &   SOIL  SOLUBIL   APPL TYPE NO-SPRAY INCORP
  ONE(MULT)    INTERVAL    Koc   (PPM )    (%DRIFT)   (FT)     (IN)
--------------------------------------------------------------------
1.000(  1.012)   4  90        .010000.0   AERL_A( 24.1)     .0    .0

FIELD AND STANDARD POND HALFLIFE VALUES (DAYS)
--------------------------------------------------------------------
METABOLIC  DAYS UNTIL  HYDROLYSIS   PHOTOLYSIS   METABOLIC  COMBINED
 (FIELD)   RAIN/RUNOFF   (POND)     (POND-EFF)    (POND)     (POND)
--------------------------------------------------------------------
  14.00        0          N/A       .00-     .00    28.00     28.00

GENERIC EECs (IN MICROGRAMS/LITER (PPB))     Version 2.0 Aug 1, 2001
--------------------------------------------------------------------
    PEAK      MAX 4 DAY     MAX 21 DAY    MAX 60 DAY    MAX 90 DAY
    GEEC      AVG GEEC      AVG GEEC      AVG GEEC      AVG GEEC
--------------------------------------------------------------------
    72.75       71.47         63.90         50.20         42.34
```

APPENDIX F-2

Risk Quotient Worksheet

Worksheet for Assessing Levels of Concern Associated with Herbicide Applications for Aquatic Species

Methodology for Determining Level of Concern	Example using 2,4-D
Maximum application rate (known constant based on label rates)	3 lb ai/ac (pounds active ingredient per acre)
EEC - Estimated Environmental Concentration (from Urban and Cook [1986] table based on direct application to a pond 1 acre-foot in volume) measured in ppb (parts per billion), and converted to ppm (parts per million)	at 3 lb ai/ac, in 1 acre-foot water, the EEC = 1103 ppb or 1.103 ppm
Toxicity - the 96 hour LC50 (a standard test) for a specific aquatic species. The LC50 is the concentration of a toxicant that causes mortality in 50% of the test organisms under a specific set of conditions.	LC50 = 250 mg/L (milligrams per liter), or = 250 ppm (testing conducted with rainbow trout)
Safety Factor - A divisor applied to the toxicity value to establish a concentration below which risk is acceptable (as determined by EPA). For endangered aquatic species, EPA uses 1/20 of the LC50 value.	1/20 of the LC50 = 12.5 ppm (250 ppm x 1/20 = 12.5 ppm)
The EPA has determined that there is a presumption of unacceptable risk to endangered aquatic species if the EEC > 1/20 LC50. Conversely, if the EEC < 1/20 LC50, the application rate used to calculate the EEC should not result in an unacceptable risk to endangered aquatic species.	For the 2,4-D amine, where: EEC = 1.103 ppm at 3 lb ai/ac maximum application rate 1/20 the LC50 = 12.5 ppm EEC is < 1/20 of the LC50
Because of some of the concerns associated with this level of concern (risk) analysis (see Table 4 in the text) and because the EPA does not define a magnitude of risk of endangered species, especially when the EEC < 1/20 LC50, a gradual "level of concern" scale was developed based on how close the EEC value is to the 1/20 LC50. The 1/20 LC50 value is divided by the EEC value and the quotient represents the level of concern for a given herbicide. The level of concern scale is as follows: If the 1/20 LC50) EEC is a quotient of >10, the level of concern is low. If the 1/20 LC50) EEC is a quotient of >1 but #10, the level of concern is moderate. If the 1/20 LC50) EEC is a quotient of #1, the level of concern is high.	For 2,4-D amine: 1/20 the LC50 = 12.5 ppm EEC = 1.103 ppm 12.5 ppm)1.103 ppm = 11 Since the quotient is >10, the level of concern is low.

The level of concern (risk) analysis is based on direct application of the active ingredient of a chemical product to a 1 acre-foot pond. This illustrates an extreme case, only remotely likely to occur during implementation of the proposed action. The risk of a direct application is mitigated in the proposed action by selecting appropriate application techniques (hand application vs aerial spray) and applying buffers adjacent to water, taking into account such factors as chemical volatility, wind speed and direction, temperature, precipitation, and ground slope. While chemical application may occur in association with ponds and lakes, further mitigation of the assessed level of concern (risk) may be realized when treating noxious weeds in association with the numerous rivers and streams within the proposed action area.

Appendix G: Interim Abundance and Productivity Targets

April 4, 2002

Frank L. Cassidy, Jr.
Chairman, Northwest Power Planning Council
851 SW Sixth Avenue, Suite 1100
Portland, OR 97204

Re: Interim Abundance and Productivity Targets for Interior Columbia Basin Salmon and Steelhead Listed under the Endangered Species Act (ESA)

Dear Mr. Cassidy,

As promised in my February 20, 2002 letter to you, enclosed are interim abundance and productivity targets for ESA listed salmon and steelhead in the Interior Columbia Basin. The National Marine Fisheries Service (NMFS) provides these to the Council, and by copy of this letter to the states, tribes and Federal agencies, to provide a preliminary and general sense of the ESA recovery objectives currently under development. These interim targets are only a starting point. NMFS will replace these targets with scientifically more rigorous and comprehensive recovery goals using viability criteria developed through the Interior Columbia Technical Recovery Team (TRT) process that commenced in October, 2001.

NMFS established the Interior Columbia TRT to develop specific population identification, characterization, and viability criteria for Interior Basin salmon and steelhead. The TRT will also characterize the relationship between the populations and their habitat and will provide specific analyses of the factors for decline (or limiting factors) for each population. The TRT will work with local experts, particularly tribal, state and federal biologists, to ensure that the most current and accurate technical information is used in developing their products. The TRT's draft recommendations for delisting criteria should be available by late 2002, with the remaining products completed by late 2003.

The TRT's efforts will provide the technical foundation and context for recovery planning. From this foundation, policy choices about recovery goals and actions can be made and recovery plans can be prepared. NMFS' recovery plan guidance for West Coast Salmon (www.nwfsc.org) refers to the TRT efforts as Phase One, and these policy tasks as Phase Two. One of our critical next steps is to work with the Council, states, tribes and stakeholders to determine how best to implement Phase Two in the Interior Columbia. It is clear that Phase Two must be part of, or at least fully coordinated with, subbasin and watershed planning and Recovery Board efforts already underway.

It is important to note that these interim abundance and productivity targets make no particular assumptions regarding harvest or any other take of listed ESUs. These are intended to represent the number and productivity of naturally-produced spawners that may be needed for recovery, in the context of whatever take or mortality is occurring. NMFS intends that final recovery goals developed in Phase Two will include harvest sufficient to meet our treaty and trust responsibilities and fulfill our mission of sustainable fisheries. These final "broader-sense" recovery goals should provide for healthy populations to meet society's needs.

The enclosure provides the interim abundance and productivity targets and an overview of how they were developed. These abundance and productivity targets for a given spawning aggregation or index area should not be considered in isolation, as they represent the values that, taken together, may be needed for the population to be self-sustaining in its natural ecosystem. It is worth clarifying that these interim targets are not the result of efforts by the Interior Columbia TRT nor the Northwest Fisheries Science Center, although they are based on scientific documents to which our Science Center and co-managers contributed. These are simply NMFS' best early guidance based on existing information.

Sincerely,

Bob Lohn

Cc: CBFWA members
Louise Solliday – OR Governor's Office
Neal Coenen – OR Governor's Office
Curt Smitch – WA Governor's Office
Jim Caswell – Idaho Office of Species Conservation
Deborah Marriott – Lower Columbia River Estuary Partnership
Dennis Rohr – Upper Columbia Fish Recovery Board
Jeff Breckel – Lower Columbia Fish Recovery Board

Enclosure

Enclosure

Interim Abundance and Productivity Targets for Pacific Salmon and Steelhead Listed under the Endangered Species Act in the Interior Columbia Basin

These interim abundance and productivity targets are provided for geographic spawning aggregations of naturally produced spawning adults. They address the portion of each evolutionarily significant unit's (ESU's) historical range below the major mainstem dams that do not provide for fish passage (e.g., Chief Joseph Dam on the upper Columbia, Hells Canyon Dam on the Snake mainstem and Dworshak Dam on the north fork Clearwater River). The potential role of geographic spawning aggregations above these dams in the ESU's viability as a whole will be evaluated through the formal recovery planning process guided by recommendations from the Interior Columbia Technical Recovery Team (Interior TRT).

It is important to note that these interim targets are not in the context of the whole ESUs, rather they are defined for tentative geographic spawning aggregations within the ESUs. The Interior TRT will develop more accurate population definitions to replace these preliminarily defined spawning aggregations. The TRT will also generate alternative delisting scenarios – different combinations of viable salmonid populations that would each provide for the recovery of the ESU as a whole.

Existing Delisting Objectives – Snake River spring/summer chinook, Snake River sockeye, Upper Columbia spring chinook and Upper Columbia steelhead

Recommended recovery objectives have been developed for Snake River spring/summer chinook spawning aggregations, Snake River fall chinook and Snake River sockeye by the Snake River Recovery Team (Bevan et al., 1994). Those recommendations were modified to apply to index stock areas[1] based on recommendations from the IDFG v NMFS Biological Requirements Workgroup (BRWG, 1994) and were incorporated into the 1995 Proposed Snake River Recovery Plan (NMFS, 1995). The targets were further modified based on input from the Idaho Department of Fish and Game and were included in another draft recovery plan for Snake River Salmon (NMFS, 1997). Population definitions and recommended abundance and productivity objectives have also been developed for upper Columbia spring chinook and steelhead ESU spawning aggregations in the Methow, Entiat, and Wenatchee through the QAR (Quantitiative Analytical Report) process (Ford et al., 2001). Ford et al. (2001) did not identify an abundance goal for the Okanogan due to a lack of sufficient historical information. However, the potential

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[1]The index area recovery objectives were developed for use in assessing the status of Snake River spring chinook stocks. Index areas have established time-series of scientific observations (e.g., redd counts), and are generally smaller in scale than geographic spawning aggregations. Objectives for these specific index areas have played a key role in the recent series of Federal Hydropower system Biological Opinions (e.g., NMFS, 2000; see section 1.3.1). Index area recovery objectives are included in Table 1(a).

for naturally spawning aggregations in this area will be evaluated by the Interior TRT. Tables 1(a) and 1(b) summarize those specific recommendations for interim targets for listed chinook and sockeye stocks in the upper Columbia and Snake River basins. Productivity criteria for Snake River sockeye were developed in the 2000 FCRPS BiOp (NMFS, 2000) for a 40-48 year time period, recognizing the time required to institute habitat rehabilitation options and the time lag of response in the sockeye populations. However, to be consistent with the targets provided for the other ESUs, the productivity targets given for Snake River sockeye in Table 1(b) represent only a general biological rule of thumb over a time period of 8 years.

New Delisting Objectives – Interior Columbia Steelhead and Middle Columbia Steelhead ESU
Population definitions, abundance and productivity targets for Snake River and Middle Columbia steelhead have not been formally developed. For these ESUs, geographic spawning aggregations and interim abundance targets are based upon the QAR approach used in the Upper Columbia Biological Requirements Report (Ford et al., 2001), and from: descriptions in the 1990 Subbasin Plans; recommendations from state level stock surveys (e.g., ODFW, 1995; WDFW, 1993; IDFG, 1985); NMFS' Proposed Recovery Plan for Snake River Salmon (NMFS, 1995); the 2000 Biological Opinion on the operation of the Federal Columbia River Power System (FCRPS BiOp) (NMFS, 2000); and Oregon Department of Fish and Wildlife reports regarding conservation assessments (Chilcote, 2001; ODFW, 1995). Table 2 lists possible interim abundance targets and interim productivity objectives for major steelhead spawning aggregations in the Upper Columbia, the Middle Columbia and the Snake River ESUs. The abundance values listed for the Wenatchee, Entiat and Methow subbasins are the levels recommended through the QAR process (Ford et al., 2001). Productivity criteria for Snake River and mid-Columbia steelhead were developed in the 2000 FCRPS BiOp (NMFS, 2000) for a 40-48 year time period, recognizing the time required to institute habitat rehabilitation options and the time lag of response in the steelhead populations. However, to be consistent with the targets provided for the other ESUs, the productivity targets given for Snake River and mid-Columbia steelhead in Table 2 represent only a general biological rule of thumb over a time period of 8 years.

Interim Targets – Description and Discussion of Caveats
Interim Abundance Targets
The enclosed Tables provide interim abundance targets generally representing the geometric mean of spawner escapement over time scales of eight years or approximately two generations. A challenge for co-managers, in the context of these interim abundance targets, is how to measure their progress toward recovery. Uncertainties associated with estimates of abundance and population trends must be considered when determining whether a population's recovery abundance goal has been met. These issues will need to be addressed in formal recovery planning.

*Interim Productivity Objective*s
In the long-term, a viable population will be characterized by a natural replacement rate (population growth rate) that fluctuates due to natural variability around an average of 1.0, but at an abundance high enough to provide a low risk of extinction. In many cases, spawner abundances are currently far below the levels required to minimize longer term risks of

extinction. In those cases, average growth rates for spawner aggregations must exceed a 1:1 replacement rate until viable population abundance levels are achieved. These interim productivity and abundance targets should not be considered in isolation. A replacement rate ≥1 is indicative of a healthy population only if the abundance target has been achieved as well. However, a measure of the growth rate during the rebuilding/recovery phase may be most informative to subbasin planning groups in the near term, as population growth parameters are more reliably quantified than are abundance parameters. The enclosed Tables include recommendations of productivity objectives utilizing the above rules of thumb, as well as recommendations from the FCRPS BiOp (NMFS, 2000), the QAR (Ford et al., 2001), and the Proposed Snake River Recovery Plan (NMFS, 1995).

Interim Spatial Structure and Diversity Objectives

The provided interim abundance and productivity targets are just a start, and do not provide a comprehensive index of healthy populations. Typically, a recovered ESU would have healthy populations representative of all the major life history types, and of all the major ecological and geographic areas within an ESU. In the absence of specific diversity data about populations, conservation of habitat diversity might be used as a reasonable interim proxy. More specifically, the QAR Biological Requirements Report (Ford et al., 2001) developed the following objective for upper Columbia River populations: "In order to be considered completely recovered, spring chinook (and steelhead) populations should be able to utilize properly functioning habitat in multiple spawning streams within each major tributary, with patterns of straying among these areas free from human caused disruptions." Furthermore, the FCRPS BiOp (NMFS 2000) states that "... currently defined populations should be maintained to ensure adequate genetic and life history diversity as well as the spatial distribution of populations within each ESU." NMFS recommends that these approaches be utilized in early Interior Columbia subbasin planning efforts.

Table 1(a). Interim Objectives – Listed Snake River and Upper Columbia Chinook ESUs[2]

Geographic Spawning Aggregations		Interim Abundance Targets [3]		Interim Productivity Objectives
***ESU*/Spawning Aggregation**	**Index Areas**	**Spawning Aggregation**	**Index Areas**	
Upper Col. Spring Chinook ESU				Upper Col. Spring chinook populations are currently well below recovery levels. The geometric mean[4] Natural Replacement Rate (NRR) will therefore need to be greater than 1.0 (QAR recommendations; Ford et al., 2001)
Methow	Methow	2000	2000	
Entiat	Entiat	500	500	
Okanogan		– –[5]		
Wenatchee	Wenatchee	3750	3750	
Snake River Spring/Summer Chinook ESU				"For delisting to be considered, the eight year (approximately two generation) geometric mean cohort replacement rate of a listed species must exceed 1.0 during the eight years immediately prior to delisting. For spring/summer chinook salmon, this goal must be met for 80% of the index areas available for natural cohort replacement rate estimation." (Proposed Snake River Recovery Plan; NMFS, 1995)
Tucannon River		1000		
Grande Ronde River		2000		
	Minam		439	
Imnaha		2500		
	Mainstem		802	
Lower Mainstem tributaries		1000		
Little Salmon River Basin		1800		
Mainstem Salmon small trib's		700		
South Fork Salmon (Sum.)		9200		
	Johnson Cr.		288	

[2] These interim targets are derived from: Bevan et al., 1994; BRWG, 1995; NMFS, 1995; and NMFS, 1997.

[3] Eight year, or approx. 2 generations, geometric mean of annual natural spawners. Abundance targets are also provided for smaller scale "Index Areas".

[4] Using the geometric mean as opposed to the arithmetic mean is a common practice when dealing with data series with inherently high annual variability. In the Columbia basin, the geometric mean has been used as a standard measure in the series of Biological Opinions issued covering the Federal Columbia River Power system (e.g., NMFS, 2000, section 1.3) and in the upper Columbia QAR.

[5] Ford et al. (2001) did not identify an abundance goal for the Okanogan due to a lack of sufficient historical information. However, the potential for naturally spawning aggregations in this area will be evaluated by the Interior TRT.

Table 1(a) *continued*. Interim Objectives – Listed Snake River and Upper Columbia Chinook ESUs

Geographic Spawning Aggregations			Interim Abundance Targets		Interim Productivity Objectives
***ESU*/Spawning Aggregation**		**Index Areas**	**Spawning Aggregation**	**Index Areas**	
Snake River Spring/Summer Chinook ESU (cont.)					*(see above)*
	Middle Fork Salmon River		9300		
		Bear Valley/Elk		911	
		Marsh Cr.		426	
	Mainstem Tributaries (Middle Fk. to Lemhi)		700		
	Lemhi River		2200		
	Pahsimeroi (Sum.)		1300		
	Mainstem Tributaries (Sum.) Lemhi to Redfish Lake Cr.		2000		
	Mainstem Tributaries (Spr.) Lemhi to Yankee Fork		2400		
	Upper East Fork Trib's (Spr.)		700		
	Upper Salmon Basin (Spr.)		5100		

Table 1(b). Interim Objectives – Snake River Fall Chinook and Sockeye ESUs

ESU	**Interim Abundance Targets**[6,7]	**Interim Productivity Objectives**
Snake River Fall Chinook ESU	2500	"For delisting to be considered, the eight year (approximately two generation) geometric mean cohort replacement rate of a listed species must exceed 1.0 during the eight years immediately prior to delisting. For spring/summer chinook salmon, this goal must be met for 80% of the index areas available for natural cohort replacement rate estimation." (Proposed Snake River Recovery Plan; NMFS, 1995)
Snake River Sockeye ESU	1000 spawners in one lake; 500 spawners per year in a second lake.	The Snake River sockeye ESU is currently well below recovery levels. The geometric mean Natural Replacement Rate (NRR) will therefore need to be greater than 1.0. [8]

[6]These interim targets are derived from the Snake River Recovery Team recommendations included in the 1995 Proposed Snake River Recovery Plan (NMFS, 1995).

[7]Eight year, or approx. 2 generations, geometric mean of annual natural spawners in the mainstem Snake River

[8]The 2000 FCRPS BiOp provided a productivity objective for Snake River sockeye, Snake River and Middle Columbia steelhead populations of "a median annual population growth rate (lambda) greater than 1.0 over a 40-48 year period." (NMFS, 2000).

Table 2(a). Interim Objectives – Snake River Steelhead ESU[9]

***ESU*/Spawning Aggregations**	**Interim Abundance Targets**[10]	**Interim Productivity Objectives**
Snake River Steelhead ESU		Snake River ESU steelhead populations are currently well below recovery levels. The geometric mean Natural Replacement Rate (NRR) will therefore need to be greater than 1.0. [8]
Tucannon R.	1300	
Asotin Cr.	400	
Grande Ronde		
Lower Gr. Ronde	2600	
Joseph Cr.	1400	
Middle Fork	2000	
Upper Mainstem	4000	
Imnaha	2700	
Clearwater River		
Mainstem	4900	
South Fork	3400	
Middle Fork	1700	
Selway R.	4900	
Lochsa R.	2800	
Salmon River		
Lower Salmon	1700	
Little Salmon	1400	
South Fork	4000	
Middle Fork	7400	
Upper Salmon	4700	
Lemhi	1600	
Pahsimeroi	800	

[9] These interim targets are derived from: Ford et al., 2001; Chilcote, 2001; NMFS, 1995; ODFW, 1995; WDFW, 1993; and IDFG, 1985.

[10] Eight year, or approx. 2 generations, geometric mean of annual natural spawners.

Table 2(b). Interim Objectives – Upper & Middle Columbia River Steelhead ESUs[11]

ESU/ Spawning Aggregations	Interim Abundance Targets[12]	Interim Productivity Objectives
Upper Columbia Steelhead ESU		
Methow R.	2500	Geometric mean Natural Return Rate (NRR) should be 1.0 or greater over a sufficient number of years to achieve a desired level of statistical power. (QAR recommendations; Ford et al., 2001)
Entiat R.	500	
Okanogan R.	– –[13]	
Wenatchee R	2500	
Middle Columbia Steelhead ESU		
Yakima River		Middle Columbia ESU steelhead populations are currently well below recovery levels. The geometric mean Natural Replacement Rate (NRR) will therefore need to be greater than 1.0.[8]
Satus/Toppenish	2400	
Naches	3400	
Mainstem (Wapato to Roza)	1800	
Mainstem (above Roza)	2900[14]	
Klickitat	3600	
Walla-Walla	2600	
Umatilla	2300	
Deschutes (Below Pelton Dam complex)	6300	
John Day		
North Fork	2700	
Middle Fork	1300	
South Fork	600	
Lower John Day	3200	
Upper John Day	2000	

[11]These interim targets are derived from: Ford et al., 2001; and NMFS, 2000.

[12]Eight year, or approx. 2 generations, geometric mean of annual natural spawners

[13]Ford et al. (2001) did not identify an abundance goal for the Okanogan due to a lack of sufficient historical information. However, the potential for naturally spawning aggregations in this area will be evaluated by the Interior TRT.

[14]NWPPC smolt capacity reduced by 50% to reflect shared production potential with resident form.

Literature Cited and References Used

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Appendix H

Listed Species Life Histories and Current ESU Status

1.1 Steelhead -- Life History

Steelhead can be divided into two basic run types based on their level of sexual maturity at the time they enter fresh water and the duration of the spawning migration (Burgner et al. 1992). The *stream-maturing* type, or summer steelhead, enters fresh water in a sexually immature condition and requires several months in fresh water to mature and spawn. The *ocean-maturing* type, or winter steelhead, enters fresh water with well-developed gonads and spawns shortly thereafter (Barnhart 1986). In basins with both summer and winter steelhead runs, it appears that the summer run occurs where habitat is not fully utilized by the winter run or a seasonal hydrologic barrier, such as a waterfall, separates them. Summer steelhead usually spawn farther upstream than winter steelhead (Withler 1966, Roelofs 1983, Behnke 1992). Coastal streams are dominated by winter steelhead, whereas inland steelhead of the Columbia River Basin are almost exclusively summer steelhead. Winter steelhead may have been excluded from inland areas of the Columbia River Basin by Celilo Falls or by the considerable migration distance from the ocean.

Inland summer steelhead of the Columbia River Basin, especially the Snake River Subbasin, are further divided into groups referred to as either *A-run* or *B-run*. These designations are based on a bimodal migration of adult steelhead at Bonneville Dam (235 km from the mouth of the Columbia River) and differences in age (1- versus 2-ocean) and adult size observed among Snake River steelhead. It is unclear, however, if the life history and body size differences observed upstream are correlated back to the groups forming the bimodal migration observed at Bonneville Dam. Furthermore, the relationship between patterns observed at the dams and the distribution of adults in spawning areas throughout the Snake River Basin is not well understood. A-run steelhead are believed to occur throughout the steelhead-bearing streams of the Snake River Basin and the inland Columbia River; B-run steelhead are thought to be produced only in the Clearwater, Middle Fork Salmon, and South Fork Salmon Rivers (IDFG 1994).

Variations in migration timing exist between the run types. In the Pacific Northwest, summer steelhead enter fresh water between May and October (Busby et al. 1996, Nickelson et al. 1992). During summer and fall, before spawning, they hold in cool, deep pools (Nickelson et al. 1992). They migrate inland toward spawning areas, overwinter in the larger rivers, resume migration to natal streams in early spring, and then spawn (Meehan and Bjornn 1991, Nickelson et al. 1992). Winter steelhead enter fresh water between November and April in the Pacific Northwest (Busby et al. 1996, Nickelson et al. 1992), migrate to spawning areas, and then spawn in late winter or spring.

Unlike Pacific salmon, steelhead are capable of spawning more than once before death. However, it is rare for steelhead to spawn more than twice before dying, and most that do so are females (Nickelson et al. 1992). Steelhead spawn in cool, clear streams with suitable gravel size, depth, and current velocity. Intermittent streams may also be used for spawning (Barnhart 1986, Everest 1973). Steelhead enter streams and arrive at spawning grounds weeks or even months before they spawn and are vulnerable to disturbance and predation during that time.

Depending on water temperature, steelhead eggs may incubate for 1.5 to four months before hatching. Juveniles rear in fresh water from one to four years, and then migrate to the ocean as smolts. Summer rearing takes place primarily in the faster parts of pools, although young-of-the-year are abundant in glides and riffles. Winter rearing occurs more uniformly at lower densities across a wide range of fast and slow habitat types. Some older juveniles move downstream to rear in larger tributaries and mainstem rivers (Nickelson et al. 1992). Productive steelhead habitat is characterized by complexity, primarily in the form of large and small wood.

Winter steelhead generally smolt after two years in fresh water (Busby et al. 1996). Steelhead typically reside in marine waters for two or three years before returning to their natal stream to spawn at four or five years of age. Populations in Oregon and California have higher frequencies of age-1-ocean steelhead than populations to the north, but age-2-ocean steelhead generally remain dominant (Busby et al. 1996). For more information on steelhead life histories see Busby et al. (1996).

1.1.1 Lower Columbia River (LCR) Steelhead ESU – Status

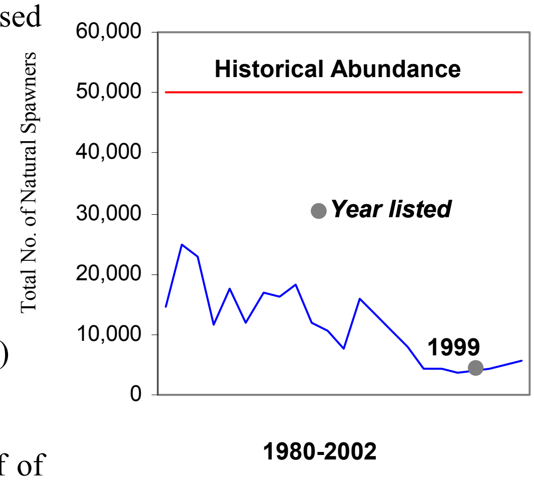
LCR Steelhead ESU Distribution

The Lower Columbia River ESU encompasses all steelhead runs in tributaries between the Cowlitz and Wind Rivers on the Washington side of the Columbia River, and the Willamette and Hood Rivers on the Oregon side. The populations of steelhead that make up the Lower Columbia River ESU are distinguished from adjacent populations by genetic and habitat characteristics. The ESU consists of summer and winter coastal steelhead runs in the tributaries of the Columbia River as it cuts through the Cascades. These populations are genetically distinct from inland populations (east of the Cascades), as well as from steelhead populations in the Upper Willamette River basin and coastal runs north and south of the Columbia River mouth. The following runs are not included in the ESU: the Willamette River above Willamette Falls (Upper Willamette River ESU), the Little and Big White Salmon rivers (Middle Columbia River ESU), and runs based on four imported hatchery stocks (early-spawning winter Chambers Creek/Lower Columbia River mix, summer run Skamania Hatchery stock, winter Eagle Creek NFH stock, and winter run Clackamas River ODFW stock) (NOAA 1998). This area has at least 36 distinct runs (Busby et al.1996), 20 of which were identified in the initial listing petition. In addition, numerous small tributaries have historical reports of fish, but no current abundance data. The major runs in the ESU for which there are estimates of run sizes and trends are the Coweeman River winter runs, North and South Fork Toutle River winter runs, Kalama River winter and summer runs, East Fork Lewis River winter run, Wind River summer runs, Clackamas River winter run, and Sandy River winter run.

LCR Steelhead ESU Population Trends

In the 2003 status review update, NOAA Fisheries modified previous approaches to ESU risk assessment to incorporate Viable Salmonid Population (VSP) criteria (McElhany et al. 2000): abundance, growth rate/productivity, spatial structure, and diversity. The current condition (NOAA Fisheries 2003a) of LCR steelhead is summarized below:

Abundance:
- Most populations show arrested declines or increased abundances in 2000-2002



Productivity:
- Long-term trends in spawners are negative for all populations but one (NF Toutle River)
- Only 1-3 of 9 populations for which there are data have productivity above replacement (depending upon assumptions about the contribution of hatchery fish to natural production)

Spatial Structure:
- 4 historical populations are extinct, and only half of 23 historical populations exhibit natural production

Diversity:
- Declines are predominantly in the summer steelhead life history
- High proportion of hatchery-origin natural spawners

Recent Events:
- Improved hatchery practices in Sandy River

NOAA Fisheries (2003a) reports recent abundance of natural origin spawners for the last 5 years of available data and estimates trends and growth rate. The majority of populations continue to have a long-term trend less than one, indicating the population is in decline. In addition, there is a high probability for most populations that the true trend/growth rate is less than one. When growth rate is estimated, assuming that hatchery origin spawners have a reproductive success equal to that of natural origin spawners, all of the populations have a negative growth rate except the North Fork Toutle winter run, which had very few hatchery origin spawners. The North Fork Toutle population is recovering from the eruption of Mt. St. Helens in 1980 and is still at low abundance (recent mean of 196 spawners). The potential reasons for these declines have been cataloged in previous status reviews and include habitat degradation, deleterious hatchery practices, and climate-driven changes in marine survival.

Based on the updated information, the information contained in previous LCR status reviews, and preliminary analyses by the Willamette Lower Columbia-TRT, NOAA Fisheries (2003a) tentatively identified 23 historical and no currently viable populations. There is some uncertainty about this ESU. Like the previous status report in 1998, NOAA Fisheries could not conclusively identify a single population that is naturally self-sustaining. Over the period of the available time series, most of the populations continue to be in decline and are at relatively low abundance (no population has recent mean abundance greater than 750 spawners). In addition, many of the populations continue to have a substantial fraction of hatchery origin spawners and may not be naturally self sustaining.

1.1.2 Upper Willamette River (UWR) Steelhead ESU -- Status

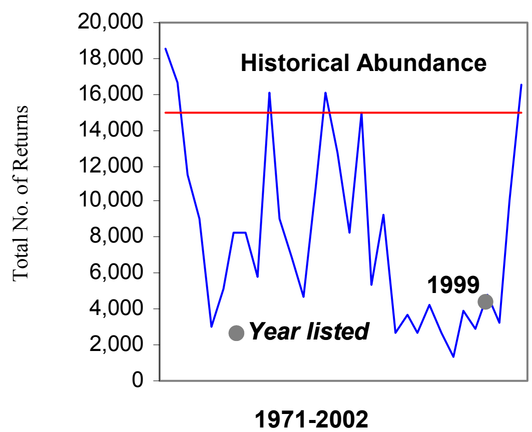
UWR Steelhead ESU Distribution

The UWR steelhead ESU occupies the Willamette River and tributaries upstream of Willamette Falls, extending to and including the Calapooia River. Rivers that contain naturally spawning winter-run steelhead include the Tualatin, Molalla, Santiam, Calapooia, Yamhill, Rickreall, Luckiamute, and Mary's, although the origin and distribution of steelhead in a number of these basins is being debated. Early migrating winter and summer steelhead have been introduced into the Upper Willamette River basin, but those components are not part of the ESU. In general, native steelhead of the Upper Willamette River basin are the late-migrating winter variety entering freshwater primarily in March and April. This atypical run timing appears to be an adaptation for ascending Willamette Falls, which functions as an isolating mechanism for UWR steelhead. Reproductive isolation resulting from the falls may explain the genetic distinction between steelhead from the Upper Willamette River basin and those in the lower river. UWR late-migrating steelhead are ocean maturing fish. Most return at age 4, with a small proportion returning as 5-year-olds (Busby et al.1996).

UWR Steelhead ESU Population Trends

In the 2003 status review update, NOAA Fisheries modified previous approaches to ESU risk assessment to incorporate VSP criteria (McElhany et al. 2000): abundance, growth rate/productivity, spatial structure, and diversity. The current condition (NOAA Fisheries 2003a) of UWR steelhead is summarized below:

Abundance:
- Improved adult returns for 2001 and 2002 encouraging
- Individual populations remain at low abundance



Productivity:
- Long-term trends remain negative for all populations
- Short-term trends are positive, reflecting strong returns in recent years

Spatial Structure:
- ~33% of historical spawning habitat blocked

Diversity:
- Hatchery releases of non-native summer steelhead

Recent Events:
- Discontinuation of “early” winter-run hatchery population

Based on the updated information provided in this report, the information contained in previous Lower Columbia River status reviews, and preliminary analyses by the Willamette/Lower Columbia Technical Recovery Team, NOAA Fisheries (2003a) has tentatively identified the number of 4-5 historical and no currently viable populations. As in the LCR steelhead ESU, NOAA Fisheries (2003a) could not conclusively identify a single population that is naturally self-sustaining. All populations are relatively small, with the recent mean abundance of the entire ESU at less than 6,000. Over the period of the available time series, most of the populations are in decline. The recent elimination of the winter-run hatchery production will allow estimation of the natural productivity of the populations in the future, but the available time series are confounded by the presence of hatchery-origin spawners. On a positive note, the counts all indicate an increase in abundance in 2001, likely at least partly as a result of improved marine conditions.

1.1.3 Middle Columbia River (MCR) Steelhead ESU -- Status

MCR Steelhead ESU Distribution

The Middle Columbia River Steelhead ESU includes steelhead populations in Oregon and Washington drainages upstream of the Hood and Wind River systems to and including the Yakima River. The Snake River is not included in this ESU. Major drainages in this ESU are the Deschutes, John Day, Umatilla, Walla-Walla, Yakima, and Klickitat river systems. Almost all steelhead populations within this ESU are summer-run fish, the exceptions being winter-run components returning to the Klickitat and Fifteen Mile Creek watersheds. A balance between 1- and 2-year-old smolt outmigrants characterizes most of the populations within this ESU. Adults return after 1 or 2 years at sea.

Most fish in this ESU smolt at two years and spend one to two years in salt water before re-entering fresh water, where they may remain up to a year before spawning. Age-2-ocean steelhead dominate the summer steelhead run in the Klickitat River, whereas most other rivers with summer steelhead produce about equal numbers of both age-1- and 2-

ocean fish. Juvenile life stages (i.e., eggs, alevins, fry, and parr) inhabit freshwater/riverine areas throughout the range of the ESU. Parr usually undergo a smolt transformation as 2-year-olds, at which time they migrate to the ocean. Subadults and adults forage in coastal and offshore waters of the North Pacific prior to returning to spawn in their natal streams. A non-anadromous form of *O. mykiss* (redband trout) co-occurs with the anadromous form in this ESU, and juvenile life stages of the two forms can be very difficult to differentiate. In addition, hatchery steelhead are also distributed within the range of this ESU.

Hatchery facilities are located in a number of drainages within the geographic area of this ESU, although there are also subbasins with little or no direct hatchery influence. The John Day River system is a large river basin supporting an estimated five steelhead populations. The John Day system has not been outplanted with hatchery steelhead and out-of-basin straying is believed to be low. The Yakima River system includes four to five populations. Hatchery production in the Yakima system was relatively limited historically and has been phased out since the early 1990s. The Umatilla, the Walla-Walla, and the Deschutes river systems each have ongoing hatchery production programs based on locally derived broodstocks.

Recent estimates of the proportion of natural spawners of hatchery origin range from low (Yakima, Walla Walla, and John Day Rivers) to moderate (Umatilla and Deschutes Rivers). Most hatchery production in this ESU is derived primarily from within-basin stocks. One recent area of concern is the increase in the number of Snake River hatchery (and possibly wild) steelhead that stray and spawn naturally within the Deschutes River subbasin. In addition, one of the main threats cited in NOAA Fisheries' listing decision for this species was the fact that hatchery fish constituted a steadily increasing proportion of the natural escapement in the MCR steelhead ESU (FPC 2000, Brown 1999).

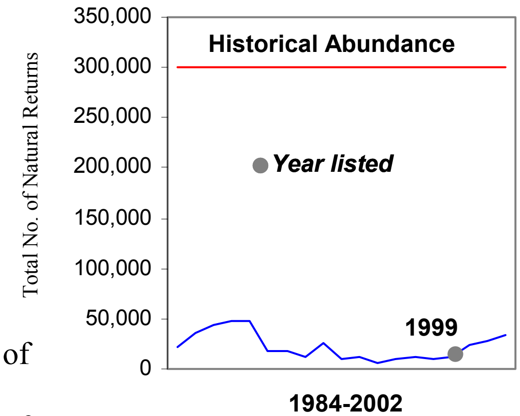
Blockages have prevented access to sizable steelhead production areas in the Deschutes River and the White Salmon River. In the Deschutes River, Pelton Dam blocks access to upstream habitat historically used by steelhead. Conduit Dam, constructed in 1913, blocked access to all but 2-3 miles of habitat suitable for steelhead production in the Big White Salmon River (Rawding 2001). Substantial populations of resident trout exist in both areas.

<u>MCR Steelhead ESU Population Trends</u>

In the 2003 status review update, NOAA Fisheries modified previous approaches to ESU risk assessment to incorporate VSP criteria (McElhany et al. 2000): abundance, growth rate/productivity, spatial structure, and diversity. The current condition (NOAA Fisheries 2003a) of MCR steelhead is summarized below:

<u>Abundance</u>:

- Large increases 2000-2002
- Deschutes, Upper John Day in excess of their interim recovery targets
- Umatilla nearing its interim recovery target
- Yakama (major drainage and historical production center) only 10% of interim recovery targets
- Residents very abundant (> anadromous)



Productivity:
- Long-term trends for most populations declining
- Long-term productivity is below replacement for 66% of populations
- Short-term productivity is above replacement for 42% of populations

Spatial Structure:
- Historical production center (Yakama) still depressed

Diversity:
- Unknown what proportion of natural spawners are out-of-ESU strays

With some exceptions, the recent 5-year average (geometric mean) abundance for natural steelhead within this ESU was higher than levels reported in the 1999 status review. Returns to the Yakima River, the Deschutes River, and to sections of the John Day River system are up substantially in comparison to 1992-1997. Yakima River returns are still substantially below interim target levels and estimated historical return levels, with the majority of spawning occurring in one tributary, Satus Creek (Berg 2001). The recent 5-year geometric mean return of the natural-origin component of the Deschutes River run has exceeded interim recovery target levels (NMFS 2002b). Recent 5-year geometric mean annual returns to the John Day basin are generally below the corresponding mean returns reported in previous status reviews. However, each of the major production areas in the John Day system has shown upward trends since the 1999 return year.

Recent year (1999-2001) redds-per-mile estimates of winter steelhead escapement in Fifteen Mile Creek are also up substantially relative to the annual levels in the early 1990s.

Returns to the Touchet River are lower that the previous 5-year average. Trend or count information for the Klickitat River winter steelhead run are not available but current return levels are believed to be below interim recovery target levels (NOAA Fisheries 2002).

NOAA Fisheries (2003a) reports the median annual rate of change in abundance since 1990 to be +2.5%, with individual trend estimates ranging from -7.9% to +11%. The same basic pattern is also reflected in population growth rate estimates for the production areas. The median short-term (1990-2001) annual population growth rate estimate was 1.045, assuming that hatchery fish on the spawning grounds did not contribute to natural production. Assuming that potential hatchery spawners contributed at the same rate as natural-origin spawners resulted in lower estimates of population growth rates. The median short-term growth rate under the assumption of equal hatchery/natural origin spawner effectiveness was 0.967.

Long-term trend estimates were also calculated using the entire length of the data series available for each production area. The median estimate of long-term trend over the 12 indicator data sets was -2.1% per year (-6.9 to +2.9), with 11 of the 12 being negative. Long-term annual population growth rates were also negative. The median long-term growth rate was 0.98 under the assumption that hatchery spawners do not contribute to production, and 0.97 under the assumption that both hatchery and natural origin spawners contribute equally.

All of the production area trends available for this ESU indicate relatively low escapement levels in the 1990s. For some of the data sets, earlier annual escapements were relatively high compared to the stream miles available for spawning and rearing. In those cases, it is reasonable to assume that subsequent production may have been influenced by density-dependent effects. In addition, there is evidence of large fluctuations in marine survival for Columbia River and Oregon coastal steelhead stocks (Cooney 2000, Chilcote 2001). Spawner return data sets for Mid-Columbia production areas are of relatively short duration. As a result of these considerations, projections based on simple population growth rate trends or on stock recruit relationships derived by fitting recent year spawner return data should be interpreted with caution.

1.1.4 Upper Columbia River (UCR) Steelhead ESU -- Status

UCR Steelhead ESU Distribution

UCR steelhead inhabit the Columbia River reach and its tributaries upstream of the Yakima River. This region includes several rivers that drain the east slopes of the Cascade Mountains and several that originate in Canada (only U.S. populations are included in the ESU). Dry habitat conditions in this area are less conducive to steelhead survival than in many other parts of the Columbia River Basin (Mullan et al. 1992).

Most current natural production occurs in the Wenatchee and Methow River systems, with a smaller run returning to the Entiat River. Very limited spawning also occurs in the Okanagan River Basin. Hatchery returns dominate the estimated escapement in the Wenatchee, Methow and Okanogan River drainages. The effectiveness of hatchery spawners relative to their natural counterparts is a major uncertainty for both populations. Indications are that natural populations in the Wenatchee, Methow, and Entiat Rivers are not self-sustaining.

The life-history patterns of upper Columbia steelhead are complex. Adults return to the Columbia River in the late summer and early fall; most migrate relatively quickly up the

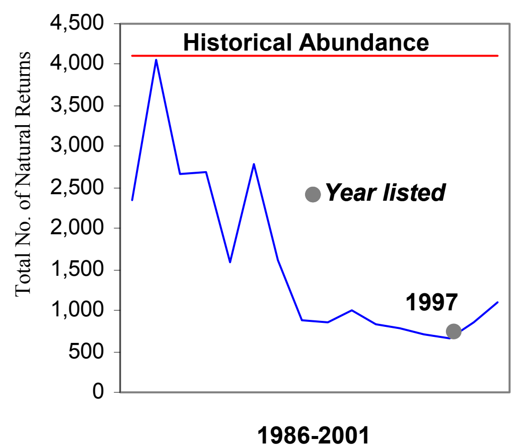
mainstem to their natal tributaries. A portion of the returning run over winters in the mainstem reservoirs, passing over the upper mid-Columbia dams in April and May of the following year. Spawning occurs in the late spring of the calendar year following entry into the river. Juvenile steelhead spend 1 to 7 years rearing in freshwater before migrating to the ocean. Smolt outmigrations are predominately age 2 and age 3 juveniles. Most adult steelhead return after 1 or 2 years at sea, starting the cycle again.
Harvest rates on upper river steelhead have been cut back substantially from historical levels. Direct commercial harvest of steelhead in non-Indian fisheries was eliminated by legislation in the early 1970s. Incidental impacts in fisheries directed at other species continued in the lower river, but at substantially reduced levels. In the 1970s and early 1980s, recreational fishery impacts in the upper Columbia escalated to very high levels in response to increasing returns augmented by substantial increases in hatchery production. In 1985, steelhead recreational fisheries in this region (and in other Washington tributaries) were changed to mandate release of wild fish. Treaty harvest of summer run steelhead (including returns to the upper Columbia) occurs mainly in mainstem fisheries directed at up-river bright fall chinook.

<u>UCR Steelhead ESU Population Trends</u>

In the 2003 status review update, NOAA Fisheries modified previous approaches to ESU risk assessment to incorporate VSP criteria (McElhany et al. 2000): abundance, growth rate/productivity, spatial structure, and diversity. The current condition (NOAA Fisheries 2003a) of UCR steelhead is summarized below:

<u>Abundance</u>:

- Improved abundances of natural returns in 2001-2002
- Current natural abundances 14-30% of interim recovery targets
- Abundant resident populations



<u>Productivity</u>:

- Recent population trends show 3-6% increase
- Long-term trends remain highly negative
- Recent declines in the proportion of natural returns

<u>Spatial Structure</u>:

- Population fragmentation

<u>Diversity</u>:

- Declines in anadromous life-history form
- Hatchery component dominates adult returns (~90%)
- Homogenization of anadromous stocks

Returns of both hatchery and naturally produced steelhead to the upper Columbia have increased in recent years. Priest Rapids Dam is below upper Columbia steelhead production areas. The average 1997-2001 return counted through the Priest Rapids fish ladder was approximately 12,900 steelhead. The average for the previous 5 years (1992-1996) was 7,800 fish.

Total returns to the upper Columbia continue to be predominately hatchery-origin fish. The percentage of the run over Priest Rapids of natural origin increased to over 25% in the 1980s, and then dropped to less than 10% by the mid-1990s. The median percent wild for 1997-2001 was 17%.

Abundance estimates of returning naturally produced upper Columbia steelhead have been based on extrapolations from mainstem dam counts and associated sampling information (e.g., hatchery/wild fraction, age composition). The natural component of the annual steelhead run over Priest Rapids increased from an average of 1,040 (1992-1996) to 2,200 (1997-2001).

The estimate of the combined natural steelhead return to the Wenatchee and Entiat Rivers increased to a geometric mean of approximately 900 for the 1996-2001 period. The average percentage natural dropped from 35% to 29% for the recent 5-year period. In terms of natural production, recent production levels remain well below the interim recovery levels developed for these populations.

The Methow steelhead population is the primary natural production area above Wells Dam. The 1997-2001 geometric mean of natural returns over Wells Dam was 358, lower than the geometric mean return of the prior status review. The most recent return reported in the data series, 1,380 naturally produced steelhead in 2001, was the highest single annual return in the 25-year (1976-2001) data series. Hatchery returns continue to dominate the run over Wells Dam. The average percent of wild origin dropped to 9% for 1996-2001 compared to 19% for the period prior to the previous status review. The median run (almost all natural origin) from 1933-1954 was approximately 2,300.

Natural returns have increased in recent years for both the Wenatchee/Entiat and Methow/Okanogan stock groupings. Population growth rates are substantially influenced by assumptions regarding the relative effectiveness of hatchery spawners. However, the relative contribution of returning steelhead of hatchery origin to natural spawning is not clearly understood. There may be timing and spatial differences in the distribution of hatchery and wild origin spawners that affect production of juveniles. Eggs and subsequent juveniles, from natural spawning, involving hatchery-origin fish may survival at a differential rate relative to spawning of natural origin adults.

NOAA Fisheries (2003a) used two sets of assumptions in estimating population growth rates, and generating return-per-spawner series for upper Columbia steelhead data sets. These assumptions represented the extremes in the range of possible relative hatchery effectiveness values, relative hatchery effectiveness equal to 1 or 0 with respect to fish of natural origin. Under the assumption that hatchery effectiveness is 0, naturally produced fish returning in a year are the progeny of the natural returns one brood cycle earlier. Under the assumption that hatchery effectiveness is 1.0, natural steelhead returning in any given year are assumed to be the product of total (hatchery plus natural) spawners.

Both short-term and long-term population growth rate estimates are positive under the assumption that hatchery fish have not contributed to natural production in recent years. Population growth rate estimates under the assumption that hatchery fish contributed at the same level as wild fish to natural production are substantially lower—under this scenario natural production is consistently and substantially below the total number (hatchery plus natural origin) of spawners in any given year.

According to NOAA Fisheries (2003a), return-per-spawner patterns for the two steelhead production areas are also substantially influenced by assumptions regarding the relative effectiveness of hatchery origin spawners. Under the assumption that hatchery and wild spawners are both contributing to the subsequent generation of natural returns, return-per-spawner levels have been consistently below 1.0 since 1976. Under this scenario natural production would be expected to decline rapidly in the absence of hatchery spawners. Under the assumption that hatchery fish returning to the upper Columbia do not contribute to natural production, return-per-spawner levels were above one until the late 1980s. Return-per-spawner estimates subsequently dropped below replacement (1.0) and remained low until the most recent brood year with measured returns—1996.

The actual contribution of hatchery returns to natural spawning remains a key uncertainty for UCR steelhead. This information need is in addition to any considerations for long-term genetic impacts of high hatchery contributions to natural spawning.

1.1.5 Snake River Basin (SR) Steelhead ESU -- Status

SR Steelhead ESU Distribution

The Snake River historically supported more than 55 percent of total natural-origin production of steelhead in the Columbia River Basin. It now has approximately 63 percent of the basin's natural production potential (Mealy 1997). The Snake River steelhead ESU is distributed throughout the Snake River drainage system, including tributaries in southwest Washington, eastern Oregon and north/central Idaho (NMFS 1997). Snake River steelhead migrate a substantial distance from the ocean (up to 1,500 km) and use high elevation tributaries (typically 1,000-2,000 m above sea level) for spawning and juvenile rearing. Snake River steelhead occupy habitat that is considerably warmer and drier (on an annual basis) than other steelhead ESUs. Snake River basin steelhead are generally classified as summer run, based on their adult run timing patterns. Summer steelhead enter the Columbia River from late June to October. After holding over the winter, summer steelhead spawn during the following spring (March to May). Managers classify up-river summer steelhead runs into to groups based primarily on ocean age and adult size upon return to the Columbia River. A-run steelhead are predominately age-1 ocean fish while B-run steelhead are larger, predominated by age-2 ocean fish.

With one exception (the Tucannon River production area), the tributary habitat used by Snake River steelhead ESU is above Lower Granite Dam. Major groupings of populations and/or subpopulations can be found in 1) the Grande Ronde River system; 2) the Imnaha River drainage; 3) the Clearwater River drainages; 4) the South Fork Salmon River; 5) the smaller mainstem tributaries before the confluence of the mainstem; 6) the Middle Fork salmon production areas, 7) the Lemhi and Pahsimeroi valley production areas and 8) upper Salmon River tributaries.

A-run populations are found in the tributaries to the lower Clearwater River, the upper Salmon River and its tributaries, the lower Salmon River and its tributaries, the Grand Ronde River, Imnaha River, and possibly the Snake River's mainstem tributaries below Hells Canyon Dam. B-run steelhead occupy four major subbasins, including two on the Clearwater River (Lochsa and Selway) and two on the Salmon River (Middle Fork and South Fork); areas that are for the most part not occupied by A-run steelhead. Some natural B-run steelhead are also produced in parts of the mainstem Clearwater and its major tributaries. There are alternative escapement objectives of 10,000 (Columbia River Fisheries Management Plan) and 31,400 (Idaho) for B-run steelhead. B-run steelhead, therefore, represent at least 1/3 and as much as 3/5 of the production capacity of the ESU.

B-run steelhead are distinguished from the A-run component by their unique life history characteristics. B-run steelhead were traditionally distinguished as larger fish with a later run timing. The recent review by the *U.S. v. Oregon* Technical Advisory Committee (TAC), a group that monitors adult salmon and steelhead escapement in the Snake River Basin, indicated that different populations of steelhead do have different size structures, with populations dominated by larger fish (i.e., greater than 77.5 cm) occurring in the traditionally defined B-run basins (TAC 1999). Larger fish occur in other populations throughout the basin, but at much lower rates. Evidence suggests that fish returning to the Middle Fork Salmon River and Little Salmon River have a more equal distribution of large and small fish. B-run steelhead also are generally older. A-run steelhead are predominately 1-ocean fish, whereas most B-run steelhead generally spend 2 or more years in the ocean before spawning. The differences in ocean age are primarily responsible for the differences in the size of A- and B-run steelhead. However, B-run steelhead are also thought to be larger at any given age than A-run fish. This may be due, at least in part, to the fact that B-run steelhead leave the ocean later in the year than A-run steelhead and thus have an extra month or more of ocean residence when growth rates are thought to be greatest.

Historically, a distinctly bimodal pattern of freshwater entry could be used to distinguish A-run and B-run fish. A-run steelhead were presumed to cross Bonneville Dam from June to late August, whereas B-run steelhead entered from late August to October. The *U.S. v. Oregon* TAC reviewed the available information on timing and confirmed that most large fish still have a later timing at Bonneville; 70 percent of the larger fish crossed the dam after August 26, the traditional cutoff date for separating A- and B-run fish (TAC

1999). However, the timing of the early part of the A-run has shifted somewhat later, thereby reducing the distinction that was so apparent in the 1960s and 1970s. The timing of the larger, natural-origin, B-run fish has not changed.

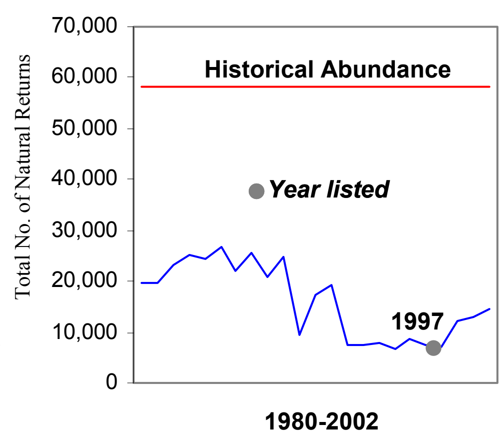
No recent genetic data are available for B-run steelhead populations in the South and Middle Forks of the Salmon River. The Dworshak National Fish Hatchery (NFH) stock and natural populations in the Selway and Lochsa Rivers are, thus far, the most genetically distinct populations of steelhead in the Snake River Basin (Waples et al. 1993). In addition, the Selway and Lochsa River populations from the Middle Fork Clearwater River appear to be very similar to each other genetically, and naturally produced rainbow trout from the North Fork Clearwater River (above Dworshak Reservoir) clearly show an ancestral genetic similarity to Dworshak NFH steelhead. The existing genetic data, the restricted geographic distribution of B-run steelhead in the Snake (Columbia) River Basin, and the unique life history attributes of these fish (i.e., larger, older adults with a later distribution of run timing compared to A-run steelhead in other portions of the Columbia River Basin) clearly support the conservation of B-run steelhead as a biologically significant component of the Snake River ESU.

SR Steelhead ESU Population Trends

In the 2003 status review update, NOAA Fisheries modified previous approaches to ESU risk assessment to incorporate VSP criteria (McElhany et al. 2000): abundance, growth rate/productivity, spatial structure, and diversity. The current condition (NOAA Fisheries 2003a) of SR steelhead is summarized below:

Abundance:

- Uncertainty given paucity of data for adult spawners
- Dam counts are currently 28% of the interim recovery target for the Snake River Basin (52,000 natural spawners)
- Joseph Creek exceeds interim recovery target



Productivity:

- Mixed long- and short-term trends in abundance and productivity

Spatial Structure:

- Populations remain in 6 major geographic areas

Diversity:

- B-run steelhead particularly depressed
- Displacement of natural fish by hatchery fish (declining proportion of natural-origin spawners)
- Homogenization of hatchery stocks within basins, and some stocks exhibiting high stray rates

Recent Events:

- Hatchery reform with increased use of local broodstock, and hatchery releases away from areas of natural production

Although direct historical estimates of production from the Snake basin are not available, the basin is believed to have supported more than half of the total steelhead production from the Columbia basin (Mallet 1974). There are some historical estimates of returns to portions of the drainage. Lewiston Dam, constructed on the lower Clearwater, began operation in 1927. Counts of steelhead passing through the adult fish ladder at the dam reached 40-60,000 in the early 1960s (Cichosz et al. 2001). Based on relative drainage areas, the Salmon River basin likely supported substantial production as well. In the early 1960s, returns to the Grande Ronde River and the Imnaha River may have exceeded 15,000 and 4,000 steelhead per year, respectively (ODFW 1991). Extrapolations from tag/recapture data indicate that the natural steelhead return to the Tucannon River may have exceeded 3,000 adults in the mid-1950s (WDF 1993).

With a few exceptions, more recent annual estimates of steelhead returns to specific production areas within the Snake River are not available. Annual return estimates are limited to counts of the aggregate return over Lower Granite Dam. Returns to Lower Granite remained at relatively low levels through the 1990s. The 2001 run size at Lower Granite Dam was substantially higher relative to the 1990s. Annual estimates of returns are available for the Tucannon River, sections of the Grande Ronde River system and the Imnaha River. The recent geometric mean abundance was down for the Tucannon relative to NOAA Fisheries' 1998 status review. Returns to the other areas were generally higher relative to the early 1990s (NOAA Fisheries 2003a).

Updated analyses of parr density survey results through 1999 by the Idaho Department of Fish and Game (IDFG) conclude that "generational parr density trends, which are analogous to spawner to spawner survivorship, indicate that Idaho spring-summer chinook and steelhead with and without hatchery influence failed to meet replacement for most generations completed since 1985 (IDFG 2002). These data, however, do not reflect the influence of increased returns in 2001 and 2002.

According to NOAA Fisheries (2003a), the median long-term population growth rate estimate to be 0.998, assuming that natural returns are produced only from natural origin spawners, and 0.733 if both hatchery and wild potential spawners are assumed to have contributed to production. Short-term estimates are higher, 1.013, assuming a hatchery effectiveness of 0, and 0.753, assuming hatchery and wild fish contribute to natural production in proportion to their numbers.

1.2 Chinook -- Life History

The chinook salmon is the largest of the Pacific salmon. The species' distribution historically ranged from the Ventura River in California to Point Hope, Alaska, in North

America, and in northeastern Asia from Hokkaido, Japan, to the Anadyr River in Russia (Healey 1991). Additionally, chinook salmon have been reported in the Mackenzie River area of northern Canada (McPhail and Lindsey 1970). Of the Pacific salmon, chinook salmon exhibit the most diverse and complex life history strategies. Healey (1986) described 16 age categories for chinook salmon, combinations of seven total ages with three possible freshwater ages. This level of complexity is roughly comparable to that seen in sockeye salmon (*O. nerka*), although the latter species has a more extended freshwater residence period and uses different freshwater habitats (Miller and Brannon 1982, Burgner 1991). Gilbert (1912) initially described two generalized freshwater life-history types: "stream-type" chinook salmon, which reside in freshwater for a year or more following emergence, and "ocean-type" chinook salmon, which migrate to the ocean within their first year. Healey (1983, 1991) has promoted the use of broader definitions for ocean-type and stream-type to describe two distinct races of chinook salmon. Healey's approach incorporates life-history traits, geographic distribution, and genetic differentiation and provides a valuable frame of reference for comparisons of chinook salmon populations.

The generalized life history of Pacific salmon involves incubation, hatching, and emergence in freshwater; migration to the ocean; and the subsequent initiation of maturation and return to freshwater for completion of maturation and spawning. The juvenile rearing period in freshwater can be minimal or extended. Additionally, some male chinook salmon mature in freshwater, thereby not emigrating to the ocean. The timing and duration of each of these stages is related to genetic and environmental determinants and their interactions to varying degrees. Although salmon exhibit a high degree of variability in life-history traits, there is considerable debate regarding the degree to which this variability is shaped by local adaptation or results from the general plasticity of the salmonid genome (Ricker 1972, Healey 1991, Taylor 1991). More detailed descriptions of the key features of chinook salmon life history can be found in Myers et al. (1998) and Healey (1991).

Chinook salmon in the Lower Columbia River and Upper Willamette River ESUs (see discussions below) exhibit both "ocean type" and "stream type" life histories. Populations tend to mature at ages 3 and 4. Juvenile life stages (i.e., eggs, alevins, fry, and parr) inhabit freshwater/riverine areas throughout the range of the ESU. Parr undergo a smolt transformation as subyearlings or yearlings in the spring at which time they migrate to the ocean. Subadults and adults forage in coastal and offshore waters of the North Pacific Ocean prior to returning to spawn in their natal streams. Adult spring-run chinook salmon typically return to fresh water in April and May and spawn in August and September, while fall-run fish begin to return in August and spawn from late September through January.

1.2.1 Lower Columbia River (LCR) Chinook ESU -- Status

LCR Chinook ESU Distribution

The LCR chinook ESU exhibits three major life history types: fall run ("tules"), late fall run ("brights"), and spring run. The ESU spans three ecological zones: Coastal (rain driven hydrograph), Western Cascade (snow or glacial driven hydrograph), and Gorge (transiting to drier interior Columbia ecological zones). This ESU includes all native populations from the mouth of the Columbia River to the crest of the Cascade Range, excluding populations above Willamette Falls (Upper Willamette ESU). The former location of Celilo Falls (drowned by The Dalles reservoir in 1960) is the eastern boundary for this ESU. Stream-type, spring-run chinook salmon found in the Klickitat River or the introduced Carson spring-chinook salmon strain are not included in this ESU.

Spring-run chinook salmon in the Sandy River have been influenced by spring-run chinook salmon introduced from the Willamette River ESU. However, analyses suggest that considerable genetic resources still reside in the existing population (Myers et al. 1998).

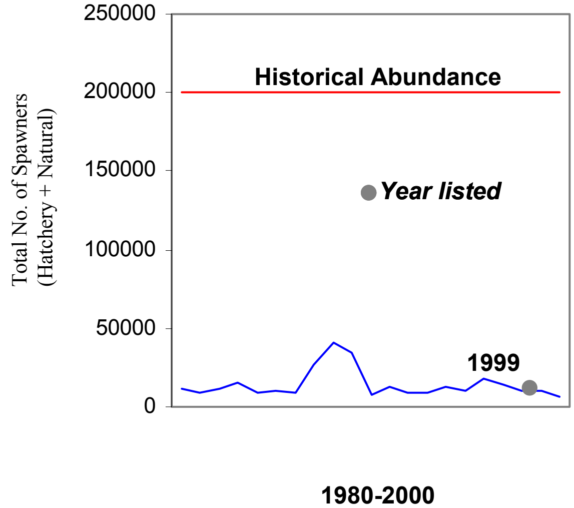
The fall chinook populations in the LCR chinook salmon ESU are currently dominated by large-scale hatchery production, relatively high harvest and extensive habitat degradation. Most fall-run fish ESU emigrate to the marine environment as sub-yearlings (Reimers and Loeffel 1967, Howell et al. 1985, WDF et al. 1993). Modifications in the river environment have altered the duration of freshwater residence. Coded wire tag recoveries from Lower Columbia River ESU fish suggest a northerly migration route in the ocean, but the fish contribute more to fisheries off British Columbia and Washington than to the Alaskan fishery. Tule fall chinook salmon return at adult ages 3 and 4, "bright" fall chinook salmon return at ages 4, 5, and 6. Tule fall chinook salmon from the LCR chinook salmon ESU spawn in the Ives Island area along the Washington shoreline approximately two miles below Bonneville Dam since 1999.

LCR Chinook ESU Population Trends

In the 2003 status review update, NOAA Fisheries modified previous approaches to ESU risk assessment to incorporate VSP criteria (McElhany et al. 2000): abundance, growth rate/productivity, spatial structure, and diversity. The current condition (NOAA Fisheries 2003a) of LCR chinook is summarized below:

Abundance:

- Estimates of natural spawning uncertain, with ~ 70% hatchery fraction and only 1-2% marking of hatchery fish.
- Population abundances show variable response to recent favorable ocean conditions



Productivity:
- For all populations except for one, long-term productivity below replacement (growth rate < 1)
- ~63% of the populations exhibit short-term (5-year) productivity below replacement

Spatial Structure:
- ~22 of 31 historic populations extant

Diversity:
- Most of extirpated populations are spring-run
- Few remaining spring-run populations
- Artificial propagation is homogenizing spring and fall life histories
- Introgression of hatchery Rogue River brights

According to NOAA Fisheries (2003a), the abundances of natural origin LCR chinook spawners range from completely extirpated for most of the spring run populations to over 6,500 for the Lewis River bright population. The majority of the fall run tule populations have a substantial fraction of hatchery origin spawners in the spawning areas and are hypothesized to be sustained largely by hatchery production. Exceptions are the Coweeman and the Sandy fall run populations which have few hatchery fish spawning on the natural spawning areas. These populations have recent mean abundance estimates of 348 and 183 spawners respectively. The majority of the spring run populations have been extirpated largely as the result of dams blocking access to their high elevation habitat. The two bright chinook populations (i.e., Lewis and Sandy) have relatively high abundances, particularly the Lewis.

Summary statistics on population trends and growth rate show that the majority of populations have a long-term trend less than one, indicating the population is in decline. In addition, there is a high probability for most populations that the true trend/growth rate is less than one. When growth rate is estimated, assuming that hatchery origin spawners have a reproductive success equal to that of natural origin spawners, all of the population have a negative growth rate except the Coweeman fall run, which had very few hatchery origin spawners. The potential reasons for these declines have been cataloged in previous status reviews and include habitat degradation, deleterious hatchery practices, and climate-driven changes in marine survival. The Lewis River bright population is considered the healthiest in the ESU. The population is significantly larger than any other population in the ESU, and, in fact, it is larger than any population of salmon in the Columbia Basin except the Hanford Reach chinook.

The spring-run populations are largely extirpated as the result of dams which block access to their high elevation habitat. Abundances have largely declined since the last status review update (1998) and trend indicators for most all populations are negative, especially if hatchery fish are assumed to have a reproductive success equivalent to that of natural origin fish. NOAA Fisheries (2003a) tentatively identified 31 historical but only 1-3 currently viable populations. This indicates that the ESU is substantially modified from its historical population structure. Most tule fall chinook populations are potentially at risk of extinction and no populations of the spring run life-history type are currently considered self-sustaining. The Lewis River late fall bright population has the highest likelihood of being self-sustaining under current conditions (NOAA Fisheries 2003a).

1.2.2 Upper Willamette River (UWR) Chinook ESU -- Status

UWR Chinook ESU Distribution

The UWR chinook salmon ESU includes native spring-run populations above Willamette Falls and in the Clackamas River. Historically, it included sizable numbers of spawning salmon in the Santiam River, the middle fork of the Willamette River, and the McKenzie River, as well as smaller numbers in the Molalla River, Calapooia River, and Abiqua Creek. UWR chinook salmon mature in their fourth or fifth years. Historically, 5-year-old fish dominated the spawning migration runs. Recently, however, most fish have matured at age 4.

The life history of UWR chinook salmon includes traits from both ocean- and stream-type developmental strategies. Coded-wire-tag recoveries indicate that the fish travel to the marine waters off British Columbia and Alaska. More UWR chinook salmon are recovered in Alaskan waters than those from the LCR ESU. The timing of the spawning migration is limited by Willamette Falls. High flows in the spring allow access to the Upper Willamette basin, whereas low flows in the summer and autumn prevent later-migrating fish from ascending the falls. The low flows may serve as an isolating mechanism, separating this ESU from others nearby.

Fish in this ESU are distinct from those of adjacent ESUs in life history and marine distribution. As part of its effort to develop viability criteria for the UWR chinook, the Willamette/Lower Columbia Technical Recovery Technical Team (WLC-TRT) identified 7 historically demographically independent populations (Myers et al. 2002): Clackamas, Molalla, North Santiam, South Santiam, Calapooia, McKenzie, and Middle Fork Willamette. However, no formal trend analyses were conducted were conducted on any of the UWR Chinook populations by the Biological Review Team (BRT) involved in the current 2003 updated status review. The two populations with long time series of abundance data (Clackmas and McKenzie) have insufficient information on the fraction of hatchery-origin spawners to permit a meaningful analysis (NOAA Fisheries 2003a).

According to NOAA Fisheries (2003a), large numbers of hatchery produced spring chinook are released in the Upper Willamette as mitigation for the loss of habitat above Federal hydroprojects. This hatchery production masks the productivity of natural population, and, interbreeding of hatchery and natural fish poses potential genetic risks -- the incidental take from the fishery promoted by the hatchery production can increase adult mortality. Harvest retention is only allowed for hatchery marked fish, however, incidental take from hooking mortality and non-compliance is still a potential issue.

UWR fall chinook are not native to the upper Willamette and are not part of the Upper Willamette River chinook ESU. UWR fall chinook hatchery fish are no longer released into the upper Willamette, though there have been substantial releases in the past (NOAA Fisheries 2003a).

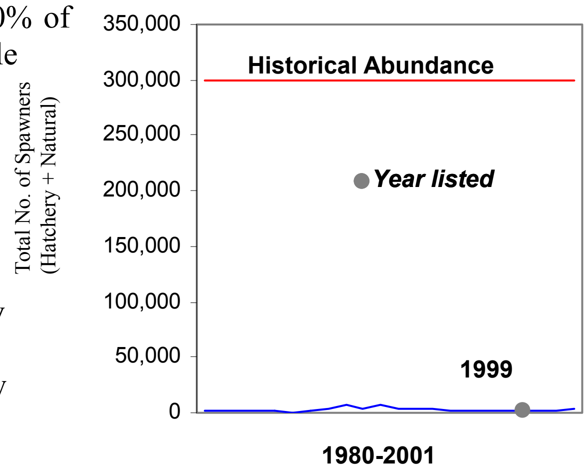
UWR Chinook ESU Population Trends

In the 2003 status review update, NOAA Fisheries modified previous approaches to ESU risk assessment to incorporate VSP criteria (McElhany et al. 2000): abundance, growth rate/productivity, spatial structure, and diversity. The current condition (NOAA Fisheries 2003a) of UWR chinook is summarized below:

Abundance:
- High hatchery fraction (historically ~ 60% of escapement), only recently distinguishable
- Fraction of historical abundance

Productivity:
- Improving trend since 1995

Spatial Structure:
- ~ 30-40% of historical habitat blocked by dams
- Natural production restricted to just a few areas



Diversity:
- Loss of local adaptation through homogenization of hatchery stocks within ESU
- Introgression of hatchery fall-run chinook

Recent Events:
- Cessation of fall-run hatchery
- Improved marking of hatchery fish and switch to a marked-fish selective fishery

Based on updated information provided by NOAA Fisheries (2003a), the information contained in previous LCR chinook status reviews, and preliminary analyses by the WLC-TRT on the UWR Chinook ESU, NOAA Fisheries (2003a) has tentatively identified 7 historical and 0-1 currently viable populations within the UWR Chinook ESU, which indicates that the ESU is substantially modified from its historical population structure with most populations considered extirpated or nearly so. The only population considered potentially self-sustaining is the McKenzie. However, its abundance has been relatively low (low thousands) with a substantial number of these fish being of hatchery origin. The population has shown a substantial increase in the last couple of years, hypothesized to be a result of increased ocean survival. It is unknown what ocean survivals will be in the future and the long-term sustainability of this population in uncertain.

The introduction of fall-run chinook salmon into the basin and the placement of a fish ladder at Willamette Falls have increased the potential for genetic introgression between wild spring- and hatchery fall-run chinook salmon, but there is no direct evidence of hybridization between these two runs. The proximate sources of risk to chinook salmon in this ESU are habitat blockages of large areas of important spawning and rearing habitat by dam construction. Remaining habitat has been degraded by effects of damming, forestry practices, agriculture, and urbanization. Another concern for this ESU is that levels of commercial and recreational harvest are high relative to the apparent productivity of natural populations. (Myers et al. 1998).

1.2.3 Upper Columbia River (UCR) Chinook 'Spring Run' ESU -- Status

UCR Chinook 'Spring Run' ESU Distribution

The UCR spring-run chinook salmon ESU inhabits tributaries upstream from the Yakima River to Chief Joseph Dam. UCR spring-run chinook salmon have a stream-type life history. Adults return to the Wenatchee River from late March through early May, and to the Entiat and Methow Rivers from late March through June. Most adults return after spending 2 years in the ocean, although 20 percent to 40 percent return after 3 years at sea. Like Snake River spring/summer chinook salmon, UCR spring-run chinook salmon experience very little ocean harvest. Peak spawning for all three populations occurs from August to September. Smolts typically spend 1 year in freshwater before migrating downstream. There are slight genetic differences between this ESU and others containing stream-type fish, but more importantly, the ESU boundary was defined using ecological differences in spawning and rearing habitat (Myers et al. 1998).

Grand Coulee Dam, completed in 1938, formed an impassable block to the upstream migration of anadromous fish. Chief Joseph Dam was constructed on the mainstem Columbia River downstream from Grand Coulee Dam and is also an anadromous block. There are no specific estimates of historical production of spring chinook from mainstem tributaries above Grand Coulee Dam. Habitat typical of that used by spring chinook salmon in accessible portions of the Columbia basin is found in the middle/upper reaches of mainstem tributaries above Grand Coulee Dam. It is likely that the historical range of this ESU included these areas.

Artificial production efforts in the area occupied by the Upper Columbia spring chinook ESU extend back to the 1890s. Hatchery efforts were initiated in the Wenatchee and Methow systems to augment catches in response to declining natural production (e.g., Craig and Soumela 1941). While there are no direct estimates of adult production from early efforts, it is likely contributions were small.

The Grand Coulee Fish Maintenance Project (1939 through 1943) may have had a major influence on this ESU because fish from multiple populations were mixed into one relatively homogenous group and redistributed into streams throughout the upper Columbia River region. In the late 1930s, the Grand Coulee Fish Maintenance Program (GCFMP) was initiated to address the fact that the completion of the Grand Coulee dam cut off anadromous access above site of the dam. Returning salmonids, including spring chinook, were trapped at Rock Island Dam and either transplanted as adults or released as juveniles into selected production areas within the accessible drainages below Grand Coulee Dam. Nason Creek in the Wenatchee system was a primary adult transplantation area in this effort. The program was conducted annually from 1938 until the mid-1940s.

Three independent populations of spring-run chinook salmon are identified for the ESU including those that spawn in the Wenatchee, Entiat, and Methow River Basins (Ford et al. 1999). All chinook in the Okanogan River are apparently ocean type and are considered part of the UCR summer/fall-run ESU, which is not listed.

<u>UCR Chinook 'Spring Run' ESU Population Trends</u>

In the 2003 status review update, NOAA Fisheries modified previous approaches to ESU risk assessment to incorporate VSP criteria (McElhany et al. 2000): abundance, growth rate/productivity, spatial structure, and diversity. The current condition (NOAA Fisheries 2003a) of UCR "spring-run" chinook is summarized below:

<u>Abundance</u>:

- Precipitous decline by 1995
- Strong 2001 returns
- 2001 Methow spawners ~ interim recovery target (2000 natural spawners)

<u>Productivity</u>:

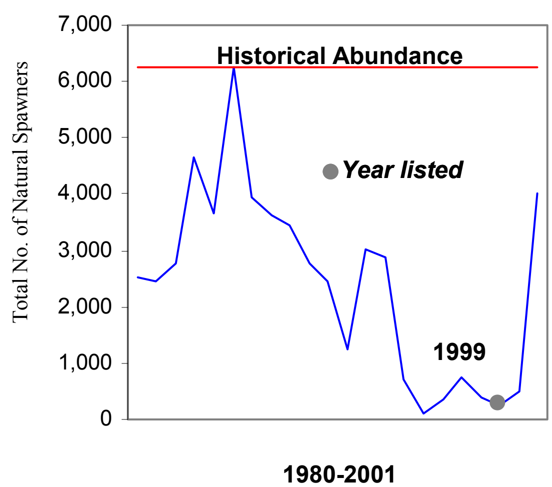
- Despite strong 2001 returns, both 5-year and long-term productivity below replacement (growth estimate < 1)

<u>Spatial Structure</u>:

- Passage/connectivity within ESU to all subpopulations (but for Icicle Creek)

<u>Diversity</u>:

- All hatchery programs in ESU are for supplementation



- In 1996 and 1998 all returns to the Methow were collected at downstream dams into the supplementation[1] program, generating concerns over the preservation of subpopulation structure

There are no estimates of historical abundance specific to this ESU prior to the 1930s. The drainages supporting this ESU are all above Rock Island Dam on the upper Columbia River. Rock Island Dam is the oldest major hydroelectric project on the Columbia River; it began operations in 1933. Counts of returning chinook have been made since the 1930s. Annual estimates of the aggregate return of spring chinook to the upper Columbia are derived from the dam counts based on the nadir between spring and summer return peaks.

All three of the existing upper Columbia River spring chinook populations have exhibited similar trends and patterns in abundance over the past 40 years. The 1998 Chinook Status Review (Myers et al. 1998) reported that long-term trends in abundance for upper Columbia spring chinook populations were generally negative, ranging from -5% to +1%. Analyses of the data series, updated to include 1996-2001 returns, indicate that those trends have continued. The long-term trend in spawning escapement is downward for all three systems. The Wenatchee River spawning escapements have declined an average of 5.6% per year, the Entiat River population at an average of 4.8%, and the Methow River population an average rate of 6.3% per year since 1958. These rates of decline were calculated from redd count data series[2].

Mainstem spring chinook fisheries harvested chinook at rates between 30%-40% per year through the early1970s. Harvest was substantially reduced by restricting mainstem commercial fisheries and sport harvest in the mid-1970s. The calculated downward trend in abundance for the upper Columbia stocks would be higher if the early redd counts had been revised to reflect the potential ‘transfer’ from harvest to escapement for the early years in the series.

In the 1960s and 1970s, spawning escapement estimates were relatively high with substantial year-to-year variability. Escapements declined in the early 1980s, then peaked at relatively high levels in the mid 1980s. Returns declined sharply in the late 1980s and early 1990s. Returns between 1990-94 were at the lowest levels observed in the 40-plus years of the data sets. The Upper Columbia Biological Requirements Workgroup (Ford et al. 2001) recommended interim delisting levels of 3,750, 500, and 2,200 spawners for the populations returning to the Wenatchee, Entiat, and Methow drainages, respectively. The most recent 5-year geometric mean spawning escapements (1997-2001) were at 8%-15% of these levels. Target levels have not been exceeded since 1985 for the Methow run and the early 1970s for the Wenatchee and Entiat populations.

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[1] Supplementation: The use of a hatchery to increase an existing population through use of a locally adapted broodstock.

[2] Prior to 1987, annual redd counts were obtained from single surveys and reported as peak counts. From 1987 on, redd counts were derived from multiple surveys and are reported as annual total counts. An adjustment factor of 1.7 was used to expand the pre-1987 redd counts for comparison with the more recent total counts. (Beamesderfer et al. 1997).

Escapements from 1996-1999 reflected a downward trend; however, escapements increased substantially in 2000 and 2001 in all three systems. Returns to the Methow River and the Wenatchee River reflected the higher return rate on natural production as well as a large increase in contributions from supplementation programs. Short-term trends (1990-2001) in natural returns remain negative for all three upper Columbia spring chinook populations. Natural returns to the spawning grounds for the Entiat, Methow, and Wenatchee River populations continued downward at average rates of 3%, 10%, and 16% respectively.

Short- and long-term trends in natural returns to the individual subpopulations within the Wenatchee and Methow systems were consistent with the aggregate population level trends.

McClure et al. (in press) reported standardized quantitative risk assessment results for 152 listed salmon stocks in the Columbia basin, including representative data sets (1980-2000 return years) for upper Columbia spring chinook. Average annual growth rate for the upper spring chinook population was estimated as 0.85, the lowest average reported for any of the Columbia River ESUs analyzed in the study. Assuming that population growth rates were to continue at the 1980-2000 levels, upper Columbia spring chinook populations are projected to have a very high probability of a 90% decline within 50 years (0.87 for the Methow River population, 1.0 for the Wenatchee and Entiat runs).

Hatchery impacts vary among the production areas. Large on-station production programs in the Wenatchee and Entiat River drainages are located in the lower reaches, some distance downstream of natural spawning areas. In the Methow River, Winthrop National Fish Hatchery is located upstream, adjacent to a portion of the mainstem spawning reach for spring chinook and steelhead. Straying of returning hatchery origin adults into the natural production areas is thought to be low for the Wenatchee River and Entiat River. In years when the return of naturally produced adults is extremely low, the proportion of hatchery adults on the spawning grounds can be high, even if the dispersal rate of the returning hatchery fish is low. It is likely that returning hatchery fish contribute to spawning in natural production areas in the Methow at a higher rate. Carcass sampling data are available for a limited number of year/area combinations for the upper Columbia drainages (e.g., WDF 1993).

Spring chinook returns to the Wenatchee and the Methow River systems have included relatively large numbers of supplementation program fish in recent years. The total return to natural spawning areas in the Wenatchee River system for 2001 is estimated to be approximately 4,000-1,200 returning from natural spawning and 2,800 from the hatchery-based supplementation program. The return to spawning areas for the Methow in 2001 is estimated at well over 9,000. Carcass surveys indicate that returning supplementation adults accounted for approximately 80% of the 2001 run to the Methow spawning areas. Supplemenation programs have contributed substantially to getting fish on the spawning grounds in recent years. Little information is available to assess the long-term impact of high levels of supplementation on productivity.

1.2.4 Snake River (SR) Chinook 'Spring/Summer' Run ESU -- Status

SR Chinook 'Spring/Summer Run' ESU Distribution

Spring and summer chinook salmon runs returning to the major tributaries of the Snake River were classified as an Evolutionarily Significant Unit (ESU) by NMFS (Matthews and Waples 1991). This ESU includes production areas that are characterized by spring-timed returns, summer-timed returns, and combinations from the two adult timing patterns. Runs classified as spring chinook are counted at Bonneville Dam beginning in early March and ending the first week of June; runs classified as summer chinook return to the Columbia River from June through August. Returning fish hold in deep mainstem and tributary pools until late summer, when they emigrate up into tributary areas and spawn. In general, spring type chinook tend to spawn in higher elevation reaches of major Snake River tributaries in mid- through late August, and summer run Snake River chinook spawn approximately 1 month later than spring-run fish.

Many of the Snake River tributaries used by spring and summer chinook runs exhibit two major features: extensive meanders through high elevation meadowlands and relatively steep lower sections joining the drainages to the mainstem Salmon (Matthews and Waples 1991). The combination of relatively high summer temperatures and the upland meadow habitat creates the potential for high juvenile salmonid productivity. Historically, the Salmon River system may have supported more than 40% of the total return of spring and summer chinook to the Columbia system (e.g., Fulton 1968)

The Snake River spring/summer chinook ESU includes current runs to the Tucannon River, the Grand Ronde River system, the Imnaha River and the Salmon River (Matthews and Waples 1991). Some or all of the fish returning to several of the hatchery programs are also listed, including those returning to the Tucannon River, Imnaha River, and Grande Ronde River hatcheries, and to the Sawtooth, Pahsimeroi, and McCall hatcheries on the Salmon River. The Salmon River system contains a range of habitats used by spring/summer chinook. The South Fork and Middle Fork tributaries to the Salmon currently support the bulk of natural production in the drainage. Two large tributaries entering above the confluence of the Middle Fork, the Lemhi and Pahimeroi Rivers, both drain broad alluvial valleys and are believed to have supported substantial, relatively productive anadromous fish runs. Returns into the upper Salmon River tributaries have re-established following the opening of passage around Sunbeam Dam on the mainstem Salmon River downstream of Stanley, ID. Sunbeam Dam was completed around 1910 as a power source for mining activities in the region. The dam was impassable to anadromous fish until the 1930s.

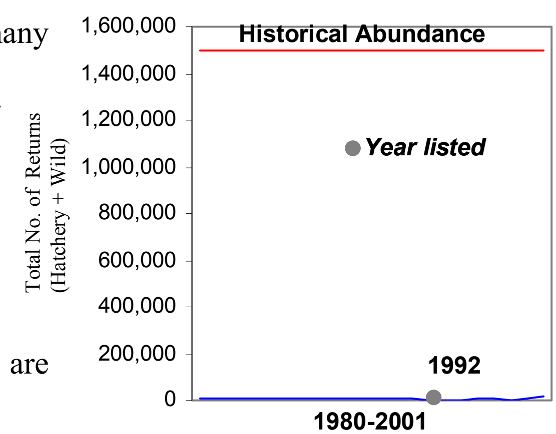
Current runs returning to the Clearwater River drainages were specifically not included in the Snake River spring/summer chinook ESU. Lewiston Dam in the lower mainstem of the Clearwater River was constructed in 1927 and functioned as an anadromous block until the early 1940s (Matthews and Waples 1991). Spring and summer chinook runs into the Clearwater system were reintroduced via hatchery outplants beginning in the late 1940s. As a result, Matthews and Waples (1991) concluded that "...the massive outplantings of nonindigenous stocks presumably substantially altered, if not eliminated, the original gene pool."

Spring and summer chinook from the Snake River basin exhibit stream type life history characteristics (Healey 1983). Most SR spring/summer chinook salmon enter individual subbasins from May through September. Eggs are deposited in late summer and early fall, incubate over the following winter and hatch in late winter/early spring of the following year. Juvenile SR spring/summer chinook salmon emerge from spawning gravels from February through June (Peery and Bjornn 1991). Typically, after rearing in their nursery streams for about 1 year, smolts begin migrating seaward in April and May (Bugert et al. 1990, Cannamela 1992). Depending on the tributary and the specific habitat conditions, juveniles may migrate extensively from natal reaches into alternative summer rearing and/or overwintering areas. After reaching the mouth of the Columbia River, spring/summer chinook salmon probably inhabit nearshore areas before beginning their northeast Pacific Ocean migration. Snake River spring/summer chinook return from the ocean to spawn primarily as 4 and 5 year old fish, after 2 to 3 years in the ocean. A small fraction of the fish return as 3-year-old 'jacks', heavily predominated by males.

SR Chinook 'Spring/Summer Run' ESU Population Trends

In the 2003 status review update, NOAA Fisheries modified previous approaches to ESU risk assessment to incorporate VSP criteria (McElhany et al. 2000): abundance, growth rate/productivity, spatial structure, and diversity. The current condition (NOAA Fisheries 2003a) of SR spring/summer chinook is summarized below:

Abundance:
- Marked increase in 2001 returns for many populations
- 2001 returns for 2 populations encouraging ~ interim recovery target levels
- Remaining populations far below their respective interim targets



Productivity:
- Long term trends << 1
- Recent trends, buoyed by last two years, are approaching 1

Spatial Structure:
- Widely distributed; much of historic habitat still available (~90%)

Diversity:
- Much habitat diversity remains
- No evidence of wide-scale straying by hatchery populations.

<u>Recent Events</u>:

- Removal of Grand Ronde (Rapid River) hatchery stock

Direct estimates of annual runs of historical spring/summer chinook to the Snake River are not available. Chapman (1986) estimated that the Columbia River produced 2.5 million to 3.0 million spring and summer chinook per year in the late 1800s. Total spring and summer chinook production from the Snake Basin contributed a substantial proportion of those returns; the total annual production of Snake River spring and summer chinook may have been in excess of 1.5 million adult returns per year (Matthews and Waples 1991). Returns to Snake River tributaries had dropped to roughly 100,000 adults per year by the late 1960s (Fulton 1968). Increasing hatchery production contributed to subsequent year's returns, masking a continued decline in natural production.

Aggregate returns of spring-run chinook (as measured at Lower Granite Dam) showed a large increase over recent year abundances. The 1997-2001 geometric mean return of natural-origin chinook exceeded 3,700. The increase was largely driven by the 2001 return—estimated to have exceeded 17,000 naturally produced spring chinook—however, a large proportion of the run in 2001 was estimated to be of hatchery origin (98.4%). The summer run over Lower Granite Dam has increased as well. The 1997-2001 geometric mean total return was slightly more than 6,000. The geometric mean return for the brood years for the recent returns (1987-96) was 3,076 (Note: does not address hatchery/wild breakdowns of the aggregate run).

The lowest five-year geometric mean returns for almost all of the individual Snake River spring/summer chinook production areas were in the 1990s. Sulphur Creek and Poverty Flats production areas had low five-year geometric mean returns in the early 1980s. Many, but not all, production areas had large increases in return year 2001.

In the 1990-2001 data series, long-term trend and long-term growth rate estimates were below 1 for all natural production data sets, reflecting the large declines since the 1960s. Short-term trends and growth rate estimates were generally positive with relatively large confidence intervals. Grande Ronde and Imnaha data sets had the highest short-term growth rate estimates. Tucannon River, Poverty Flat (did not have 2000 and 2001 included) and Sulphur Creek index areas had the lowest short-term growth rate estimates in the series. Patterns in returns per spawners for stocks with complete age information (e.g., Minam River) show a series of extremely low return rates in the 1990s followed by increases in the 1995-97 brood years (NOAA Fisheries 2003a).

1.2.5 Snake River (SR) Chinook 'Fall Run' ESU -- Status

SR Chinook 'Fall Run' ESU Distribution

The SR fall chinook salmon ESU, listed as threatened on April 22, 1992 (NOAA 1992), includes all natural-origin populations of fall chinook in the mainstem Snake River and several tributaries including the Tucannon, Grande Ronde, Salmon, and Clearwater Rivers. Fall chinook salmon from the Lyons Ferry Hatchery are included in the ESU but are not listed.

Snake River fall chinook spawn above Lower Granite Dam in the mainstem Snake River and in the lower reaches of major tributaries entering below Hells Canyon Dam. Adult fall chinook enter the Columbia River in July and August. The Snake River component of the fall chinook run migrates past the Lower Snake river mainstem dams in September and October. Spawning occurs from October through November. Juveniles emerge from the gravels in March and April of the following year. Downstream migration generally begins within several weeks of emergence (Becker 1970, Allen and Meekin 1973), and juveniles rear in backwaters and shallow water areas through mid-summer before smolting and migrating to the ocean—thus they exhibit an ocean-type juvenile history. Once in the ocean, they spend 1 to 4 years (though usually 3 years) before beginning their spawning migration. Fall returns in the Snake River system are typically dominated by 4-year-old fish.

Fall chinook returns to the Snake River generally declined through the first half of this century (Irving and Bjornn 1991). In spite of the declines, the Snake River basin remained the largest single natural production area for fall chinook in the Columbia drainage into the early 1960s (Fulton 1968). Spawning and rearing habitat for Snake River fall chinook was significantly reduced by the construction of a series of Snake River mainstem dams. Historically, the primary spawning fall chinook spawning areas were located on the upper mainstem Snake River. Currently, natural spawning is limited to the area from the upper end of Lower Granite Reservoir to Hells Canyon dam and the lower reaches of the Imnaha , Grande Ronde, Clearwater and Tucannon Rivers.

Adult counts at Snake River dams are an index of the annual return of Snake River fall chinook to spawning grounds. Lower Granite Dam is the uppermost of the mainstem Snake River dams that allow for passage of anadromous salmonids. Adult traps at Lower Granite Dam have allowed for sampling of the adult run as well as for removal of non-local hatchery returns.

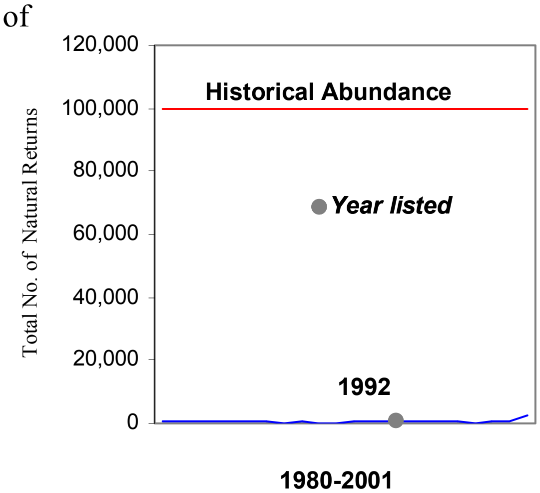
Lyons Ferry Hatchery was established as one of the hatchery programs under the Lower Snake Compensation Plan administered through the USFWS. Snake River fall chinook production is a major program for Lyons Ferry Hatchery, which is operated by the Washington Department of Fish and Wildlife and is located along the Snake mainstem between Little Goose Dam and Lower Monumental Dam. WDFW began developing a Snake River fall chinook broodstock in the early 1970s through a trapping program at Ice Harbor Dam and Lower Granite Dam. The Lyons Ferry facility became operational in the mid-1980s and took over incubation and rearing for the Snake River egg bank program.

A major Snake River fall chinook supplementation effort based upon the Lyons Ferry Snake River fall chinook broodstock has been implemented in recent years. Acclimation facilities adjacent to major natural spawning areas have been used to acclimate release groups of yearling smolts. Additional releases of sub-yearlings have been made, depending on the availability of sufficient broodstock to maintain the on-station program and the off-station yearling releases. Returns in 2000 and 2001 reflect increases in the off-station plants in recent years as well as improved survival after release.

SR Chinook 'Fall Run' ESU Population Trends

In the 2003 status review update, NOAA Fisheries modified previous approaches to ESU risk assessment to incorporate VSP criteria (McElhany et al. 2000): abundance, growth rate/productivity, spatial structure, and diversity. The current condition (NOAA Fisheries 2003a) of SR "fall-run" chinook is summarized below:

Abundance:
- 2001 natural returns (2652 adults) up markedly from last 10 years (< 1000 adults/yr)
- 2001 natural *returns* > interim recovery target of 2500 natural *spawners* for the ESU
- 2001 total returns (8700 hatchery + wild adults) is in the range of the estimated potential capacity of the area



Productivity:
- Long-term and short-term trends in natural returns per spawner are positive, depending upon assumptions regarding the contribution of hatchery fish
- Trends presumably reflect Pacific decadal oscillation/strong ocean conditions

Spatial Structure:
- ESU comprise of only one population
- Loss of ~80% historical spawning habitat

Diversity:
- Improvements in managing straying of non-ESU fish
- Concern that hatchery egg collection below Lower Granite Dam incorporates non-ESU strays

Recent Events:
- Improved flow regime pursuant to FCRPS 2000 BiOp

No reliable estimates of historical abundance are available. Because of their dependence on mainstem habitat for spawning, however, fall chinook salmon probably have been affected by the development of irrigation and hydroelectric projects to a greater extent than any other species of salmon. It has been estimated that the mean number of adult SR fall chinook salmon declined from 72,000 in the 1930s and 1940s to 29,000 during the 1950s. Despite this decline, the Snake River remained the most important natural production area for fall chinook salmon in the entire Columbia River Basin through the 1950s. The number of adults counted at the uppermost Snake River mainstem dams averaged 12,720 total spawners from 1964 to 1968, 3,416 spawners from 1969 to 1974, and 610 spawners from 1975 to 1980 (Waples et al. 1991).

The 1999 NMFS Status Review Update noted increases in the Lower Granite Dam counts in the mid-1990s, and the upward trend in returns--the 2001 count over Lower Granite Dam exceeded 8,700 adult fall chinook--has continued. The 1997 through 2001 escapements were the highest on record since the count of 1,000 in 1975. Wild chinook returns and hatchery returns from increased production in the Lyons Ferry Hatchery Snake River egg bank stock have provided the bulk of the increase in returns. Returns classified as natural origin exceeded 2,600 in 2001. The 1997-2001 geometric mean natural origin count over Lower Granite Dam was 871 fish. The largest increase in fall chinook returns to the Snake River spawning area was from the Lyons Ferry Snake River stock component. Returns increased from under 200 per year prior to 1998 to over 1,200 and 5,300 adults in 2000 and 2001, respectively. The increase includes returns from the on-station release program as well as returns from large supplementation releases above Lower Granite Dam.

Both the long-term and short-term trends in natural returns are positive (1.013, 1.188). The short-term (1990-2001) estimates of the median population growth rate are 0.98 with a hatchery spawning effectiveness of 1.0 (equivalent to that of wild spawners) and 1.137 with a hatchery spawning effectiveness of 0. The estimated long-term growth rate for the Snake River fall chinook population is strongly influenced by the hatchery effectiveness assumption. If hatchery spawners have been equally as effective as natural-origin spawners in contributing to brood year returns, the long-term estimate is 0.899 and the associated probability that is less than 1.0 is estimated as 98.7%. If hatchery returns over Lower Granite Dam are not contributing at all to natural production, the long-term estimate of is 1.024. The associated probability that is greater than 1.0 is 25.7%, under the assumption that hatchery effectiveness is 0.

1.3 Snake River Sockeye -- Life History

Snake River sockeye salmon adults enter the Columbia River primarily during June and July. Arrival at Redfish Lake, which now supports the only remaining run of Snake River sockeye salmon, peaks in August, and spawning occurs primarily in October (Bjornn et al. 1968). Eggs hatch in the spring between 80 and 140 days after spawning. Fry remain in the gravel for 3 to 5 weeks, emerge from April through May, and move immediately into the lake. Once there, juveniles feed on plankton for 1 to 3 years before they migrate to the ocean (Bell 1986). Migrants leave Redfish Lake during late April through May (Bjornn et al. 1968) and travel almost 900 miles to the Pacific Ocean. Smolts reaching the ocean remain inshore or within the influence of the Columbia River plume during the early summer months. Later, they migrate through the northeast Pacific Ocean (Hart 1973, Hartt and Dell 1986). Snake River sockeye salmon spend 2 to 3 years in the Pacific Ocean and return in their fourth or fifth year of life.

1.3.1 Snake River (SR) Sockeye ESU -- Status

SR Sockeye ESU Distribution

The SR sockeye salmon ESU, listed as endangered on November 20, 1991 (NOAA 1991), includes populations of sockeye salmon from the Snake River Basin, Idaho (extant populations occur only in the Salmon River subbasin). Under NOAA Fisheries' interim policy on artificial propagation (NOAA 1993), the progeny of fish from a listed population that are propagated artificially are considered part of the ESA-listed species and are protected under ESA. Thus, although not specifically designated in the 1991 listing, SR sockeye salmon produced in IDFG's captive broodstock program are included in the ESA-listed ESU. Given the dire status of the wild population under any criteria, NOAA Fisheries considers the captive broodstock and its progeny essential for recovery.

Historically, Snake River sockeye salmon were produced in the Salmon River subbasin in Alturas, Pettit, Redfish, and Stanley lakes and in the South Fork Salmon River subbasin in Warm Lake. Sockeye salmon may have been present in one or two other Stanley basin lakes (Bjornn et al. 1968). Elsewhere in the Snake River Basin, sockeye salmon were produced in Big Payette Lake on the North Fork Payette River and in Wallowa Lake on the Wallowa River (Evermann 1895, Toner 1960, Bjornn et al. 1968, Fulton 1970).

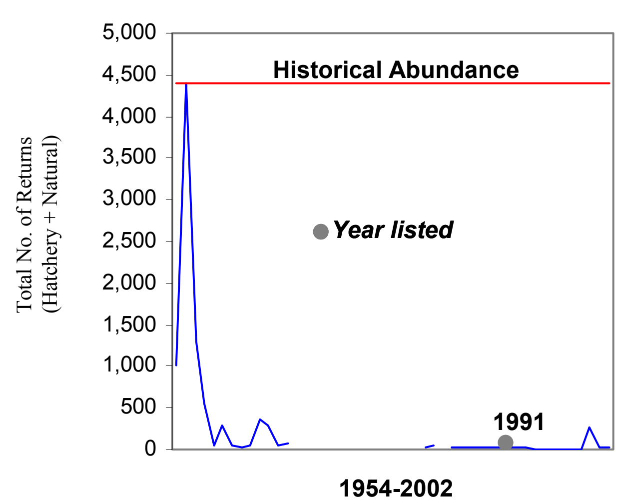
SR Sockeye ESU Population Trends

In the 2003 status review update, NOAA Fisheries modified previous approaches to ESU risk assessment to incorporate VSP criteria (McElhany et al. 2000): abundance, growth rate/productivity, spatial structure, and diversity. The current condition (NOAA Fisheries 2003a) of SR sockeye is summarized below:

Abundance:

- ~ 16 naturally produced adults in the last decade
- Captive broodstock program initiated in 1991 has provided temporary rescue from extinction

Productivity:



- Return of 257 hatchery adults in 2000, while hatchery returns in 2000 and 2001 ~ 25
- Natural population trends are not encouraging

Spatial Structure:
- Historically occurred in 4 lakes within the Stanley Basin
- Redfish Lake is the only extant population

Diversity:
- Residual-type sockeye in Redfish Lake
- Possible remnant gene pools in Stanley and Petit Lakes

Escapement of sockeye salmon to the Snake River has declined dramatically in the last several decades, primarily because the construction of hydropower dams made it difficult for sockeye salmon to have access to traditional spawning areas (Gustafson et al. 1997). Adult counts at Ice Harbor Dam declined from 3,170 in 1965 to zero in 1990 (ODFW and WDFW 1999). The Idaho Department of Fish and Game counted adults at a weir in Redfish Lake Creek during 1954 through 1966; adult counts dropped from 4,361 in 1955 to fewer than 500 after 1957 (Bjornn et al. 1968). A total of 16 wild sockeye salmon returned to Redfish Lake between 1991 and 1999. During 1999, seven hatchery-produced, age-3 adults returned to the Sawtooth Hatchery. Three of these adults were released to spawn naturally, and four were taken into the IDFG captive broodstock program. In 2000, 257 hatchery-produced, age-4 sockeye salmon returned to the Stanley basin (weirs at the Sawtooth Hatchery and Redfish Lake Creek). Adults numbering 243 were handled and redistributed to Redfish (120), Alturas (52), and Pettit (28) lakes, with the remaining 43 adults incorporated into the IDFG captive broodstock program. In 2001, 36 adult sockeye were counted at Lower Granite Dam (FPC 2002).

Low numbers of adult Snake River sockeye salmon preclude a quantitative analysis of the status of this ESU. However, because only16 wild and 264 hatchery-produced adult sockeye returned to the Stanley basin between 1990 and 2000, and, although 257 hatchery adults returned in 2000, only 26 hatchery adults returned in 2001 and 22 in 2002. NOAA Fisheries considers the status of this ESU to be dire under any criteria.

1.4 Chum -- Life History

Historically, chum salmon were distributed throughout the coastal regions of western Canada and the United States, as far south as Monterey Bay, California. Presently, major spawning populations are found only as far south as Tillamook Bay on the northern Oregon coast. Chum salmon spawn primarily in freshwater and apparently exhibit obligatory anadromy (there are no recorded landlocked or naturalized freshwater populations - Randall et al. 1987). Chum salmon spend more of their life history in marine waters than do other Pacific salmonids. Chum salmon, like pink salmon, usually spawn in the lower reaches of rivers, with redds usually dug in the mainstem or in side channels of rivers from just above tidal influence to nearly 100 km from the sea. Juveniles outmigrate to seawater almost immediately after emerging from the gravel

(Salo 1991). This ocean-type migratory behavior contrasts with the stream-type behavior of some other species in the genus *Oncorhynchus* (e.g., coastal cutthroat trout, steelhead, coho salmon, and most types of chinook and sockeye salmon), which usually migrate to sea at a larger size, after months or years of freshwater rearing. This means that survival and growth in juvenile chum salmon depend less on freshwater conditions (unlike stream-type salmonids which depend heavily on freshwater habitats) than on favorable estuarine conditions. Another behavioral difference between chum salmon and species that rear extensively in freshwater is that chum salmon form schools, presumably to reduce predation (Pitcher 1986), especially if their movements are synchronized to swamp predators (Miller and Brannon 1982).

1.4.1 Columbia River (CR) Chum ESU -- Status

CR Chum ESU Distribution

Chum salmon from the CR ESU spawn in tributaries and in mainstem spawning areas below Bonneville Dam, most often on the Washington side of the Columbia River (Johnson et al. 1997). Chum salmon enter the Columbia River from mid-October through early December and spawn from early November to late December. Recent genetic analysis of fish from Hardy and Hamilton Creeks and from the Grays River indicate that these fish are genetically distinct from other chum salmon populations in Washington (Salo 1991, WDF et al. 1993, and Johnson et al. 1997).

CR Chum ESU Population Trends

In the 2003 status review update, NOAA Fisheries modified previous approaches to ESU risk assessment to incorporate VSP criteria (McElhany et al. 2000): abundance, growth rate/productivity, spatial structure, and diversity. The current condition (NOAA Fisheries 2003a) of CR chum is summarized below:

Abundance:

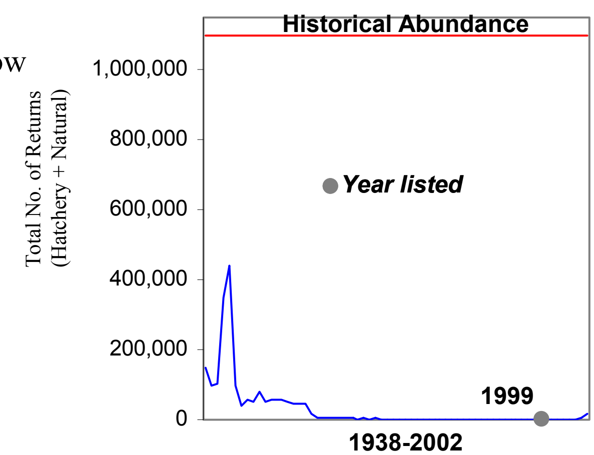
- Abundance remained low (2000-4000) during 1980's and 1990's
- Unofficial 2002 reports suggest large increases in abundance at several locations (~20,000).

Productivity:

- Productivity over recent years at or below replacement (but for 2002)
- Uncertain cause of large 2002 reported returns

Spatial Structure:

- Approximately 90% of historic populations in ESU are extirpated



Diversity:

- Loss of connectivity due to population extirpations
- Loss of off-channel areas
- Only 3 extant populations

Other Considerations:

- Negative interactions with hatchery releases of yearling steelhead/chinook/coho

Recent Events:

- Improved management of incidental harvest
- Improved flow management at Bonneville Dam for lower Columbia River Gorge populations
- Initiation of Grays River supplementation program with first returns in 2002

Previously, chum salmon were reported in almost every river in the lower Columbia River basin, but most runs disappeared by the 1950s (Rich 1942, Marr 1943, Fulton 1970). Historically, the CR chum salmon ESU supported a large commercial fishery landing more than 500,000 fish per year. Commercial catches declined beginning in the mid-1950s. There are now no recreational or directed commercial fisheries for chum salmon in the Columbia River, although chum salmon are taken incidentally in the gill-net fisheries for coho and chinook salmon, and some tributaries have a minor recreational harvest. The estimated minimum run size for the CR chum salmon ESU has been relatively stable, although at a very low level, since the run collapsed during the mid-1950s. Current abundance is probably less than 1% of historical levels, and the ESU has undoubtedly lost some (perhaps much) of its original genetic diversity.

Because of the well-known aversion of chum salmon to surmounting in-river obstacles to migration, the effects of the mainstem Columbia River hydropower system have probably been more severe for chum salmon than for other salmon species. Bonneville Dam presumably continues to impede the recovery of upriver populations. Substantial habitat loss in the Columbia River estuary and associated areas presumably was an important factor in the decline and also represents a significant continuing risk for this ESU.

The total number of chum salmon returning to the Columbia in the last 50 years has averaged perhaps a few thousand, returning to a very restricted subset of the historical range. Significant spawning occurs in only two of the 16 historical populations, meaning that 88% of the historical populations are extirpated, or nearly so. The two extant populations are at Grays River and the Lower Gorge. These two populations have been at low abundance for the last 50 years in the range where stochastic processes could lead to extinction. Encouragingly, there has been a substantial increase in the abundance of these two populations and the new (or newly discovered) I-205 population. However, it is not known if this increase will continue and the abundance is still substantially below the historical levels.

The Columbia chum dramatically increased in abundance in 2002 for unknown reasons. Several hypotheses have been floated regarding this increase. These include:

- Improved ocean conditions
- Grays and Chinook river hatchery program
- Mainstem flow agreements (the lower gorge population is in the tailrace of Bonneville Dam and subject to hydrosystem induced flow fluctuations)
- Favorable freshwater conditions
- Increased sampling effort (Since the 2000 survey, effort seems to have increased, though this alone certainly does not explain the apparent increase).

These are all possible contributors to the increase, but the reason for the increase is unknown, just as it is unknown exactly why chum were restricted to low abundance and limited distribution for the last 50 years. It does not appear that chum have expanded their range in 2002 beyond the Grays River, Lower Gorge, and I-205 areas, though not all the data on the 2002 survey has been reported. Since the cause of the 2002 increase is unknown, it is impossible to know if it will continue.

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