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

Refer to NMFS No: 2013/9724

March 22, 2013

F. Lorraine Bodi
Vice President for Environment, Fish & Wildlife
Bonneville Power Administration Mailstop KE-4
P.O. Box 3621
Portland, Oregon 97208-3621

Re: Endangered Species Act Section 7 Formal Programmatic Biological and Conference Opinion, Letter of Concurrence, and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Consultation for Bonneville Power Administration's Habitat Improvement Program III (HIP III) KEC-4

Dear Ms. Bodi:

The enclosed document contains a programmatic biological and conference opinion (opinion) and letter of concurrence prepared by the National Marine Fisheries Service (NMFS) pursuant to section 7(a)(2) of the Endangered Species Act (ESA) on the effects of the Bonneville Power Administration (BPA) funding habitat improvement actions within the Columbia River Basin and coastal rivers in the State of Oregon north of Cape Blanco. BPA funds habitat improvement activities to fulfill its obligations under section 4(h) the Pacific Northwest Electric Power Planning and Conservation Act of 1980 (Public Law 96-501) and in response to the requirements of various biological opinions, including the 2008 Biological Opinion on the Operation of the Federal Columbia River Power System.

In this opinion, NMFS concluded that the proposed program and activities authorized under that program are not likely to adversely affect the Eastern distinct population segment of Steller sea lion (*Eumetopias jubatus*), southern green sturgeon (*Acipenser medirostris*), Pacific eulachon (*Thaleichthys pacificus*), or designated critical habitat for southern green sturgeon or eulachon. The Steller sea lion does not have critical habitat designated in the action area.

NMFS also concluded that the proposed program and activities authorized under that program are not likely to jeopardize the continued existence of the following 14 species, or result in the destruction or adverse modification of their designated or proposed critical habitats.

- Lower Columbia River Chinook salmon (*Oncorhynchus tshawytscha*)
- Upper Willamette River spring-run Chinook salmon
- Upper Columbia River spring-run Chinook salmon
- Snake River spring/summer-run Chinook salmon

- Snake River fall-run Chinook salmon
- Columbia River chum salmon (*O. keta*)
- Lower Columbia River coho salmon (*O. kisutch*)
- Oregon Coast coho salmon
- Snake River sockeye salmon (*O. nerka*)
- Lower Columbia River steelhead (*O. mykiss*)
- Upper Willamette River steelhead
- Middle Columbia River steelhead
- Upper Columbia River steelhead
- Snake River Basin steelhead

As required by section 7 of the ESA, NMFS is providing an incidental take statement with the opinion. The incidental take statement describes reasonable and prudent measures NMFS considers necessary or appropriate to minimize the impact of incidental take associated with this action. The take statement sets forth nondiscretionary terms and conditions, including reporting requirements, that the Federal action agency must comply with to carry out the reasonable and prudent measures. Incidental take from actions that meet these terms and conditions will be exempt from the ESA's prohibition against the take of listed species, except for eastern Steller sea lion.

Constructing or maintaining barriers which eliminate or impede a listed species' access to habitat or ability to migrate, and any water withdrawal or other alteration of streamflow when it significantly impairs spawning, migration, feeding, or other essential behavioral pattern, is a habitat-modifying activity that may harm listed species and therefore may be considered a take under the ESA.[1] NMFS identified impaired passage and altered streamflow due to irrigation diversions, among other things, as a primary factor limiting recovery of many listed species considered in this opinion. The proposed action area is also designated as critical habitat and the function and conservation role of that habitat is degraded in many areas due, in part, to altered hydrology. However, water would have continued to be withdrawn using the existing irrigation facilities whether or not irrigation diversions are retrofitted by BPA, so the existing passage impairments and water withdrawals are part of the current environmental baseline for those sites. However, NMFS does not consider any take that may be associated with such passage impairments or withdrawals to be incidental to the proposed action and compliance with these terms and conditions will not remove the prohibition against any take that may occur due to those withdrawals.

This document also includes the results of our analysis of the action's likely effects on essential fish habitat (EFH) pursuant to section 305(b) of the Magnuson-Stevens Fishery Conservation and Management Act (MSA), and includes two conservation recommendations to avoid, minimize, or otherwise offset potential adverse effects on EFH. This conservation recommendation is a subset of the ESA take statement's terms and conditions. Section 305(b) (4) (B) of the MSA

[1] See, 64 FR 60727 (November 8, 1999) (defining "harm" as an element of "take" in the ESA, and citing constructing or maintaining barriers that eliminate or impede a listed species' access to habitat or ability to migrate and removing water or otherwise altering streamflow when it significantly impairs spawning, migration, feeding or other essential behavioral patterns as an example of harm).

requires Federal agencies to provide a detailed written response to NMFS within 30 days after receiving these recommendations.

If the response is inconsistent with the EFH conservation recommendation, the Federal action agency must explain why the recommendations will not be followed, including the scientific justification for any disagreements over the effects of the action and the recommendations. In response to increased oversight of overall EFH program effectiveness by the Office of Management and Budget, NMFS established a quarterly reporting requirement to determine how many conservation recommendations are provided as part of each EFH response and how many are adopted by the action agency. Therefore, we request that in your statutory reply to the EFH portion of this consultation, you clearly identify the number of conservation recommendations accepted.

Please direct questions regarding this opinion to Dr. Nancy Munn at 503.231.6269, of my staff in the Habitat Conservation Division.

Sincerely,

Michael Tehan

for William W. Stelle, Jr.
Regional Administrator

cc: U.S. Fish and Wildlife Service

Endangered Species Act Section 7 Formal Programmatic Opinion, Letter of Concurrence
and
Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Conservation Recommendations

Habitat Improvement Program III funded by the Bonneville Power Administration in the Columbia River Basin in Oregon, Washington, and Idaho

NMFS Consultation Number: 2013/9724

Federal Action Agency: Bonneville Power Administration

Affected Species and Determinations:

ESA-Listed Species	ESA Status	Is the action likely to adversely affect this species or its critical habitat?	Is the Action likely to jeopardize this species?	Is the action likely to destroy or adversely modify critical habitat for this species?
Lower Columbia River Chinook salmon	T	Yes	No	No
Upper Willamette River Chinook salmon	T	Yes	No	No
Upper Columbia River spring-run Chinook salmon	E	Yes	No	No
Snake River spring/summer run Chinook salmon	T	Yes	No	No
Snake River fall-run Chinook salmon	T	Yes	No	No
Columbia River chum salmon	T	Yes	No	No
Lower Columbia River coho salmon	T	Yes	No	No*
Oregon Coast coho salmon	T	Yes	No	No
Snake River sockeye salmon	E	Yes	No	No
Lower Columbia River steelhead	T	Yes	No	No
Upper Willamette River steelhead	T	Yes	No	No
Middle Columbia River steelhead	T	Yes	No	No
Upper Columbia River steelhead	T	Yes	No	No
Snake River Basin steelhead	T	Yes	No	No
Southern green sturgeon	T	No	N/A	N/A
Eulachon	T	No	N/A	N/A
Steller sea lion	T	No	N/A	N/A

*Critical Habitat was proposed for LCR coho salmon on January 14 (78 FR 2726)

Fishery Management Plan that Describes EFH in the Action Area	Would the action adversely affect EFH?	Are EFH conservation recommendations provided?
Coastal Pelagic Species	Yes	Yes
Pacific Coast Groundfish	Yes	Yes
Pacific Coast Salmon	Yes	Yes

Consultation Conducted By:	National Marine Fisheries Service Northwest Region
Issued by:	William W. Stelle, Jr. Regional Administrator
Date:	March 22, 2013

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GLOSSARY

For this consultation –

Action means all activities or programs of any kind authorized, funded, or carried out, in whole or in part, by a Federal action agency.

Action area means all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action (50 CFR 402.02).

Active channel width means the stream width measured perpendicular to stream flow between the ordinary high water lines, or at the channel bankfull elevation if the ordinary high water lines are indeterminate. This width includes the cumulative active channel width of all individual side- and off-channel components of channels with braided and meandering forms, and measure outside the area influence of any existing stream crossing, e.g., five to seven channel widths upstream and downstream.

Applicant means any person who requires formal approval, authorization, or funding from a Federal action agency as a prerequisite to conducting the action.

Bankfull elevation means the elevation at which a stream first reaches the top of its natural banks and overflows, and is indicated by the topographic break from a vertical bank to a flat floodplain or the topographic break from a steep slope to a gentle slope.

Conserve, conserving, and conservation mean to use and the use of all methods and procedures which are necessary to bring any endangered species or threatened species to the point at which the measures provided pursuant to the Federal Endangered Species Act are no longer necessary.

Conservation recommendation means a suggestion by NMFS regarding a discretionary measure to minimize or avoid adverse effects of a proposed action on listed species or critical habitat or regarding the development of information.

Critical habitat means any geographical area designated as critical habitat in CFR part 226.

Cumulative effects means those effects of future state or private activities, not involving Federal action, that are reasonably certain to occur within the action area of the Federal action subject to consultation.

Effects of the action means 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 that action that will be added to the environmental baseline.

Endangered species means a species that is in danger of extinction throughout all or a significant portion of its range.

Environmental baseline means the past and present impacts of all Federal, State, or private actions and other human activities in the action area, the anticipated impacts of all proposed Federal projects in the action area that have already undergone formal or early section 7 consultation, and the impact of State or private actions which are contemporaneous with the consultation in process.

Ephemeral effects means effects that are expected to last for hours or days.

Estuary or other saltwater area means an area with maximum intrusion of more than 0.5 ppt measured at depth; in the Columbia River, this includes all areas downstream from Jim Crow Sands (river mile 27).

Fill means any material that has been placed below the plane of the ordinary high water mark or the high tide line.

Functional floodplain means an area that is interconnected with the main channel through physical and biological processes such as periodic inundation, the erosion, transport and deposition of bed materials, nutrient cycling, groundwater recharge, hyporheic flows, the production and transport of large wood, aquatic food webs, and fish life history. These processes interact to create and maintain geomorphic features such as alcoves, backwaters, backwater deposits, braided channels, flooded wetlands, groundwater channels, overflow channels, oxbows or oxbow lakes, point bars, ponds, side channels, and sloughs. These features may be difficult to distinguish on smaller streams, where floodplain deposits are subject to rapid removal and alteration. These permanent or intermittent geomorphic features are extensions of the main stream channel and are critical to the survival and recovery of ESA-listed salmon and steelhead. The functional floodplain area is often assumed to be coincident with the flood prone area, if the entrenchment ratio is less than 2.2, or 2.2 times the active channel width if entrenchment ratio is greater than 2.2. This area may also be reduced by the presence of geomorphic features, flow regulation, or encroachment of built infrastructure.

Harm means significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering.

Hazardous material means any chemical or substance which, if released into an aquatic habitat, could harm fish, including, but not limited to, petroleum products, radioactive material, chemical agents, and pesticides.

Habitat Improvement Program means habitat restoration actions funded by the Bonneville Power Administration in fulfillment of its obligations under the Northwest Power and Conservation Council's Columbia River Basin Fish and Wildlife Program and the various biological opinions issued to the agency.

Incidental take means takings that result from, but are not the purpose of, carrying out an otherwise lawful activity conducted by the Federal action agency or applicant.

Indirect effects means effects that are caused by the proposed action and are later in time, but still are reasonably certain to occur.

Interdependent actions means actions that have no independent utility apart from the action under consideration.

Interrelated actions means actions that are part of a larger action and depend on the larger action for their justification.

In-water work means any part of an action that occurs below ordinary high or within the wetted channel, *e.g.*, excavation of streambed materials, fish capture and removal, flow diversion, streambank protection, and work area isolation.

Jeopardize the continued existence of means to engage in an action that reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species.

Large wood means a tree, log, rootwad, or engineered logjam that is large 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 or near which the wood occurs.

Listed species means any species of fish, wildlife, or plant which has been determined to be endangered or threatened under section 4 of the Federal Endangered Species Act.

Long-term effects means effects are expected to last for months, years or decades.

Natural water means all perennial or seasonal waters except water conveyance systems that are artificially constructed and actively maintained for irrigation.

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.

Primary constituent elements (PCE) means the biological and physical features of critical habitat that are essential to the conservation of listed species.

Reasonable and prudent measures (RPM) means actions the NMFS believes necessary or appropriate to minimize the amount or extent of incidental take.

Recovery means 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 Federal Endangered Species Act.

Restoration Review Team (RRT) means an internal tam of technical experts who shall provide a design review of each moderate to high-risk project in accordance with design complexity and significance. This is a new internal QA/QC process at BPA. The RRT structure will include a RRT Team leader, Core Team members, Technical Team members, and representatives from NMFS and/or USFWS.

Saltwater area – see estuary**.**

Scope of the action means the range of actions and impacts to be considered in the analysis of effects.

Shallow water means a water column depth of less than 20 feet as measured at Ordinary Low Water or Mean Lower Low Water.

Shallow water area means the areal extent of the waterbody where the column depth is less than 20 feet as measured at Ordinary Low Water or Mean Lower Low Water.

Short-term effects means effects that are expected to last for weeks.

Streambank toe means the part of the streambank below ordinary high water.

Take means to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct.

Threatened species means a species that is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range.

Viable Salmonid Population means an independent population of any Pacific salmonid that has a negligible risk of extinction due to threats from demographic variation, local environmental variation and genetic changes over a 100 year time frame.

LIST OF ABBREVIATIONS

BA	Biological Assessment
BPA	Bonneville Power Administration
CFR	Code of Federal Regulations
cfs	Cubic feet per second
CHART	Critical Habitat Analytical Review Team
EFH	Essential Fish Habitat
ELJ	Engineered log jam
ESA	Endangered Species Act
FR	Federal Register
HAPC	Habitat Area of Particular Concern
HIP	Habitat Improvement Program
HUC	Hydraulic Unit Code
LCR	Lower Columbia River
LW	Large wood
LWR	Lower Willamette River
MCR	Middle Columbia River
MSA	Magnuson Stevens Act
NMFS	National Marine Fisheries Service
OC	Oregon Coast
PCE	Primary constituent element
PNF	Project notification form
RM	River Mile
RPM	Reasonable and prudent measure
RRT	Restoration Review Team
SR	Snake River
SRB	Snake River Basin
TRT	Technical Review Team
UCR	Upper Columbia River
U.S.C.	United States Code
UWR	Upper Willamette River
VSP	Viable Salmonid Population
WLC	Willamette/Lower Columbia

1. INTRODUCTION

This Introduction section provides information relevant to the other sections of this document and is incorporated by reference into Sections 2 and 3 below.

1.1 Background

The programmatic biological opinion (opinion) and incidental take statement portions of this document were prepared by the National Marine Fisheries Service (NMFS) in accordance with section 7(b) of the Endangered Species Act (ESA) of 1973, as amended (16 U.S.C. 1531, *et seq*.), and implementing regulations at 50 CFR 402.

The NMFS also completed an Essential Fish Habitat (EFH) consultation. It was prepared in accordance with section 305(b)(2) of the Magnuson-Stevens Fishery Conservation and Management Act (MSA) (16 U.S.C. 1801, *et seq*.) and implementing regulations at 50 CFR 600.

The opinion and EFH conservation recommendation are both in compliance with section 515 of the Treasury and General Government Appropriations Act of 2001 (Public Law 106-5444) ("Data Quality Act") and underwent pre-dissemination review.

1.2 Consultation History

On July 2, 2012, the Bonneville Power Administration (BPA), requested formal consultation on the implementation of its Habitat Improvement Program (HIP III). The NMFS received a final biological assessment (BA) on July 3, 2012, and received revised conservation measures on November 21, 2012. The BPA funds the implementation of about 500 fish and wildlife projects a year. The projects include repairing and improving fish spawning habitat, studying fish diseases, supplementing fish populations, resident fish mitigation, and protecting and improving wildlife habitat. The fish and wildlife habitat improvement projects funded by BPA are the focus of this consultation. The BPA funds these projects in fulfillment of its obligations under two auspices: The Northwest Power and Conservation Council's Columbia River Basin Fish and Wildlife Program, and the various Biological Opinions issued to BPA including the 2008 opinion addressing the operation and maintenance of the Federal Columbia River Hydropower System (FCRPS).

NMFS has issued two previous opinions and EFH consultations for BPA-funded habitat improvement activities. On August 1, 2003, NMFS issued a programmatic opinion and EFH consultation (refer to NMFS No. NWR-2003-750) for BPA's Habitat Improvement Program (HIP I). A total of 310 project activities were funded and implemented under the HIP I opinion (one project approval may have involved more than one activity category). The most commonly funded activities were (in descending order): vegetation management by herbicide use; fish passage activities; remove, consolidate or improve irrigation diversion dams; vegetation planting; stream channel and floodplains; and upland surveys/installation of stream monitoring devices.

In 2005, NMFS re-designated critical habitat for 11 salmon and steelhead species in the Columbia River Basin. The original critical habitat designations for these species were withdrawn in response to a lawsuit settled in 2002. The HIP I opinion did not consider critical habitat for these species. Therefore, on June 21, 2007, the BPA submitted a new BA and re-initiated formal consultation for the HIP, updating the list of activities, and requesting that consultation include an analysis of designated critical habitat. NMFS issued a second opinion for BPA's Habitat Improvement Program, called HIP II, on January 10, 2008 (refer to NMFS No.: NWR-2007-3996). The HIP II opinion had an expiration date of December 31, 2012.

Beginning in 2010, BPA created a quality control process to review all HIP documents prior to submission to NMFS to improve consistency, and thus more detailed implementation information is available from 2010 forward. Under HIP II, 753 project activities were funded and implemented (again, one project may have involved more than one activity category). Of these, 263 were vegetation management projects, with a total of 23,887 acres treated with herbicides (primarily eastern Oregon, eastern Washington, and Idaho); of these, 3,186 acres were within riparian areas. Other common activities, in descending order, were installing habitat-forming natural materials and instream structures; fish passage (maintain facilities and improve passage); and replace bridges, culverts, and fords. Table 1 provides information on the total number of projects that were covered under HIP II by activity category and subcategory.

Table 1. Total number of projects that were covered under HIP II by activity category and subcategory, from 2008 through April 30, 2012.

Category of Activity	Sub-Category of Activity	No. of Projects
Surveying, Construction, Operation and Maintenance Activities		136
Planning and habitat protection actions (78)	Survey stream channels, floodplain, & uplands; install stream monitoring	0
	Devices such as streamflow & temperature monitors	57
	Acquire fee-title easement, enter cooperative agreements, lease land, &/or water	6
	Protect streambanks using bioengineering methods	15
Small-scale Instream Habitat Actions (110)	Install habitat-forming natural materials instream structures	43
	Improve secondary channel habitats	17
	Create, rehabilitate, & enhance riparian & wetland habitat	16
	Improve fish passage	34
	Supplement in-channel nutrients	0
Livestock Impact Reduction (55)	Construct fencing for grazing control	29
	Install off-channel watering facilities	22
	Harden fords for livestock crossing of streams	4
Control of Soil Erosion from Upland Farming (28)	Create upland conservation buffers	2
	Implement conservation cropping systems	0
	Stabilize soils via planting and seeding	16
	Implement erosion control practices	10
Irrigation and Water Delivery/Management Actions (35)	Convert delivery system to drip or sprinkler irrigation	1
	Convert water conveyance from open ditch to pipeline, line leaking ditches and canals	8
	Convert from instream diversions to groundwater wells for primary water sources	5
	Install or upgrade/maintain existing fish screens	9
	Consolidate diversions, replace irrigation diversion with pump station, remove diversion	9
	Install or replace return flow cooling systems	1
	Install irrigation water siphon beneath waterway	2
Native Plant Community Establishment and Protection (321)	Plant vegetation	58
	Manage vegetation using physical controls	43
	Manage vegetation using herbicides	220
Road Actions (45)	Maintain roads	13
	Maintain, remove, and replace bridges, culverts and fords	27
	Decommission roads	5
Special Actions (2)	Install/develop wildlife structures	2

Despite the increased number of activities implemented under the terms and conditions of the HIP II opinion, the amount of take (capture and mortality) was far less than what was authorized by NMFS in HIP II (capture of a maximum of 5,000 listed salmon and steelhead per year, with 5% lethal take allowed). From the beginning of 2008 through April 30, 2012, a total of 1,306 fish were captured, and 8 of those fish died.

A complete record of this consultation is on file at the Habitat Conservation Division Office in Portland, Oregon.

1.3 Proposed Action

The BPA proposes to implement its HIP in the Columbia River Basin and along the Oregon Coast within the range of the Oregon Coast coho salmon, under the Pacific Northwest Electric Power Planning and Conservation Act of 1980 (Public Law 96-501) to mitigate for the effects of the Federal Columbia River Power System on fish, wildlife, and their habitat.

1.3.1 Summary of Changes from the Previous HIP II Opinion

The HIP III is a reorganization and expansion of the original HIP II activity categories. By using existing opinions on similar restoration-based programmatic actions, BPA has taken advantage of existing successful approaches to promote regional consistency in design criteria for similar project types. The documents used include: U.S. Fish and Wildlife Service (USFWS) Partners for Fish and Wildlife, U.S. Forest Service (USFS) – Bureau of Land Management (BLM) Aquatic Restoration Biological Opinion (ARBO 1), USFS - BLM Aquatic Restoration Biological Opinion (ARBO 2 Draft BA), NOAA Restoration Center's Biological Opinion, U.S. Army Corps of Engineers (USACE) Standard Local Operating Procedures for Endangered Species (SLOPES IV) (Restoration and Transportation) (in Oregon), USACE Washington State Fish Passage and Habitat Enhancement Restoration Programmatic Consultation , and the BPA HIP II opinion (NWR-2007-3996). Using criteria, conservation measures, and language from these existing programs, BPA has added activities that are new to HIP such as piling removal, low flow consolidation, headcut and grade stabilization, boulder structures, engineered logjams, and channel reconstruction.

BPA has proposed to form an internal restoration review team (RRT) of technical experts who shall provide a design review of each moderate to high-risk project in accordance with design complexity and significance. This is a new internal quality assurance/quality control (QA/QC) process at BPA whose role is to define high, medium, and low risk project types, and then provide additional review on medium and higher risk projects. This process is described in detail in Appendix C of the BA. The RRT structure will include a Team leader, Core Team members, Technical Team members, and representatives from NMFS and/or USFWS. The RRT will evaluate projects to (a) ensure consistency between projects, (b) maximize ecological benefits of restoration and recovery projects, and (c) ensure consistent use and implementation throughout the geographic area covered by the opinions.

Although the RRT will play an important role in evaluating habitat improvement projects, there is some uncertainty associated with their review process. In order to account for this uncertainty, we analyzed the effects of carrying out projects as described by the proposed activity categories with application of the general and activity-specific conservation measures. We did not assume the RRT review process would result in a further reduction of the short-term adverse effects of any particular project. Our evaluation of the beneficial effects of the proposed actions is based on scientific literature and our past experience with similar types of actions. We did not assume the RRT review would maximize the beneficial effects of any particular project.

In addition, through HIP III, BPA has requested consultation for the following new species and their critical habitat: Oregon Coast coho salmon, Pacific Eulachon, Green Sturgeon, Steller sea lion, and proposed critical habitat for Lower Columbia River coho salmon. The geographic coverage has been expanded beyond the Columbia Basin to include the Oregon Coast north of Cape Blanco.

1.3.2 Categories of Actions

BPA proposes to fund eight categories of restoration actions under HIP III (Table 2).

Table 2. The categories and activities that BPA proposes to fund under HIP III.

Category		**Activities**
1. Fish Passage Restoration	a. Profile Discontinuities	Dams, water control or legacy structure removal
		Consolidate, or Replace Existing Irrigation Diversions
		Headcut and Grade Stabilization
		Low Flow Consolidation
		Providing Fish Passage at an Existing Facility
	b. Fish Passage Restoration/ Transportation Infrastructure	Bridge and Culvert Removal or Replacement
		Bridge and Culvert Maintenance
		Installation of Fords
2. River, Stream, Floodplain, and Wetland Restoration		Improve Secondary Channel and Wetland Habitats
		Set-back or Removal of Existing, Berms, Dikes, and Levees
		Protect Streambanks Using Bioengineering Methods
		Install Habitat-Forming Natural Material Instream Structures (Large Wood, Boulders, and Spawning Gravel)
		Riparian Vegetation Planting
		Channel Reconstruction
3. Invasive and Non-Native Plant Control		Manage Vegetation using Physical Controls
		Manage Vegetation using Herbicides
4. Piling Removal		
5. Road and Trail Erosion Control, Maintenance, and Decommissioning		Maintain Roads
		Decommission Roads
6. In-channel Nutrient Enhancement		
7. 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 or Canals
		Convert from Instream Diversions to Groundwater Wells for Primary Water Sources
		Install or Replace Return Flow Cooling Systems
		Install Irrigation Water Siphon Beneath Waterway

Category		Activities
		Livestock Watering Facilities
		Install New or Upgrade/Maintain Existing Fish Screens
8. Fisheries, Hydrologic, and Geomorphologic Surveys		

1.3.3 Program Administration

1. **Project Review**. To ensure compliance with this opinion, BPA environmental compliance staff will individually review each action using the existing Form 1 and Form 2 from the HIP II program. BPA will notify the project sponsor if they need to complete the Project Notification Form (PNF). Based on information provided on the PNF, BPA will determine whether the project needs RRT review (see section 1.13.1 above), based on level of risk for the project category or design considerations. If RRT review is triggered, then procedures described in Appendix C of the BA must be followed by the project sponsor.

2. **Project Notification**. The BPA will submit a project notification form (Appendix A of the BA) to NMFS no later than 30 days before beginning in-water work on any action that will be funded or carried under this program. Appendix A of the BA describes BPA's internal standard operating procedures for submission and content of those email notifications. Environmental leads on the contract will submit completed forms to a BPA HIP reporting mailbox for QA/QC. The BPA mailbox manager will check forms before forwarding to NMFS (hip.nwr@noaa.gov) for approval.

3. **Variance Requests.** Because of the wide range of proposed activities and the natural variability within and between stream systems, BPA (on behalf of the applicant) may require variations from criteria specified herein. NMFS will consider granting variances, especially when there is a clear conservation benefit or there are no additional adverse effects (especially incidental take) beyond that covered by the opinion. Minor variances can be authorized by the NMFS Branch Chief.

   Variance requests may be submitted and approved by email correspondence and will include:
   1) Name and brief description of project, location of project and 6th field HUC number.
   2) Define the requested variance and the relevant criterion by page number.
   3) Current environmental conditions (current flow and weather conditions).
   4) Biological justification as to why a variance is necessary and a brief rationale why the variance will either provide a conservation benefit or, at a minimum, not cause additional adverse effects beyond the scope of the Opinion
   5) Include as attachments any necessary approvals by state agencies.

4. **Documentation** (to be posted onsite by the contractor in a location visible to the public)

   1) Name(s), phone number(s), and address(es) of the person(s) responsible for oversight.

2) A description of hazardous materials that will be used, including inventory, storage, and handling procedures.
3) Procedures to contain and control a spill of any hazardous material generated, used or stored on-site, including notification of proper authorities.
4) A standing order to cease work in the event of high flows except as necessary to minimize resource damage (above those addressed in the design and implementation plans) or exceedance of take or water quality limitations.

5. **Inspections and Monitoring**. Project sponsor staff or their designated representative will provide implementation monitoring to ensure compliance with this biological opinion, including:
   a) General conservation measures and project design criteria are adequately followed; and
   b) Effects to ESA-listed species are not greater than predicted and take limitations are not exceeded.

6. **Annual Program Report**. BPA requires project notifications via email for each set of contract actions implemented. Appendix A of the BA describes BPA's internal standard operating procedures for submission and content of those email notifications. Environmental leads on the contract will submit completed forms to a BPA HIP reporting mailbox for QA/QC. The BPA mailbox manager will check forms before forwarding to NMFS (hip.nwr@noaa.gov) for approval. There are two standard reporting forms: the project notification form and the project completion form (which includes fish capture/mortality information). All activities that require a site rehabilitation plan will be monitored for a period of five years of the activity to ensure that the performance standards of the plan are being met.

   In addition, BPA will host an annual meeting and provide an annual monitoring report to NMFS by April 15 each year that describes BPA's efforts to carry out the HIP.

1.3.4 General Conservation Measures Applicable to all Actions

The activities covered under this consultation are intended to protect and restore fish and wildlife habitat with long-term benefits to ESA-listed species. However, project construction activities have short-term adverse effects to ESA-listed species and their critical habitats. To minimize these short-term adverse effects and make them predictable for purposes of programmatic analysis, BPA proposes the following general conservation measures for use as applicable to each project.

7. **Project Design and Site Preparation**

1) Climate change. Current regional climate change projections, such as changes in flow magnitude and duration, will be considered during project design for the life of the project.

2) State and Federal Permits. All applicable regulatory permits and official project authorizations will be obtained before project implementation. These permits and authorizations include, but are not limited to, National Environmental Policy Act, National Historic Preservation Act, and the appropriate state agency removal and fill permit, Army Corps of Engineers 404 permits, and associated 401 water quality certifications.

3) Timing of in-water work. Appropriate state (Oregon Department of Fish and Wildlife (ODFW)[2], Washington Department of Fish and Wildlife (WDFW), or Idaho Department of Fish and Game (IDFG), guidelines for timing of in-water work windows (IWW) will be followed[3]. The need for isolation and dewatering will also be evaluated when determining the appropriate IWW for the species affected.
    a) Exceptions to ODFW, WDFW, or IDFG, in-water work windows will be processed using the **Variance** procedures on the previous page.

4) Contaminants. The project sponsor will complete a site assessment with the following elements to identify the type, quantity, and extent of any potential contamination for any action that involves excavation of more than 20 cubic yards of material:
    a) A review of available records, such as former site use, building plans, and records of any prior contamination events;
    b) A site visit to inspect the areas used for various industrial processes and the condition of the property;
    c) Interviews with knowledgeable people, such as site owners, operators, and occupants, neighbors, or local government officials; and
    d) A summary, stored with the project file, that includes an assessment of the likelihood that contaminants are present at the site, based on items 3(a) through 3(c).

5) Site layout and flagging. Prior to construction, the action area will be clearly flagged to identify the following:
    a) Sensitive resource areas, such as areas below ordinary high water, spawning areas, springs, and wetlands;
    b) Equipment entry and exit points;
    c) Road and stream crossing alignments;
    d) Staging, storage, and stockpile areas; and
    e) No-spray areas and buffers.

6) Temporary access roads and paths.

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[2] NMFS does not allow in-water work during the ODFW winter work window for the Willamette River downstream of Willamette Falls, i.e., Dec 1 to Jan 31.

[3] ODFW (Oregon Department of Fish and Wildlife) 2008. Oregon guidelines for timing of in-water work to protect fish and wildlife resources. Available at: http://www.dfw.state.or.us/lands/inwater/Oregon_Guidelines_for_Timing_of_%20InWater_work2008.pdf

WDFW (Washington Department of Fish and Wildlife) 2010. Times when spawning or incubating salmonids are least likely to be within Washington state freshwaters. Available at: http://wdfw.wa.gov/licensing/hpa/freshwater_incubation_avoidance_times_28may2010.pdf

a) Existing access roads and paths will be preferentially used whenever reasonable, and the number and length of temporary access roads and paths through riparian areas and floodplains will be minimized to lessen soil disturbance and compaction, and impacts to vegetation.
b) Temporary access roads and paths will not be built on slopes where grade, soil, or other features suggest a likelihood of excessive erosion or failure. If slopes are steeper than 30%, then the road will be designed by a civil engineer with experience in steep road design.
c) The removal of riparian vegetation during construction of temporary access roads will be minimized. When temporary vegetation removal is required, vegetation will be cut at ground level (not grubbed).
d) At project completion, all temporary access roads and paths will be obliterated, and the soil will be stabilized and revegetated. Road and path obliteration refers to the most comprehensive degree of decommissioning and involves decompacting the surface and ditch, pulling the fill material onto the running surface, and reshaping to match the original contour.
e) Temporary roads and paths in wet areas or areas prone to flooding will be obliterated by the end of the in-water work window.

7) Temporary stream crossings.
   a) Existing stream crossings will be preferentially used whenever reasonable, and the number of temporary stream crossings will be minimized.
   b) Temporary bridges and culverts will be installed to allow for equipment and vehicle crossing over perennial streams during construction.
   c) Vehicles and machinery will cross streams at right angles to the main channel wherever possible.
   d) The location of the temporary crossing will avoid areas that may increase the risk of channel re-routing or avulsion.
   e) Potential spawning habitat (i.e., pool tailouts) and pools will be avoided to the maximum extent possible.
   f) No stream crossings will occur at active spawning sites, when holding adult listed fish are present, or when eggs or alevins are in the gravel. The appropriate state fish and wildlife agency will be contacted for specific timing information.
   g) After project completion, temporary stream crossings will be obliterated and the stream channel and banks restored.

8) Staging, storage, and stockpile areas
   a) Staging areas (used for construction equipment storage, vehicle storage, fueling, servicing, and hazardous material storage) will be 150-feet or more from any natural water body or wetland, or on an adjacent, established road area in a location and manner that will preclude erosion into or contamination of the stream or floodplain.
   b) Natural materials used for implementation of aquatic restoration, such as large wood, gravel, and boulders, may be staged within the 100-year floodplain.
   c) Any large wood, topsoil, and native channel material displaced by construction will be stockpiled for use during site restoration at a specifically identified and flagged area.

d) Any material not used in restoration, and not native to the floodplain, will be removed to a location outside of the 100-year floodplain for disposal.

9) Equipment. Mechanized equipment and vehicles will be selected, operated, and maintained in a manner that minimizes adverse effects on the environment (e.g., minimally-sized, low pressure tires; minimal hard-turn paths for tracked vehicles; temporary mats or plates within wet areas or on sensitive soils). Gas-powered equipment with tanks larger than 5 gallons will be refueled in a vehicle staging area placed 150-feet or more from a natural waterbody or wetland, or in an isolated hard zone, such as a paved parking lot or adjacent, established road. All vehicles and other mechanized equipment will be:
   a) Stored, fueled, and maintained in a vehicle staging area placed 150-feet or more from any natural water body or wetland or on an adjacent, established road area;
   b) Inspected daily for fluid leaks before leaving the vehicle staging area for operation within 150-feet of any natural water body or wetland; and
   c) Thoroughly cleaned before operation below ordinary high water, and as often as necessary during operation, to remain grease free.

10) Erosion control. Erosion control measures will be prepared and carried out, commensurate in scope with the action, that may include the following:
   a) Temporary erosion controls will be in place before any significant alteration of the action site and appropriately installed downslope of project activity within the riparian buffer area until site rehabilitation is complete.
      i) If there is a potential for eroded sediment to enter the stream, sediment barriers will be installed and maintained for the duration of project implementation.
      ii) Temporary erosion control measures may include fiber wattles, silt fences, jute matting, wood fiber mulch and soil binder, or geotextiles and geosynthetic fabric.
      iii) Soil stabilization utilizing wood fiber mulch and tackifier (hydro-applied) may be used to reduce erosion of bare soil if the materials are noxious weed free and nontoxic to aquatic and terrestrial animals, soil microorganisms, and vegetation.
      iv) Sediment will be removed from erosion controls once it has reached 1/3 of the exposed height of the control.
      v) Once the site is stabilized after construction, temporary erosion control measures must be removed.
   b) Emergency erosion controls will be available at the work site and include the following:
      i) A supply of sediment control materials; and
      ii) An oil-absorbing floating boom whenever surface water is present.

11) Dust abatement. The project sponsor will determine the appropriate dust control measures (if necessary) by considering soil type, equipment usage, prevailing wind direction, and the effects caused by other erosion and sediment control measures. In addition, the following criteria will be followed:
   a) Work will be sequenced and scheduled to reduce exposed bare soil subject to wind erosion.

b) Dust-abatement additives and stabilization chemicals (typically magnesium chloride, calcium chloride salts, or ligninsulfonate) will not be applied within 25-feet of water or a stream channel and will be applied so as to minimize the likelihood that they will enter streams. Applications of ligninsulfonate will be limited to a maximum rate of 0.5 gallons per square yard of road surface, assuming a 50:50 (ligninsulfonate to water) solution.
c) Application of dust abatement chemicals will be avoided during or just before wet weather, and at stream crossings or other areas that could result in unfiltered delivery of the dust abatement materials to a waterbody (typically these would be areas within 25-feet of a waterbody or stream channel; distances may be greater where vegetation is sparse or slopes are steep).
d) Spill containment equipment will be available during application of dust abatement chemicals.
e) Petroleum-based products will not be used for dust abatement.

12) Spill prevention, control, and countermeasures. The use of mechanized machinery increases the risk for accidental spills of fuel, lubricants, hydraulic fluid, or other contaminants into the riparian zone or directly into the water. Additionally, uncured concrete and form materials adjacent to the active stream channel may result in accidental discharge into the water. These contaminants can degrade habitat, and injure or kill aquatic food organisms and ESA-listed species. The project sponsor will adhere to the following measures:
a) A description of hazardous materials that will be used, including inventory, storage, and handling procedures will be available on-site.
b) Written procedures for notifying environmental response agencies will be posted at the work site.
c) Spill containment kits (including instructions for cleanup and disposal) adequate for the types and quantity of hazardous materials used at the site will be available at the work site.
d) Workers will be trained in spill containment procedures and will be informed of the location of spill containment kits.
e) Any waste liquids generated at the staging areas will be temporarily stored under an impervious cover, such as a tarpaulin, until they can be properly transported to and disposed of at a facility that is approved for receipt of hazardous materials.

13) Invasive species control. The following measures will be followed to avoid introduction of invasive plants and noxious weeds into project areas:
a) Prior to entering the site, all vehicles and equipment will be power washed, allowed to fully dry, and inspected to make sure no plants, soil, or other organic material adheres to the surface.
b) Watercraft, waders, boots, and any other gear to be used in or near water will be inspected for aquatic invasive species.

8. Construction Conservation Measures

1) Work Area Isolation & Fish Salvage.
   a) Any work area within the wetted channel will be isolated from the active stream whenever ESA-listed fish are reasonably certain to be present, or if the work area is less than 300 feet upstream from active spawning habitats.
   b) When work area isolation is required, engineering design plans will include all isolation elements, fish release areas, and, when a pump is used to dewater the isolation area and fish are present, a fish screen that meets NMFS's fish screen criteria (NMFS 2011c, or most current).
   c) Work area isolation and fish capture activities will occur during periods of the coolest air and water temperatures possible, normally early in the morning versus late in the day, and during conditions appropriate to minimize mortality for the species present.
   d) Salvage operations shall follow the ordering, methodologies, and conservation measures specified below in Steps 1 through 6. Steps 1 and 2 will be implemented for all projects where work area isolation is necessary according to condition 1(a) above. Electrofishing (Step 3) can be implemented to ensure all fish have been removed following Steps 1 and 2, or when other means of fish capture may not be feasible or effective. Dewatering and rewatering (Steps 4 and 5) will be implemented unless wetted in-stream work is deemed to be minimally harmful to fish, and is beneficial to other aquatic species. Dewatering will not be conducted in areas occupied by lamprey, unless lampreys are salvaged using guidance set forth in "USFWS Best Management Practices to Minimize Adverse Effects to Pacific Lamprey".
      i) **Step 1: Isolate**
         (1) Block nets will be installed at up and downstream locations and maintained in a secured position to exclude fish from entering the project area.
         (2) Nets will be secured to the stream channel bed and banks until fish capture and transport activities are complete.
         (3) If block nets or traps remain in place more than one day, the nets and traps will be monitored at least daily to ensure they are secured to the banks and free of organic accumulation, and to minimize fish predation in the trap.
         (4) Nets and traps will be monitored hourly anytime there is instream disturbance.
      ii) **Step 2: Salvage –** As described below, fish trapped within the isolated work area will be captured to minimize the risk of injury, then released at a safe site:
         (1) Fish will be collected by hand or dip nets, as the area is slowly dewatered.
         (2) Seines with a mesh size to ensure entrapment of the residing ESA-listed fish will be used.
         (3) Minnow traps will be left in place overnight and used in conjunction with seining.
         (4) If buckets are used to transport fish:
            (a) The time fish are in a transport bucket will be limited, and will be released as quickly as possible;
            (b) The number of fish within a bucket will be limited based on size, and fish will be of relatively comparable size to minimize predation;
            (c) Aerators for buckets will be used or the bucket water will be frequently changed with cold clear water at 15 minute or more frequent intervals.
            (d) Buckets will be kept in shaded areas or will be covered by a canopy in exposed areas.

(e) Dead fish will not be stored in transport buckets, but will be left on the stream bank to avoid mortality counting errors.

(5) As rapidly as possible (especially for temperature-sensitive bull trout), fish will be released in an area that provides adequate cover and flow refuge. Upstream release is preferred, but fish released downstream will be sufficiently outside of the influence of construction.

(6) Salvage will be supervised by a qualified fisheries biologist experienced with work area isolation and competent to ensure the safe handling of all fish.

iii) **Step 3: Electrofishing –** Electrofishing will be used only after other salvage methods have been employed or when other means of fish capture may not be feasible or effective. If electrofishing will be used to capture fish for salvage, the salvage operation will be led by an experienced fisheries biologist and the following guidelines will be followed:

(1) The NMFS' electrofishing guidelines[4] will be used

(2) Only direct current (DC) or pulsed direct current (PDC) will be used.

(a) If conductivity is less than 100 µs, voltage ranges from 900 to 1100 v. will be used;

(b) For conductivity ranges between 100 to 300 µs, voltage ranges will be 500 to 800 v.;

(c) For conductivity greater than 300 µs, voltage will be less than 400 v.

(3) Electrofishing will begin with a minimum pulse width and recommended voltage and then gradually increase to the point where fish are immobilized.

(4) The anode will not intentionally contact fish while the current is being emitted.

(5) If mortality or obvious injury (defined as dark bands on the body, spinal deformations, de-scaling of 25% or more of body, and torpidity or inability to maintain upright attitude after sufficient recovery time) occurs during electrofishing, operations will be immediately discontinued, machine settings, water temperature and conductivity checked, and procedures adjusted or postponed to reduce mortality.

iv) **Step 4: Dewater –** Dewatering, when necessary, will be conducted over a sufficient period of time to allow species to naturally migrate out of the work area.

(1) Diversion around the construction site may be accomplished with a coffer dam and an associated pump, a by-pass culvert or pipe, or a lined, non-erodible diversion ditch.

(2) All pumps will have fish screens to avoid juvenile fish entrainment, and will be operated in accordance with current NMFS fish screen criteria (NMFS 2011, or most recent version). If the pumping rate exceeds 3 cfs, a NMFS Hydro Division fish passage review will be necessary.

(3) Dissipation of flow energy at the bypass outflow will be provided to prevent damage to riparian vegetation or stream channel.

(4) Safe reentry of fish into the stream channel will be provided, preferably into pool habitat with cover, if the diversion allows for downstream fish passage.

(5) Seepage water will be pumped to a temporary storage and treatment site or into upland areas to allow water to percolate through soil or to filter through vegetation prior to reentering the stream channel.

[4] NMFS 2000 - http://www.nwr.noaa.gov/ESA-Salmon-Regulations-Permits/4d-Rules/upload/electro2000.pdf

v) **Step 5: Re-watering –** Upon project completion, the construction site will be slowly re-watered to prevent loss of surface flow downstream and to prevent a sudden increase in stream turbidity. During re-watering, the site will be monitored to prevent stranding of aquatic organisms below the construction site.

vi) **Step 6: Salvage Notice –** Once salvage operations are completed, a salvage report will document procedures used, any fish injury or mortality (including numbers of fish affected), and a description of the causes for mortality, as required on the reporting form.

2) Fish passage. Fish passage will be provided for any adult or juvenile fish likely to be present in the action area during construction, unless passage did not exist before construction or the stream is naturally impassable at the time of construction. If the provision of temporary fish passage during construction will result in increased negative impacts to aquatic species of interest or their habitat, a variance can be requested from the NMFS Branch Chief and the USFWS Field Office Supervisor. Pertinent information, such as the species affected, length of stream reach affected, proposed time for the passage barrier, and alternatives considered, will be included in the variance request. After construction, adult and juvenile passage that meets NMFS' fish passage criteria (NMFS 2011c) will be provided for the life of the action.

3) Construction and discharge water.
   a) Surface water may be diverted to meet construction needs, but only if developed sources are unavailable or inadequate.
   b) Diversions will not exceed 10% of the available flow.
   c) All construction discharge water will be collected and treated using the best available technology applicable to site conditions.
   d) Treatments to remove debris, nutrients, sediment, petroleum hydrocarbons, metals and other pollutants likely to be present will be provided.

4) Minimize time and extent of disturbance. Earthwork (including drilling, excavation, dredging, filling and compacting) in which mechanized equipment is in stream channels, riparian areas, and wetlands will be completed as quickly as possible. Mechanized equipment will be used in streams only when project specialists believe that such actions are the only reasonable alternative for implementation, or would result in less sediment in the stream channel or damage (short- or long-term) to the overall aquatic and riparian ecosystem relative to other alternatives. To the extent feasible, mechanized equipment will work from the top of the bank, unless work from another location would result in less habitat disturbance.

5) Cessation of work. Project operations will cease under the following conditions:
   a) High flow conditions that may result in inundation of the project area, except for efforts to avoid or minimize resource damage;
   b) When allowable water quality impacts, as defined by the 401 water quality certification, have been exceeded.

9. Post-construction Conservation Measures

1) Site restoration. When construction is complete:
   a) All streambanks, soils, and vegetation will be cleaned up and restored as necessary using stockpiled large wood, topsoil, and native channel material.
   b) All project related waste will be removed.
   c) All disturbed areas will be rehabilitated in a manner that results in similar or improved conditions relative to pre-project conditions. This will be achieved through redistribution of stockpiled materials, seeding, and/or planting with local native seed mixes or plants.

2) Revegetation. Long-term soil stabilization of the disturbed site will be accomplished with reestablishment of native vegetation using the following criteria:
   a) Planting and seeding will occur prior to or at the beginning of the first growing season after construction.
   b) An appropriate mix of species that will achieve establishment, shade, and erosion control objectives, preferably forb, grass, shrub, or tree species native to the project area or region and appropriate to the site will be used.
   c) Vegetation, such as willow, sedge and rush mats, will be salvaged from disturbed or abandoned floodplains, stream channels, or wetlands to be replanted during site restoration.
   d) Invasive species will not be used.
   e) Short-term stabilization measures may include the use of non-native sterile seed mix (when native seeds are not available), weed-free certified straw, jute matting, and other similar techniques.
   f) Surface fertilizer will not be applied within 50-feet of any stream channel, waterbody, or wetland.
   g) Fencing will be installed as necessary to prevent access to revegetated sites by livestock or unauthorized persons.
   h) Re-establishment of vegetation in disturbed areas will achieve at least 70% of pre-project conditions within 3-years.
   i) Invasive plants will be removed or controlled until native plant species are well-established (typically 3-years post-construction).

3) Site access. The project sponsor will retain the right of reasonable access to the site, such that the project sponsor can monitor the success over the life of the project.

4) Obliteration. When the project is completed, the contractor will obliterate all temporary access roads, crossings, and staging areas obliterated, and will stabilize the soils stabilized and revegetate. When necessary, loosen compacted areas, such as access roads, stream crossings, staging, and stockpile areas to allow for revegetation and improved infiltration.

The following is a description of the categories and sub-categories of activities that BPA proposes to fund.

1.3.5 Category 1. Fish Passage Restoration

The BPA proposes to review and fund fish passage projects for migrating ESA-listed salmonids. The objective of fish passage is to allow all life stages of salmonids access to historical habitat and focuses on restoring safe upstream and downstream fish passage to stream reaches that have become isolated by obstructions.

BPA grouped passage projects according to the effects and review requirements in the following subcategories: **Profile Discontinuities** and **Transportation Infrastructure**. These subcategories represent a logical break between transportation-related effects and effects due to physical fish barriers, classified by water velocity, water depth, and barrier height (profile discontinuities).

Subcategory-Profile Discontinuities
The BPA proposes to fund removal, modification, construction and maintenance of instream structures to improve fish passage. The objective of this activity category is to allow all life stages of ESA-listed salmonids access to historical habitats from which they have been excluded by non-functioning structures or instream profile discontinuities resulting from insufficient depth, or excessive jump heights and velocities.

The BPA proposes the following activities to improve fish passage: (a) Dams, water control or legacy structure removal; (b) consolidate, or replace existing irrigation diversions; (c) headcut and grade stabilization; (d) low flow consolidation; and (e) providing fish passage at an existing facility.

a. Dams, Water Control Structures, or Legacy Structures Removal
Description. BPA proposes to fund and review fish passage projects to restore more natural channel and flow conditions by removing dams, channel-spanning weirs, earthen embankments, subsurface drainage features, spillway systems, tide gate removals, outfalls, pipes, instream flow redirection structures (*e.g.*, drop structure, gabion, groin), or similar devices used to control, discharge, or maintain water levels.

Dams include instream structures that are no taller than 10 feet for streams with an active channel width of less than 50-feet and a slope less than 4%, or up to 16.4 feet tall and a slope greater than 4%.

If the structure being removed contains material (i.e. large wood, boulders) that is typically found within the stream or floodplain at that site, the material can be reused to improve habitat. Any such project must follow the design criteria outlined in the *Install Habitat-Forming Natural Material Instream Structures (Large Wood, Boulders, and Spawning Gravel)* activity category.

Guidelines for Review. The following proposed activities are considered ***low risk*** and will not require RRT review: subsurface drainage features, tide gates, outfalls, pipes, and instream flow redirection structures.

The following proposed removal activities for the following structures are considered ***medium*** to ***high risk*** and will require RRT and NMFS Hydro Division review: small dams, channel spanning weirs, earthen embankments and spillway systems.

Prior to going to the RRT, Medium to High Risk projects shall address the General Project and Data Summary Requirement Checklist (Appendix C of the BA) in addition to the following:

1) A longitudinal profile of the stream channel thalweg for 20 channel widths upstream and downstream of the structure shall be used to determine the potential for channel degradation.
2) A minimum of three cross-sections – one downstream of the structure, one through the reservoir area upstream of the structure, and one upstream of the reservoir area outside of the influence of the structure) to characterize the channel morphology and quantify the stored sediment.
3) Sediment characterization to determine the proportion of coarse sediment (>2mm) in the reservoir area.
4) A survey of any downstream spawning areas that may be affected by sediment released by removal of the water control structure or dam. Reservoirs with a d35 greater than 2 mm (i.e., 65% of the sediment by weight exceeds 2 mm in diameter) may be removed without excavation of stored material, if the sediment contains no contaminants; reservoirs with a d35 less than 2 mm (i.e., 65% of the sediment by weight is less than 2 mm in diameter) will require partial removal of the fine sediment to create a pilot channel, in conjunction with stabilization of the newly exposed streambanks with native vegetation.

Conservation Measures.

1) Restore all structure bankline "keys" and fill in "key" holes with native materials as to restore contours of stream bank and floodplain. Compact the fill material adequately to prevent washing out of the soil during over bank flooding. Do not mine material from the stream channel to fill in "key" holes. When removal of buried (keyed) structures may result in significant disruption to riparian vegetation and/or the floodplain, consider leaving the buried structure sections within the streambank.
2) If the legacy structures (log, rock, or gabion weirs) were placed to provide grade control, evaluate the site for potential headcutting and incision due to structure removal by using the appropriate guidance.[5] If headcutting and channel incision are likely to occur due to structure removal, additional measures must be taken to reduce these impacts (see grade control options described under *Headcut and Grade Stabilization* activity category).

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[5] Castro, J. 2003. Geomorphologic Impacts of Culvert Replacement and Removal: Avoiding Channel Incision. Oregon Fish and Wildlife Office, Portland, OR. Available at: http://library.fws.gov/pubs1/culvert-guidelines03.pdf

Dichotomous Key to Evaluate the Potential for Stream Incision at Sites Being Considered for Culvert Replacement or Removal Projects, FWS, Lacey, WA

3) If the structure is being removed because it has caused an over-widening of the channel, consider implementing other HIP III restoration categories to decrease the width to depth ratio of the stream at that location to a level commensurate with representative upstream and downstream sections (within the same channel type).
4) Tide gates can only be removed not modified or replaced.

b. Consolidate, or Replace Existing Irrigation Diversions

Description. The BPA proposes to fund and review the consolidation or replacement of existing diversions with pump stations or engineered riffles (including rock structures) to reduce the number of diversions on streams and thereby conserve water and improve habitat for fish, improve the design of diversions to allow for fish passage and adequate screening, or reduce the annual instream construction of push-up dams and instream structures. Small instream rock structures that facilitate proper pump station operations are allowed when designed in association with the pump station. Infiltration galleries and lay-flat stanchions are not proposed within this action. Periodic maintenance of irrigation diversions will be conducted to ensure their proper functioning, *i.e*., cleaning debris buildup, and replacement of parts.

Unneeded or abandoned irrigation diversion structures will be removed where they are barriers to fish passage, have created unacceptable habitat modifications, or are causing sediment concerns through deposition behind the structure or downstream scour according to *Dams, Water Control Structures, or Legacy Structures Removal* section.

Guidelines for Review.
The following proposed activities are considered ***low risk*** and will not require RRT review: Irrigation diversion structures less than 3 feet tall that are to be removed only.

This proposed activity is considered ***medium*** to ***high risk*** and will require RRT and NMFS Hydro Division review: Irrigation diversion structures greater than 3 feet in height that are to be removed or replaced.

Prior to going to the RRT, medium to high risk projects shall address the General Project and Data Summary Requirements (Appendix C of the BA) in addition to the following:

1) A longitudinal profile of the stream channel thalweg for 20 channel widths upstream and downstream of the structure shall be used to determine the potential for channel degradation.
2) A minimum of three cross-sections – one downstream of the structure, one through the reservoir area upstream of the structure, and one upstream of the reservoir area outside of the influence of the structure) to characterize the channel morphology and quantify the stored sediment.

Conservation Measures.
1) Diversion structures will be designed to meet NMFS Anadromous Salmonid Passage Facility Design Guidelines (NMFS 2011c or most recent version).
2) Placement of rock structures or engineered riffles shall follow criteria outlined in the *Headcut and Grade Stabilization* activity category).

3) Diversions will be designed so that diverted water withdrawal is equal to or less than the irrigator's state water right, or equal to the current rate of diversion, whichever is less.
4) Project design will include the installation of a totalizing flow meter device on all diversions for which installation of this device is possible. A staff gauge or other device capable of measuring instantaneous flow will be utilized on all other diversions.
5) Multiple existing diversions may be consolidated into one diversion if the consolidated diversion is located at the most downstream existing diversion point unless sufficient low flow conditions are available to support unimpeded passage. The design will clearly identify the low flow conditions within the stream reach relative to the cumulative diverted water right. If instream flow conditions are proven favorable for fish passage and habitat use then diversion consolidation may occur at the upstream structure.
6) If low flow conditions coupled with diversion withdrawals result in impassable conditions for fish, then irrigation system efficiencies will be implemented with water savings committed to improve reach passage conditions.

c. Headcut and Grade Stabilization

Description. BPA proposes to fund and review the restoration of fish passage and grade control (i.e. headcut stabilization) with geomorphically appropriate structures constructed from rock or large wood (LW). Boulder structures and roughened channels may be installed for grade control at culverts, mitigate headcuts, and to provide passage at small dams or other channel obstructions that cannot otherwise be removed. For wood dominated systems, grade control engineered log jams (ELJs) should be considered as an alternative.

Grade control ELJs are designed to arrest channel downcutting or incision and retain sediment, lower stream energy, and increase water elevations to reconnect floodplain habitat and diffuse downstream flood peaks. Grade control ELJs also serve to protect infrastructure that is exposed by channel incision and to stabilize over-steepened banks. Unlike hard weirs or rock grade control structures, a grade control ELJ is a complex broadcrested structure that dissipates energy more gradually.

Guidelines for Review. The following proposed activities are considered ***low risk*** and will not require RRT review: Rock structures, roughened channels and grade control structures that are less than 18 inches in height and include all of the following conservation measures.

The proposed activities are considered ***medium*** to ***high risk*** and will require RRT and NMFS Hydro Division review: Rock structures, roughened channels and grade control structures that are above 18 inches in height.

Prior to submission to the RRT, medium to high risk projects shall address the General Project and Data Summary Requirements (Appendix C in the BA) in addition to the following:
1) A longitudinal profile of the stream channel thalweg for 20 channel widths upstream and downstream of the structure shall be used to determine the potential for channel degradation.

2) A minimum of three cross-sections – one downstream of the structure, one through the reservoir area upstream of the structure, and one upstream of the reservoir area outside of the influence of the structure) to characterize the channel morphology and quantify the stored sediment.

Conservation Measures.

1) All structures will be designed to the design benchmarks set in (NMFS 2011 or most recent version).
2) Construction of passage structures over dams is limited to dams of less than seven feet in height.
3) Construction of passage structures is limited to facilitate passage at existing diversion dams, not in combination with new dams.
4) Install rock structures low in relation to channel dimensions so that they are completely overtopped during channel-forming flow events (approximately a 1.5-year flow event).
5) Rock structures are to be placed diagonally across the channel or in more traditional upstream pointing "V" or "U" configurations with the apex oriented upstream. The apex should be lower than the structure wings to support low flow consolidation.
6) Rock structures are to be constructed to allow upstream and downstream passage of all native fish species and life stages that occur in the stream. This can be accomplished by providing plunges no greater than 6" in height, allowing for juvenile fish passage at all flows.
7) Key rock structures into the stream bed to minimize structure undermining due to scour, preferably at least 2.5x their exposure height. The structure should also be keyed into both banks, if feasible greater than 8 feet.
8) Include fine material in the structure material mix to help seal the structure/channel bed, thereby preventing subsurface flow. Geotextile material can be used as an alternative approach to prevent subsurface flow
9) Rock for structures shall be durable and of suitable quality to assure permanence in the climate in which it is to be used. Rock sizing depends on the size of the stream, maximum depth of flow, planform, entrenchment, and ice and debris loading
10) Full spanning rock structure placement shall be coupled with measures to improve habitat complexity (LW placement etc.) and protection of riparian areas.
11) The use of gabions, cable or other means to prevent the movement of individual boulders in a rock structure is not allowed.
12) If geomorphic conditions are appropriate, consideration should be given towards use of a roughened channel or constructed riffle to minimize the potential for future development of passage (jump height) barrier.
13) Headcut stabilization shall incorporate the following measures:
    a. Armor head-cut with sufficiently sized and amounts of material to prevent continued up-stream movement. Materials can include both rock and organic materials which are native to the area.
    b. Focus stabilization efforts in the plunge pool, the head cut, as well as a short distance of stream above the headcut.
    c. Minimize lateral migration of channel around head cut ("flanking") by placing rocks and organic material at a lower elevation in the center of the channel cross section to direct flows to the middle of channel.

d. Provide fish passage over a stabilized head-cut through a series of log or rock structures or a roughened channel.
e. Headcut stabilization structure will be constructed utilizing streambed simulation bed material, which will be washed into place until there is apparent surface flow and minimal subsurface material to ensure fish passage immediately following construction if natural flows are sufficient.
f. Structures will be constructed with stream simulation materials and fines added and pressure washed into the placed matrix. Successful washing will be determined by minimization of voids within placed matrix such that ponding occurs with little to no percolation losses to minimize low flow fish passage effects immediately following construction.

d. Low Flow Consolidation

Description. BPA proposes to fund and review projects that: (a) modify diffused or braided flow conditions that impede fish passage; (b) modify dam aprons with shallow depth (less than 10 inches); or (c) utilize temporary placement of sandbags, hay bales, and ecology blocks to provide depths and velocities passable to upstream migrants.

Land use practices such as large scale agriculture, including irrigation, and urban and residential development have drastically changed the hydrology of affected watersheds. Reduced forest cover and increased impervious surface have resulted in increased runoff and peak flows and in less aquifer recharge, resulting in increased frequency, duration and magnitude of summer droughts.

Guidelines for Review. All of the proposed activities under the *Low Flow Consolidation* activity category are considered ***medium*** to ***high risk*** and will both require RRT and NMFS Hydro Division review.

Prior to going to the RRT, medium to high risk projects shall address the General Project and Data Summary Requirements (Appendix C of the BA) in addition to the following measures.
Conservation Measures.

1) Fish Passage will be designed to the design benchmarks set in (NMFS 2011 or most recent version).
2) Conceptual Design Review process with NMFS Hydropower Division will be implemented.
3) All material placed in the stream to aid low flow fish passage will be removed when stream flows increase, prior to anticipated high flows that could wash consolidation measures away or cause flow to go around them.

e. Provide Fish Passage at an Existing Facility
Description. BPA proposes to fund and review projects that: (a) re-engineer improperly designed fish passage or fish collection facilities; (b) conduct periodic maintenance of fish passage or fish collection facilities to ensure proper functioning, *e.g*., cleaning debris buildup, replacement of parts; and (c) install a fish ladder at an existing facility.

Guidelines for Review. The following proposed activities are considered ***low risk*** and will not require RRT review: Periodic Maintenance of Fish passage or Fish Collection Facilities.

All of the other the proposed activities under *the Provide Fish Passage at an Existing Facility* activity category that are not upkeep and maintenance are considered ***medium*** to ***high risk*** and will require both RRT and NMFS Hydropower review.

Prior to going to the RRT, medium to high risk projects shall address the *General Project and Data Summary Requirements* (Appendix C of the BA) in addition to the following measures.

Conservation Measures.
1) Fish Passage will be designed to the design benchmarks set in (NMFS 2011c or most recent version).
2) Design consideration should be given for Pacific Lamprey passage.[6] Fish ladders that are primarily designed for salmonids are usually impediments to lamprey passage as they do not have adequate surfaces for attachment, velocities are often too high and there are inadequate places for resting. Providing for rounded corners, resting areas or providing a natural stream channel (stream simulation) or wetted ramp for passage over the impediment have been effective in facilitating lamprey passage.

Subcategory-Transportation Infrastructure

The BPA proposes to review and fund maintenance, removal, or replacement of bridges, culverts and fords to improve fish passage, prevent streambank and roadbed erosion, facilitate natural sediment and wood movement, and eliminate or reduce excess sediment loading.

The BPA proposes the following activities to improve fish passage: (a) Bridge and culvert removal or replacement; (b) bridge and culvert maintenance; and (c) installation of fords.

a. Bridge and Culvert Removal or Replacement
Description. For unimpaired fish passage it is desirable to have a crossing that is a larger than the channel bankfull width, allows for a functional floodplain, allows for a natural variation in bed elevation, and provides bed and bank roughness similar to the upstream and downstream channel.

In general, bridges will be the first choice for a site as opposed to culverts because bridges typically do not constrict a stream channel to as great a degree as culverts and usually allow for

[6] 2010 (USFWS) Best Management Practices to Minimize Adverse Effects to Pacific Lamprey. http://www.fws.gov/pacific/Fisheries/sphabcon/lamprey/pdf/Best%20Management%20Practices%20for%20Pacific%20Lamprey%20April%202010%20Version.pdf

vertical movement of the streambed. Bottomless culverts may provide a good alternative for fish passage where foundation conditions allow their construction and width criteria can be met.

Guidelines for Review. The following proposed activities are considered ***low risk*** and will not require RRT review: Culverts and bridges that meet all of the following conservation measures.

The following proposed activities are considered ***medium* to *high risk*** and will require RRT review: Culverts and bridges that do not meet all of the following conservation measures will require a RRT review and a variance from NMFS.

Prior to going to the RRT, medium to high risk projects shall address the General Project and Data Summary Requirements (Appendix C of the BA) in addition to the following:

1) Designs must demonstrate that the vertical and lateral stability of the stream channel are taken into consideration when designing a crossing.
2) Designs must demonstrate that culverts and bridges shall mimic the natural stream processes and allow for fish passage, sediment transport, and flood and debris conveyance.
3) An explanation of why a particular design was chosen with consideration to the following priority list: (a) Nothing – realign road to avoid crossing the stream. (b) bridge – new bridges will span the stream to allow for long-term dynamic channel stability. (c) streambed simulation – bottomless arch or embedded culvert.
4) Designs shall include site sketches, drawings, aerial photographs, or other supporting specifications, calculations, or information that is commensurate with the scope of the action, that show the active channel, the 100-year floodplain, the functional floodplain, any artificial fill within the project area, the existing crossing to be replaced, and the proposed crossing.
5) Designs must demonstrate that the crossings: (a) Avoid causing local scour of streambanks and reasonably likely spawning areas; (b) allow the fluvial transport of large wood, up to a site potential tree height in size, through the project area without becoming stranded on the bridge structure; (c) allow for likely channel migration patterns within the functional floodplain for the design life of the bridge; and otherwise align with well-defined, stable channels.

Conservation measures.

1) Stream crossings shall be designed to the design benchmarks set in (NMFS 2011 or most recent version) and restore floodplain function.
2) A crossing shall: (a) Maintain the general scour prism, as a clear, unobstructed opening (i.e., free of any fill, embankment, scour countermeasure, or structural material); (b) be a single span structure that maintains a clear, unobstructed opening above the general scour elevation that is at least as wide as 1.5 times the active channel width; or (c) be a multiple span structure that maintains a clear, unobstructed opening above the general scour elevation, except for piers or interior bents, that is at least as wide as 2.2 times the active channel width.[7] This criterion will restore any physical or biological processes associated with a fully functional floodplain that was degraded by the previous crossing.

[7] For guidance on how to complete bridge scour and stream stability analysis, see Lagasse *et al*. 2001a (HEC-20), Lagasse *et al*. 2001b (HEC-23), Richardson and Davis 2001 (HEC-18), ODOT 2005, and AASHTO 2007.

3) Bridge scour and stream stability countermeasures may be applied below the general scour elevation, however, except as described above in (2), no scour countermeasure may be applied above the general scour elevation.
4) Remove all other artificial constrictions within the functional floodplain of the project area as follows: (a) remove existing roadway fill, embankment fill, approach fill, or other fills; (b) install relief conduits through existing fill; (c) remove vacant bridge supports below total scour depth, unless the vacant support is part of the rehabilitated or replacement stream crossing; and (d) reshape exposed floodplains and streambanks to match upstream and downstream conditions.
5) If the crossing will occur within 300 feet of active spawning area, only full span bridges or streambed simulation will be used.
6) Projects in stream channels with gradients above six percent will utilize a bridge or if a bridge is determined to not be feasible, the crossing will be designed using the stream simulation option.
7) Culverts shall not be longer than: 150 feet for stream simulation, 75 feet for no-slope and 500 for any other option. Maximum culvert width shall be 20 feet, for widths greater than 20 feet a bridge will be used.
8) The proponent shall include suitable grade controls to prevent culvert failure caused by changes in stream elevation. Grade control structures to prevent headcutting above or below the culvert or bridge may be built using rock or wood as outlined in the *Headcut and Grade Stabilization* criteria under the **Profile Discontinuity** activity subcategory.

b. Bridge and Culvert Maintenance

Conservation measures:

1) Culverts will be cleaned by working from the top of the bank, unless culvert access using work area isolation would result in less habitat disturbance. Only the minimum amount of wood, sediment and other natural debris necessary to maintain culvert function will be removed; spawning gravel will not be disturbed.
2) All large wood, cobbles, and gravels recovered during cleaning will be placed downstream of the culvert.
3) Do all routine work in the dry. If necessary using work area isolation criteria outlined in the **General Conservation Measures Applicable to all Actions**.
4) Culverts or bridge abutments will not be filled with vegetation, debris, or mud.

c. Installation of Fords

Description. In many streams, crossings have degraded riparian corridors and in-stream habitat resulting in increased and chronic sedimentation and reduced riparian functions including shading and recruitment of LW. Fords will be installed to allow improved stream crossing conditions only. New fords shall not be installed when there was not a previously existing stream crossing.

Guidelines for Review. The following proposed activities are considered ***low risk*** and will not require RRT review: Fords that meet all of the following conservation measures.

The following proposed activities are considered ***medium* to *high risk*** and will require RRT review: Fords that do not meet all of the following conservation measures will require a RRT review and a variance from NMFS.

Prior to going to the RRT, medium to high risk projects shall address the General Project and Data Summary Requirements (Appendix C of the BA) in addition to the following:

1) Information detailing locations of ESA-listed salmonid spawning areas within the reach.
2) Designs must demonstrate that the ford 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.

Conservation Measures:

1) Stream crossings shall be designed to the design benchmarks set in (NMFS 2011c or most recent version).
2) The ford will not create barriers to the passage of adult and juvenile fish.
3) Ford stream crossings will involve the placement of river rock along the stream bottom.
4) Existing access roads or trails and stream crossings will be used whenever possible, unless new construction would result in less habitat disturbance and the old trail or crossing is retired.
5) The ford will not be located in an area that will result in disturbance or damage to a properly functioning riparian area.
6) Fords will be placed on bedrock or stable substrates whenever possible.
7) Fords will not be placed in areas where ESA-listed salmonids spawn or are suspected of spawning, or within 300 feet of such areas if spawning areas may be disturbed.
8) Bank cuts, if any, will be stabilized with vegetation, and approaches and crossings will be protected with river rock (not crushed rock) when necessary to prevent erosion.
9) Fords will have a maximum width of 20 feet.
10) Fences will be installed (or are already existing and functioning) along with all new fords to limit access of livestock to riparian areas. Fenced off riparian areas will be maximized and planted with native vegetation. Fences will not inhibit upstream or downstream movement of fish or significantly impede bedload movement. Where appropriate, construct fences at fords to allow passage of large wood and other debris.

1.3.6 Category 2. River, Stream, Floodplain and Wetland Restoration

The BPA proposes to review and fund river, stream, floodplain and wetland restoration actions with the objective to provide the appropriate habitat conditions required for foraging, rearing, and migrating ESA-listed salmonids.

Projects utilizing habitat restoration actions outlined within this activity category shall be linked to limiting factors identified within the appropriate sub-basin plan, recovery plan or shall be prioritized by recommended restoration activities identified within a localized region by a technical oversight and steering committee (i.e. the Columbia River Estuary). Individual projects may utilize a combination of the activities listed in the *River, Stream, Floodplain and Wetland Restoration* activity category.

The BPA proposes the following activities to improve fish passage: (a) Improve Secondary Channel and Wetland Habitats, (b) Set-back or Removal of Existing, Berms, Dikes, and Levees; (c) Protect Streambanks Using Bioengineering Methods; (d) Install Habitat-Forming Natural Material Instream Structures (Large Wood, Boulders, and Spawning Gravel); (e) Riparian Vegetation Planting; and (f) Channel Reconstruction.

a. Improve Secondary Channel and Wetland Habitats[8]

Description. The BPA proposes to review and fund projects that reconnect historical stream channels within floodplains, restore or modify hydrologic and other essential habitat features of historical river floodplain swales, abandoned side channels, spring-flow channels, wetlands, historical floodplain channels, and create new self-sustaining side channel habitats which are maintained through natural processes.

Actions include the improvement and creation of secondary channels, off channel habitats and wetlands to increase the available area and access to rearing habitat; increase hydrologic capacity to 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.

Reconnection of historical off- and side channels habitats that have been blocked includes: the removal of plugs, which impede water movement through off- and side-channels; excavating pools and ponds in the historic floodplain/channel migration zone to create connected wetlands; and reconnecting existing side channels with a focus on restoring fish access and habitat forming processes (hydrology, riparian vegetation). Wetland habits will be created to reestablish a hydrologic regime that has been disrupted by human activities, including functions such as water depth, seasonal fluctuations, flooding periodicity, and connectivity.

All activities intended for improving secondary channel habitats will provide the greatest degree of natural stream and floodplain function achievable and shall be implemented to address basin specified limiting factors. Up to two project adjustments, including adjusting the elevation of the created side channel habitat are included under this proposal. The long-term development of a restored side channel will depend on natural processes like floods and mainstem migration.

Guidelines for Review. Secondary channel and wetland habitats projects are considered ***medium to high*** risk and will require that all conservation measures are met in addition to RRT review. If all conservation measures cannot be met, then a variance and review from NMFS will be required.

Prior to going to the RRT, medium to high risk projects shall address the General Project and Data Summary Requirements (Appendix C of the BA) in addition to the following:

1) Designs must demonstrate a clear linkage to limiting factors identified within the appropriate sub-basin plan, recovery plan or recommendations by a technical oversight and steering committee within a localized region.

[8] For detailed descriptions of each technique refer to the WDFW Stream Habitat Restoration Guidelines: http://wdfw.wa.gov/publications/pub.php?id=00043

2) Evidence of historical channel location, such as land use surveys, historical photographs, topographic maps, remote sensing information, or personal observation.
3) If new side channel habitat is proposed, designs must demonstrate sufficient hydrology and that the project will be self-sustaining over time. Self-sustaining means the restored or created habitat would not require major or periodic maintenance, but function naturally within the processes of the floodplain.
4) Designs must demonstrate that the proposed action will mimic natural conditions for gradient, width, sinuosity and other hydraulic parameters.
5) Designs must demonstrate that the proposed action will not result in the creation of fish passage issues or post construction stranding of juvenile or adult fish.

Conservation Measures:

1) Off- and side-channel improvements can include minor excavation ($\leq$ 10%) of naturally accumulated sediment within historical channels. There is no limit as to the amount of excavation of anthropogenic fill within historic side channels as long as such channels can be clearly identified through field and/or aerial photographs.
2) Excavated material removed from off- or side-channels shall be hauled to an upland site or spread across the adjacent floodplain in a manner that does not restrict floodplain capacity. 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.
3) Excavation depth will never exceed the maximum thalweg depth in the main channel.
4) Restoration of existing side channels including one-time dredging and an up to two times project adjustment including adjusting the elevation of the created side channel habitat.
5) Side channel habitat will be constructed to prevent fish stranding by providing perennial flow through the constructed channel.
6) All side channel and pool habitat work will occur in isolation from waters occupied by ESA-listed salmonid species until project completion, at which time a final opening may be made by excavation to waters occupied by ESA-listed salmonid or water will be allowed to return into the area.
7) Adequate precautions will be taken to prevent the creation of fish passage issues or stranding of juvenile or adult fish.

b. Set-back or Removal of Existing Berms, Dikes, and Levees

Description. The BPA proposes to review and fund projects that reconnect estuary, stream and river channels with floodplains, increase habitat diversity and complexity, moderate flow disturbances, and provide refuge for fish during high flows by either removing existing berms, dikes or levees or increasing the distance that they are set back from active streams or wetlands. This action includes the removal of fill, such as dredge spoils from past channelization projects, road, trail, and railroad beds, dikes, berms, and levees to restore natural estuary and fresh-water floodplain functions. Such functions include overland flow during high flows, dissipation of flood energy, increased water storage to augment low flows, sediment and debris deposition, growth of riparian vegetation, nutrient cycling, and development of side channels and alcoves.

Only actions intended solely restoring floodplain and estuary functions or enhancing fish habitat are eligible. Covered actions in freshwater, estuarine, and marine areas include: 1) full and partial removal of levees, dikes, berms, and jetties; 2) breaching of levees, dikes and berms; 3) lowering of levees, dikes and berms; and 4) setback of levees, dikes and berms.

Guidelines for Review. Set-back or removal of existing berms, dikes, and levees projects are considered ***medium to high*** risk and will require that all conservation measures are met and will require RRT review. If all conservation measures cannot be met then a variance and review from NMFS will be required.

Prior to going to the RRT, medium to high risk projects shall address the General Project and Data Summary Requirements (Appendix C of the BA) in addition to the following:

> Designs must demonstrate a clear linkage to limiting factors identified within the appropriate sub-basin plan, recovery plan or recommendations by a technical oversight and steering committee within a localized region.

Conservation Measures:

1) To the greatest degree possible, nonnative fill material, originating from outside the floodplain of the action area will be removed from the floodplain to an upland site.
2) Where it is not possible to remove or set-back all portions of dikes and berms, or in areas where existing berms, dikes, and levees support abundant riparian vegetation, openings will be created with breaches.
3) Breaches shall be equal to or greater than the active channel width (as defined above) to reduce the potential for channel avulsion during flood events.
4) In addition to other breaches, the berm, dike, or levee shall always be breached at the downstream end of the project and/or at the lowest elevation of the floodplain to ensure the flows will naturally recede back into the main channel thus minimizing fish entrapment.
5) When necessary, loosen compacted soils once overburden material is removed.
6) Overburden or fill comprised of native materials, which originated from the project area, may be used within the floodplain to create set-back dikes and fill anthropogenic holes provided that does not impede floodplain function.
7) When full removal is not possible and a setback is required, the new structure locations should be prioritized to the outside of the meander belt width, or to the outside of the channel meander zone margins.

c. Protect Streambanks Using Bioengineering Methods

Description. The BPA proposes to review and fund projects that restore eroding streambanks by bank shaping and installation of coir logs or other soil reinforcements using bioengineering techniques as necessary to support the development of riparian vegetation. This may include planting or installing LW, trees, shrubs, and herbaceous cover as necessary to restore ecological function in riparian and floodplain habitats.

Streambank erosion often occurs within meandering alluvial rivers on the outside of meander bends. The rate of erosion and meander migration is often accelerated due to degradation of the stream side riparian vegetation and land use practices that have removed riparian woody species. Historically, as the river migrates into the adjacent riparian areas, LW would be recruited from the banks resulting in reduced near bank velocities and increased boundary roughness. Where a functional riparian area is lacking, the lateral bank erosion may occur at an unnaturally accelerated rate. The goal of streambank restoration is to re-establish long term riparian processes through revegetation and riparian buffer strips. Structural bank protection may be used to provide short term stability to banklines allowing for vegetation establishment.

The primary proposed structural streambank stabilization action is the use of LW and vegetation to increase bank strength and resistance to erosion in an ecological approach to engineering streambank stabilization. The following bioengineering techniques[9] are proposed for use either individually or in combination: (a) Woody plantings and variations (*e.g.*, live stakes, brush layering, facines, brush mattresses); (b) herbaceous cover, for use on small streams or adjacent wetlands; (c) deformable soil reinforcement, consisting of soil layers or lifts strengthened with biodegradable coir fabric and plantings that are penetrable by plant roots; (d) coir logs (long bundles of coconut fiber), straw bales and straw logs used individually or in stacks to trap sediment and provide a growth medium for riparian plants; (e) bank reshaping and slope grading, when used to reduce a bank slope angle without changing the location of its toe, to increase roughness and cross section, and to provide more favorable planting surfaces; (f) tree and LW rows, live siltation fences, brush traverses, brush rows and live brush sills in floodplains, used to reduce the likelihood of avulsion in areas where natural floodplain roughness is poorly developed or has been removed and (g) floodplain flow spreaders, consisting of one or more rows of trees and accumulated debris used to spread flow across the floodplain; and (h) use of LW as a primary structural component.

Guidelines for Review. Protect streambanks using bioengineering methods are considered ***low risk*** and will not require RRT review: Streambank projects with 1) bankfull flow less than 500 cfs; 2) height of bank less than 5 feet; 3) bankfull velocity less than 5 ft/sec.

The following proposed activities are considered ***medium*** to ***high risk*** and will require RRT review: Streambank projects with: 1) bankfull flow greater than 500 cfs; 2) height of bank greater than 5 feet; and 3) bankfull velocity greater than 5 ft/sec.

Prior to going to the RRT, medium to high risk projects shall address the General Project and Data Summary Requirements (Appendix C of the BA) in addition to the following:

Designs must demonstrate a clear linkage to limiting factors identified within the appropriate sub-basin plan, recovery plan or recommendations by a technical oversight and steering committee within a localized region.

[9] For detailed descriptions of each technique refer to the WDFW Integrated Streambank Protection Guidelines: http://wdfw.wa.gov/publications/00046/,the USACE's EMRRP Technical Notes, Stream Restoration: http://el.erdc.usace.army.mil/publications.cfm?Topic=technote&Code=emrrp, or the NRCS National Engineering Handbook Part 654, Stream Restoration: http://policy.nrcs.usda.gov/viewerFS.aspx?id=3491

Conservation Measures:

1) Without changing the location of the bank toe, damaged streambanks will be restored to a natural slope, pattern, and profile suitable for establishment of permanent woody vegetation. This may include sloping of unconsolidated bank material to a stable angle of repose, or the use of benches in consolidated, cohesive soils. The purpose of bank shaping is to provide a more stable platform for the establishment of riparian vegetation, while also reducing the depth to the water table, thus promoting better plant survival.
2) Streambank restoration projects shall include the placement of a riparian buffer strip consisting of a diverse assemblage of species native to the action area or region, including trees, shrubs, and herbaceous species. Do not use noxious or invasive species.
3) Large wood will be used as an integral component of all streambank protection treatments unless restoration can be achieved with soil bioengineering techniques alone.
4) LW will be placed to maximize near bank hydraulic complexity and interstitial habitats through use of various LW sizes and configurations of the placements.
5) Structural placement of LW should focus on providing bankline roughness for energy dissipation vs. flow re-direction that may affect the stability of the opposite bankline.
6) LW 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 lying on the ground may be used for additional roughness and to add complexity to LW placements but will not constitute the primary structural components.
7) Wood that is already within the stream or suspended over the stream may be repositioned to allow for greater interaction with the stream.
8) LW anchoring will not utilize cable or chain. Manila, sisal or other biodegradable ropes may be used for lashing connections. If hydraulic conditions warrant use of structural connections then rebar pinning or bolting may be used. The utilization of structural connections should be used minimally and only to ensure structural longevity in high energetic systems such as (high gradient systems with lateral confinement and limited floodplain). Need for structural anchorage shall be demonstrated in the design documentation.
9) Rock will not be used for streambank restoration, except as ballast to stabilize large wood unless it is necessary to prevent scouring or downcutting of an existing flow control structure (*e.g.*, a culvert or bridge support, headwall, utility lines, or building). In this case rock may be used as the primary structural component for construction of vegetated riprap with large woody debris. Scour holes may be filled with rock to prevent damage to structure foundations but will not extend above the adjacent bed of the river. This does not include scour protection for bridge approach fills.
10) The rock may not impair natural stream flows into or out of secondary channels or riparian wetlands.
11) Any action that requires additional excavation or structural changes to a road, culvert, bridge foundation or that may affect fish passage is covered under the **Fish Passage Restoration** activity category.
12) Fencing will be installed as necessary to prevent access and grazing damage to revegetated sites and project buffer strips.

13) Riparian buffer strips associated with streambank protection shall extend from the project bankline towards the floodplain a minimum distance of 35 feet.

d. Install Habitat-Forming Natural Material Instream Structures (LW, Boulders, and Spawning Gravel)[10]

Description. The BPA proposes to review and fund projects that include placement of natural habitat-forming structures to provide instream spawning, rearing and resting habitat for salmonids and other aquatic species. Projects will provide high flow refugia; increase interstitial spaces for benthic organisms; increase instream structural complexity and diversity including rearing habitat and pool formation; promote natural vegetation composition and diversity; reduce embeddedness in spawning gravels and promote spawning gravel deposition; reduce siltation in pools; reduce the width/depth ratio of the stream; mimic natural input of LW (*e.g.*, whole conifer and hardwood trees, logs, root wads); decrease flow velocities; and deflect flows into adjoining floodplain areas to increase channel and floodplain function. In areas where natural gravel supplies are low (immediately below reservoirs, for instance), gravel placement can be used to improve spawning habitat.

Anthropogenic activities that have altered riparian habitats, such as splash damming and the removal of LW and logjams, have reduced instream habitat complexity in many rivers and have eliminated or reduced features like pools, hiding cover, and bed complexity. Salmonids need habitat complexity for rearing, feeding, and migrating. To offset these impacts LW, boulders and spawning gravel will be placed in stream channels either individually or in combination.

Large wood will be placed to increase coarse sediment storage, increase habitat diversity and complexity, retain gravel for spawning habitat, improve flow heterogeneity, provide long-term nutrient storage and substrate for aquatic macroinvertebrates, moderate flow disturbances, increase retention of leaf litter, and provide refugia for fish during high flows. Engineered log jams create a hydraulic shadow, a low-velocity zone downstream that allows sediment to settle out. Scour holes develop adjacent to the log jam which can provide valuable fish and wildlife habitat by redirecting flow and providing stability to a streambank or downstream gravel bar.

Boulder placements increase habitat diversity and complexity, improve flow heterogeneity, provide substrate for aquatic vertebrates, moderate flow disturbances, and provide refuge for fish during high flows. The placement of individual large boulders and boulder clusters to increase structural diversity is important to provide holding and rearing habitat for ESA-listed salmonids where similar natural rock has been removed. This treatment will be used in streams that have been identified as lacking structural diversity and that are naturally and/or historically have had boulders.

[10] For detailed descriptions of each technique refer to the WDFW Stream Habitat Restoration Guidelines: http://wdfw.wa.gov/publications/pub.php?id=00043, WDFW Integrated Streambank Protection Guidelines: http://wdfw.wa.gov/publications/00046/,the USACE's EMRRP Technical Notes, Stream Restoration: http://el.erdc.usace.army.mil/publications.cfm?Topic=technote&Code=emrrp, or the NRCS National Engineering Handbook Part 654, Stream Restoration: http://policy.nrcs.usda.gov/viewerFS.aspx?id=3491

The quality and quantity of available spawning gravel has been impacted by many anthropogenic features and activities. For example, dams and culverts can block the downstream movement of gravel and result in gravel starved reaches. Channelization, hard streambank stabilization, and diking restrict a stream from meandering and recruiting gravel. Elimination of riparian buffers and grazing up to the stream's edge introduces fines that often cause embedded or silted-in spawning gravel. Spawning gravel will be placed to improve spawning substrate by compensating for an identified loss of a natural gravel supply and may be placed in conjunction with other projects, such as simulated log jams 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 and linkage to basin defined limiting factors. Instream structures capable of enhancing habitat forming processes and migratory corridors will be installed only within previously degraded stream reaches, where past disturbances have removed habitat elements such as LW, boulders, or spawning gravel.

Guidelines for Review. The following proposed activities are considered ***low risk*** and will not require RRT review: Installation of habitat forming structures that meet all of the following conservation measures.

The following proposed activities are considered ***medium*** to ***high risk*** and will require RRT review: Installation of habitat forming structures that do not meet all of the following conservation measures will require a RRT review and a variance from NMFS.

Prior to going to the RRT, medium to high risk projects shall address the General Project and Data Summary Requirements (Appendix C of the BA) in addition to the following:

1) Designs must demonstrate a clear linkage to limiting factors identified within the appropriate sub basin plan, recovery plan or recommendations by a technical oversight and steering committee within a localized region.
2) Designs must demonstrate that the large wood placements mimic natural accumulations of large wood in the channel, estuary, or marine environment and addresses basin defined limiting factors.
3) Designs must demonstrate that boulder placements will be limited to stream reaches with an intact, well-vegetated riparian area, including trees and shrubs where those species would naturally occur, or that are part of riparian area restoration action; and a stream bed that consists predominantly of coarse gravel or larger sediments.
4) Designs must demonstrate that boulder sizing is appropriate for the size of the stream, maximum depth of flow, planform, entrenchment, and ice and debris loading.
5) For systems where boulders were not historically a component of the project stream reach, it must be demonstrated how this use of this technique will address limiting factors and provide the appropriate post restoration habitats.
6) Designs must demonstrate that LW and boulder placements will not result in a fish passage barrier.

7) Designs must demonstrate that spawning gravel augmentation is limited to areas where the natural supply has been eliminated or significantly reduced through anthropogenic means.

Conservation Measures for the use of LW:

1) LW placements for other purposes than habitat restoration or enhancement are excluded from this consultation.
2) LW will be placed in channels that have an intact, well-vegetated riparian buffer area that is not mature enough to provide large wood, or in conjunction with riparian rehabilitation or management.
3) LW may partially or completely span the channel in first order streams if the active channel top width is less than 20 feet.
4) When available and if the project is located within the appropriate morphology and sized stream, trees with rootwads attached should be a minimum length of 1.5 times the bankfull channel width, while logs without rootwads should be a minimum of 2.0 times the bankfull width.
5) Stabilizing or key pieces of large wood that will be relied on to provide streambank stability or redirect flows must be intact, hard, and undecayed to partly decaying, and should have untrimmed root wads to provide functional refugia habitat for fish. Use of decayed or fragmented wood found lying on the ground or partially sunken in the ground is not acceptable for key pieces but may be incorporated to add habitat complexity.
6) The partial burial of LW and boulders may constitute the dominant means of placement and key boulders (footings) or LW can be buried into the stream bank or channel.
7) If LW anchoring is required, a variety of methods may be used. These include buttressing the wood between riparian trees, the use of manila, sisal or other biodegradable ropes for lashing connections or if hydraulic conditions warrant use of structural connections then rebar pinning or bolting may be used. The utilization of structural connections should be used minimally and only to ensure structural longevity in high energetic systems such as (high gradient systems with lateral confinement and limited floodplain). Need for structural anchorage shall be demonstrated in the design documentation.
8) Rock may be used for ballast but is limited to that needed to anchor the LW.

Conservation Measures for Boulder Placement:

1) Boulder placements for other purposes than habitat restoration or enhancement are excluded from this consultation.
2) The cross-sectional area of boulder placements may not exceed 25% of the cross-sectional area of the low flow channel, or be installed to shift the stream flow to a single flow pattern in the middle or to the side of the stream.
3) Boulders will be machine-placed (no end dumping allowed) and will rely on the size of boulder for stability.
4) Boulders will be installed low in relation to channel dimensions so that they are completely overtopped during channel-forming flow events (approximately a 1.5-year flow event).
5) Permanent anchoring, including rebar or cabling, may not be used.

Conservation Measures for Placement of Spawning Gravel:

1) Spawning gravel to be placed in streams must be obtained from an upland source outside of the channel and riparian area and properly sized gradation for that stream, clean, and non-angular. When possible use gravel of the same lithology as found in the watershed. After spawning gravel placement, allow the stream to naturally sort and distribute the material.
2) A maximum of 100 cubic yards of spawning-sized gravel can be imported or relocated and placed upstream of each structure when in combination with other restoration activities that address the underlying systematic problem. For example a combined project consisting of: planting streambank vegetation, placing instream LW and supplementing spawning gravel.
3) Imported gravel must be free of invasive species and non-native seeds.

e. Riparian Vegetation Planting

Description. The BPA proposes to fund vegetation planting to recover watershed processes and functions associated with native plant communities and that will help restore natural plant species composition and structure. Under this activity category, project proponents would plant trees, shrubs, herbaceous plants, and aquatic macrophytes to help stabilize soils. Large trees such as cottonwoods and conifers will be planted in areas where they historically occurred but are currently either scarce or absent. Native plant species and seeds will be obtained from local sources to ensure plants are adapted to local climate and soil chemistry.

Vegetation management strategies will be utilized that are consistent with local native succession and disturbance regimes and specify seed/plant source, seed/plant mixes, and soil preparation. Planting will address the abiotic factors contributing to the sites' succession, *i.e.*, weather and disturbance patterns, nutrient cycling, and hydrologic condition. Only certified noxious weed-free seed (99.9%), hay, straw, mulch, or other vegetation material for site stability and revegetation projects will be utilized.

Guidelines for Review. The proposed activities are considered low risk and will not require RRT review: Riparian vegetation planting that meet all of the following conservation measures.

Conservation Measures:

1) An experienced silviculturist, botanist, ecologist, or associated technician shall be involved in designing vegetation treatments.
2) Species to be planted must be of the same species that naturally occurs in the project area.
3) Tree and shrub species as well as sedge and rush mats to be used as transplant material shall come from outside the bankfull width, typically in abandoned flood plains, and where such plants are abundant.
4) Sedge and rush mats should be sized as to prevent their movement during high flow events.
5) Concentrate plantings above the bankfull elevation.

f. Channel Reconstruction

Description. The BPA proposes to review and fund channel reconstruction projects to improve aquatic and riparian habitat diversity and complexity, reconnect stream channels to floodplains, reduce bed and bank erosion, increase hyporheic exchange, provide long-term nutrient storage, provide substrate for macroinvertebrates, moderate flow disturbance, increase retention of organic material, and provide refuge for fish and other aquatic species by reconstructing stream channels and floodplains that are compatible within the appropriate watershed context and geomorphic setting.

The reconstructed stream system shall be composed of a naturally sustainable and dynamic planform, cross-section, and longitudinal profile that incorporates unimpeded passage and temporary storage of water, sediment, organic material, and species. Stream channel adjustment over time is to be expected in naturally dynamic systems and is a necessary component to restore a wide array of stream functions. It is expected that for most projects there will be a primary channel with secondary channels that are activated at various flow levels to increase floodplain connectivity and to improve aquatic habitat through a range of flows. This proposed action is not intended to artificially stabilize streams into a single location or into a single channel for the purposes of protecting infrastructure or property.

Channel reconstruction consists of re-meandering or movement of the primary active channel, and may include structural elements such as streambed simulation materials, streambank restoration, and hydraulic roughness elements. For bed stabilization and hydraulic control structures, constructed riffles shall be preferentially used in pool-riffle stream types, while roughened channels and rock structures shall be preferentially used in step-pool and cascade stream types. Material selection (large wood, rock, gravel) shall also mimic natural stream system materials.

Due to the complexity of channel reconstruction projects, there shall be separate procedural guidelines, data and information requirements, that will be refined, amended, and updated through an iterative collaborative process with BPA, NMFS, and USFWS.

Guidelines for Review. The channel reconstruction activity is considered ***high risk*** and will require RRT and NMFS Hydro Division review. Project sponsors shall address the General Project and Data Summary Requirements (Appendix C of the BA) and the following Conservation Measures, prepare a Design Report, complete of the River Restoration Analysis Tool, and include a Monitoring and Adaptive Management Plan.

Conservation Measures: Because of the complexity of channel reconstruction projects, there shall be an interdisciplinary design team minimally consisting of a biologist, engineer, and hydrologist.

Data requirements for RRT & NMFS review and analysis include:

1) Designs must demonstrate a clear linkage to limiting factors identified within the appropriate sub-basin plan, recovery plan or recommendations by a technical oversight and steering committee within a localized region.
2) Detailed construction drawings.
3) Designs must demonstrate that channel reconstruction will identify, correct to the extent possible, and then account for in the project development process, the conditions that lead to the degraded condition.
4) Designs must demonstrate that the proposed action will mimic natural conditions for gradient, width, sinuosity and other hydraulic parameters.
5) Designs must demonstrate that structural elements shall fit within the geomorphic context of the stream system.
6) Designs must demonstrate sufficient hydrology and that the project will be self-sustaining over time. Self-sustaining means the restored or created habitat would not require major or periodic maintenance, but function naturally within the processes of the floodplain.
7) Designs must demonstrate that the proposed action will not result in the creation of fish passage issues or post construction stranding of juvenile or adult fish.

The content requirements for the Design Report, use of the River Restoration Analysis Tool, and the Monitoring and Adaptive Management Plan are described in the BA.

1.3.7 Category 3. Invasive and Non-Native Plant Control

The BPA proposes to fund management of vegetation using physical control and through the use of herbicides to control or eliminate non-native, invasive plant species that compete with or displace native plant communities. The goal is to recover watershed processes and functions associated with native plant communities.

a. Manage Vegetation Using Physical Control

BPA proposes to use the following two mechanisms for vegetation management by physical control: (a) 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. 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. (b) Mechanical control includes techniques such as mowing, tilling, disking, or plowing. Mechanical control may be carried out over large areas or be confined to smaller areas (known as scalping). Ground-disturbing mechanical activity will be restricted in established buffer zones 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.

*Guidelines for Review***.** The proposed activities are considered low risk and will not require RRT review.

Conservation Measures.

1) For mechanical control that will disturb the soil, an untreated area will be maintained within the immediate riparian buffer area to prevent any potential adverse effects to stream channel or water quality conditions.
2) Ground-disturbing mechanical activity will be restricted in established buffer zones adjacent to streams, lakes, ponds, wetlands and other identified sensitive habitats based on percent slope. For slopes less than 20%, a buffer width of at least 35 feet will be used. For slopes over 20%, no ground-disturbing mechanical equipment will be used.
3) 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.
4) 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.

b. Manage Vegetation Using Herbicides

The BPA proposes to fund management of vegetation using chemical herbicides to recover watershed processes and functions associated with native plant communities.

Herbicides will be applied in liquid or granular form using wand or boom sprayers mounted on or towed by trucks, or via 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 petroleum-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. Aerial treatment is not proposed to be covered under this consultation, nor is treatment of aquatic weeds except for knotweed (*Polygonum cuspidatum*).

Maximum herbicide treatment area. The area treated with herbicides above bankfull elevation, within riparian areas, will not exceed 10 acres above bankfull elevation and 2 acres below bankfull elevation, per 1.6-mile reach of a stream, per year.

Herbicide applicator qualifications. Herbicides will be applied only by an appropriately licensed applicator using an herbicide specifically targeted for a particular plant species that will cause the least impact to non-target species. The applicator will be responsible for preparing and carrying out the herbicide transportation and safety plan, as follows.

Herbicide transportation and safety plan. The applicator will prepare and carry out an herbicide safety/spill response plan to reduce the likelihood of spills or misapplication, to take remedial actions in the event of spills, and to fully report the event. At a minimum, the plan will: (a) Address spill prevention and containment; (b) estimate and limit the daily quantity of herbicides to be transported to treatment sites; (c) require that impervious material be placed beneath mixing areas in such a manner as to contain small spills associated with mixing/refilling; (d) require a spill cleanup kit be readily available for herbicide transportation, storage and application; (e) outline reporting procedures, including reporting spills to the appropriate regulatory agency; (f) ensure applicators are trained in safe handling and transportation procedures and spill cleanup; (g) require that equipment used in herbicide storage, transportation and handling are maintained in a leak proof condition; (h) address transportation routes so that hazardous conditions are avoided to the extent possible; (i) specify mixing and loading locations away from waterbodies so that accidental spills do not contaminate surface waters; (j) require that spray tanks be mixed or washed further than 150 feet of surface water; (k) ensure safe disposal of herbicide containers; (l) identify sites that may only be reached by water travel and limit the amount of herbicide that may be transported by watercraft; (m) all individuals involved, including any contracted applicators, will be instructed on the plan.

Herbicides. BPA proposes the use of the following herbicides in the typical application rates (see Table 3) for invasive plant control. These products were previously evaluated in risk assessments by the USFS http://www.fs.fed.us/foresthealth/pesticide/risk).

Table 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
2,4-D (amine)	Many	0.5 - 1.5 lbs.	4.0 lbs	Upland & Riparian
Aminopyralid	Milestone®	0.11 - 0.22 lbs	0.375 lb	Upland & Riparian
Chlorsulfuron	Telar®	0.25 - 1.33 oz	3.0 oz	Upland
Clethodim	Select®	0.125 – 0.5 lbs	0.50 lb	Upland
Clopyralid	Transline®	0.1 - 0.375 lbs	0.5 lb	Upland & Riparian
Dicamba	Banvel® only	0.25 - 7.0 lbs	8.0 lbs	Upland & Riparian
Glyphosate 1 Glyphosate 2	Many Many	0.5 - 2.0 lbs 0.5 - 2.0 lbs	3.75 lbs 3.75 lbs	Upland & Riparian Upland
Imazapic	Plateau®	0.063 – 0.189 lbs	0.189 lb	Upland & Riparian
Imazapyr	Arsenal® Habitat®	0.5 – 1.5 lbs.	1.5 lbs	Upland & Riparian
Metsulfuron methyl	Escort®	0.33 - 2.0 oz	4.0 oz	Upland
Picloram	Tordon®	0.125 - 0.50 lb	1 lb	Upland
Sethoxydim	Poast®	0.1875 – 0.375 lb	0.375 lb	Upland
Sulfometuron methyl	Oust®	0.023 - 0.38 oz	2.25 oz	Upland
Triclopyr (TEA)	Garlon 3A®	1.0 - 2.5 lbs	9.0 lbs	Upland & Riparian

2,4-D. As a result of the National Consultation[11], this herbicide shall comply with all relevant reasonable and prudent alternatives from the 2011 Biological Opinion (NMFS 2011b):

1) Do not apply when wind speeds are below 2 mph or exceed 10 mph, except when winds in excess of 10 mph will carry drift away from salmonid-bearing waters.
2) Do not apply when a precipitation event, likely to produce direct runoff to salmonid bearing waters from the treated area, is forecasted by NOAA/NWS (National Weather Service) or other similar forecasting service within 48 h following application.
3) Control of invasive plants within the riparian habitat shall be by individual plant treatments for woody species, and spot treatment of less than 1/10 acre for herbaceous species.

Adjuvants. The following adjuvants are proposed for use (Table 4). Polyethoxylated tallow amine (POEA) surfactant and herbicides that contain POEA (e.g., Roundup) will not be used.

Herbicide carriers. Herbicide carriers (solvents) are limited to water or specifically labeled vegetable oil.

*Herbicide mixing***.** Herbicides will be mixed more than 150 feet from any natural waterbody to minimize the risk of an accidental discharge and no more than three different herbicides may be mixed for any one application.

Herbicide application rates. Herbicides will be applied at the lowest effective label rates, including the typical and maximum rates given (Table 4). For broadcast spraying, application of herbicide or surfactant will not exceed the typical label rates.

[11] On June 30, 2011, NMFS issued a final biological opinion addressing the effects of this herbicide on ESA-listed Pacfic salmonids. The opinion has concluded that EPA's proposed registration of certain uses of 2,4-D, including aquatic uses of 2,4-D BEE are likely to jeopardize the continued existence of the 28 endangered and threatened Pacific salmonids. http://www.nmfs.noaa.gov/pr/consultation/pesticides.htm

Table 4. Adjuvants proposed for use by BPA.

Adjuvant Type	Trade Name	Labeled Mixing Rates per Gallon of Application Mix	General Geographic Application Areas
Colorants	Dynamark™ U.V. (red)	0.1 fl oz	Riparian
	Aquamark™ Blue	0.1 fl oz	Riparian
	Dynamark™ U.V. (blu)	0.5 fl oz	Upland
	Hi-Light® (blu)	0.5 fl oz	Upland
Surfactants	Activator 90®	0.16 – 0.64 fl oz	Upland
	Agri-Dex®	0.16 – 0.48 fl oz	Riparian
	Entry II®	0.16 – 0.64 fl oz	Upland
	Hasten®	0.16 – 0.48 fl oz	Riparian
	LI 700®	0.16 – 0.48 fl oz	Riparian
	R-11®	0.16 – 1.28 fl oz	Riparian
	Super Spread MSO®	0.16 – 0.32 fl oz	Riparian
	Syl-Tac®	0.16 – 0.48 fl oz	Upland
Drift Retardants	41-A®	0.03 – 0.06 fl oz	Riparian
	Valid®	0.16 fl oz	Upland

Herbicide application methods. Liquid or granular forms of herbicides to be applied by a licensed applicator as follows: (a) Broadcast spraying – hand held nozzles attached to back pack tanks or vehicles, or by using vehicle mounted booms; (b) spot spraying – hand held nozzles attached to back pack tanks or vehicles, hand-pumped spray, or squirt bottles to spray herbicide directly onto small patches or individual plants using; (c) hand/selective – wicking and wiping, basal bark, fill (“hack and squirt”), stem injection, cut-stump; (d) triclopyr – will not be applied by broadcast spraying.

*Emergent Knotweed Application***.** No aquatic application of chemicals is covered by this consultation except for treating emergent knotweed. Only aquatic labeled glyphosate formulations will be used. The only application methods for emergent knotweed are stem injection (formulation up to 100% for emergent stems greater than 0.75 inches in diameter), wicking or wiping (diluted to 50% formulation), and hand-held spray bottle application of glyphosate (up to the percentage allowed by label instructions when applied to foliage using low pressure hand-held spot spray applicators).

Most knotweed patches are expected to have overland access. However, some sites may be reached only by water travel, either by wading or inflatable raft (or kayak). The following measures will be used to reduce the risk of a spill during water transport: (a) No more than 2.5 gallons of glyphosate will be transported per person or raft, and typically it will be one gallon or less; (b) glyphosate will be carried in 1 gallon or smaller plastic containers. The containers will be wrapped in plastic bags and then sealed in a dry-bag. If transported by raft, the dry-bag will be secured to the watercraft.

Minimization of herbicide drift and leaching. Herbicide drift and leaching will be minimized as follows: (a) Do not spray when wind speeds exceed 10 miles per hour, or are less than 2 miles per hour; (b) be aware of wind directions and potential for herbicides to affect aquatic habitat area downwind; (c) keep boom or spray as low as possible to reduce wind effects; (d) increase spray droplet size whenever possible by decreasing spray pressure, using high flow rate nozzles, using water diluents instead of oil, and adding thickening agents; (e) do not apply herbicides during temperature inversions, or when ground temperatures exceed 80 degrees Fahrenheit; (f) do not spray when rain, fog, or other precipitation is falling or is imminent. Wind and other weather data will be monitored and reported for all broadcast applications.

Tables 5 and 6 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.

Herbicide Reporting. Herbicide use will follow the same approval process as other activities covered by this opinion, with the submittal of the Proposed Herbicide Use Table (Appendix A of the BA) to BPA. If herbicide use is the only activity proposed under HIP III, submittal of a 120-day implementation report is not required.

Table 5. Herbicide buffer widths to minimize impacts on non-target resources.

Herbicide	Broadcast Application[12]		Backpack Sprayer/Bottle[13] Spot Spray Foliar/Basal		Hand Application[14] Wicking/Wiping/Injection
	Min buffer from high water mark (ft)	Max/ Min wind speed (mph)	Min buffer from high water mark (ft)	Max/ Min wind speed (mph)	Min buffer from high water mark (wind speed not a factor)
2,4-D (amine)	100	10/2	50	5/2	15 feet for aquatic labeled formulations.
Aminopyralid	100	10/2	15	5/2	Up to high water mark.
Chlorsulfuron	100	10/2	15	5/2	Up to high water mark.
Clethodim	NA	NA	50	5/2	Do not use within 50 feet of any surface water.
Clopyralid	100	10/2	15	5/2	Up to high water mark.
Dicamba (Banvel only)	100	10/2	15	5/2	Up to high water mark.
Glyphosate 1	100	10/2	15	5/2	Up to water's edge for aquatic labeled formulations. See knotweed General Herbicide Conservation Measures for emergent application restrictions.
Glyphosate 2	100	10/2	100	5/2	100 feet
Imazapic	100	10/2	15	5/2	Up to water's edge for aquatic labeled formulations.
Imazapyr	100	10/2	15	5/2	Up to water's edge for aquatic labeled formulations; otherwise, up to the high water mark.
Metsulfuron	100	10/2	15	5/2	Up to high water mark.
Picloram	100	8/2	100	5/2	Do not use within 100 feet of any surface water.
Sethoxydim	100	10/2	50	5/2	Do not use within 50 feet of any surface water.
Sulfometuron	100	10/2	15	5/2	Up to high water mark.
Triclopyr (TEA)	100	10/2	50	5/2	Up to high water mark6 for cut-stump application of aquatic labeled formulations; 15 feet for other applications.
Herbicide Mixtures	100	Most conservative of listed herbicides.	15	Most conservative of listed herbicides.	Most conservative of listed herbicides.

[12] Ground-based only broadcast application methods via truck/ATV with motorized low-pressure, high-volume sprayers using spray guns, broadcast nozzles, or booms.
[13] Spot and localized foliar and basal/stump applications using a hand-pump backpack sprayer or field-mixed or pre-mixed hand-operated spray bottle.
[14] 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.

Table 6. Adjuvant buffer widths to minimize impacts on non-target resources.

Adjuvant	Broadcast Application[15]	Backpack Sprayer/Bottle[16] Spot Spray Foliar/Basal	Hand Application[17] Wicking/Wiping/Injection
	Minimum buffer (ft)	Minimum buffer (ft)	Minimum buffer (ft) (wind speed not a factor)
Dynamark (red)	100	15	Up to water's edge when using herbicides labeled for aquatic uses.
Dynamark (yel)	100	15	Up to water's edge when using herbicides labeled for aquatic uses.
Dynamark (blu)	100	>50 <50 Do not use	>50 Herbicide dependent from Table 2-3. <50 Do not use.
Hi-Light (blu)	100	>50 <50 Do not use	>50 Herbicide dependent from Table 2-3. <50 Do not use.
Activator 90®	100	15	Up to water's edge for aquatic labeled formulations.
Agri-Dex	100	15	Up to water's edge for aquatic labeled formulations.
Entry II	100	<100 Do not use	<100 Do not use.
Hasten	100	15	Up to water's edge for aquatic labeled formulations.
LI 700	100	15	Up to water's edge for aquatic labeled formulations.
R-11	100	>50 <50 Do not use	>50 Herbicide dependent from Table 2-3. <50 Do not use.
Super Spread MSO	100	15	Up to water's edge for aquatic labeled formulations.
Syl-Tac	100	<50	<50 Do not use.
41-A	100	15	Up to water's edge when using herbicides labeled for aquatic uses.
Valid	100	50	<50 Do not use.

[15] Ground-based only broadcast application methods via truck/ATV with motorized low-pressure, high-volume sprayers using spray guns, broadcast nozzles, or booms.
[16] Spot and localized foliar and basal/stump applications using a hand-pump backpack sprayer or field-mixed or pre-mixed hand-operated spray bottle.
[17] 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.

1.3.8 Category 4. Piling Removal

Description. The following steps will be used to minimize creosote release, sediment disturbance, and elevated total suspended solids: (a) Installation of a floating surface boom to capture floating surface debris; (b) keeping all equipment (e.g., bucket, steel cable, vibratory hammer) out of the water, grip piles above the waterline, and complete all work during low water and low current conditions; (c) dislodging the piling with a vibratory hammer, whenever feasible—never intentionally break a pile by twisting or bending; (d) slowly lifting the pile from the sediment and through the water column; (e) placing the pile in a containment basin on a barge deck, pier, or shoreline without attempting to clean or remove any adhering sediment (a containment basin for the removed piles and any adhering sediment may be constructed of durable plastic sheeting with sidewalls supported by hay bales or another support structure to contain all sediment, and return flow may be directed back to the waterway); (f) filling the holes left by each piling with clean, native sediments; (g) disposing of all removed piles, floating surface debris, any sediment spilled on work surfaces, and all containment supplies at a permitted upland disposal site.

Broken piles. If a pile breaks above the surface of uncontaminated sediment, or less than 2 feet below the surface, every attempt short of excavation will be made to remove it entirely. If the pile cannot be removed without excavation, saw the stump off at least 3 feet below the surface of the sediment. If a pile breaks above contaminated sediment, saw the stump off at the sediment line; if a pile breaks within contaminated sediment, make no further effort to remove it and cover the hole with a cap of clean substrate appropriate for the site. If dredging is likely in the area of piling removal, use a global positioning device (GPS) to note the location of all broken piles for future use in site debris characterization.

1.3.9 Category 5. Road and Trail Erosion Control, Maintenance and Decommissioning

a. Maintain Roads

Description. BPA proposes to fund road maintenance activities within the riparian zone, including: (a) Creating barriers to human access: gates, fences, boulders, logs, tank traps, vegetative buffers, and signs, (b) surface maintenance, such as building and compacting the road prism, grading, and spreading rock or surfacing material, (c) drainage maintenance and repair of inboard ditch lines, waterbars, sediment traps (d) removing and hauling or stabilizing pre-existing cut and fill material or slide material (e) snowplowing (f) relocating portions of roads and trails to less sensitive areas outside of riparian buffer areas. The proposed activity does not include asphalt resurfacing, widening roads, or new construction or relocation of any permanent road inside a riparian buffer area except for a bridge approach in accordance to the section on Transportation Infrastructure**.**

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. Road maintenance will not be attempted when surface material is saturated with water and erosion problems could result.

Conservation Measures:

1) 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 will be applied so as to minimize the likelihood that they will enter streams.
2) 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).
3) Spill containment equipment will be available during chemical dust abatement application.
4) Oil or oil-based products will not be used for dust abatement.

b. Decommission Roads

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 will be installed, fill or sidecast materials will be removed, road prism will be reshaped, sediment catch basins will be 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. These activities will be conducted during dry-field conditions—low to moderate soil moisture levels. Slide and waste material will be disposed in stable, non-floodplain sites unless materials are to restore natural or near-natural contours, and approved by a geotechnical engineer or other qualified personnel.

1.3.10 Category 6. In-channel Nutrient Enhancement

Description. BPA proposes to fund the application of nutrients throughout a waterway corridor by placement of salmon carcasses into waterways, placement of carcass analogs (processed fish cakes) into waterways, or placement of inorganic fertilizers into waterways.

Conservation Measure:

1) In Oregon, projects are permitted through Oregon Department of Environmental Quality (ODEQ). Carcasses must originate from the treated watershed or be certified disease-free by an ODFW pathologist.
2) In Washington, WDFW publication entitled “Salmon Carcass Analogs, and Delayed Release Fertilizers to Enhance Stream Productivity in Washington State” (WDFW 2004), will be followed.
3) Carcasses will be of species native to the watershed and placed during the normal migration and spawning times, as would naturally occur in the watershed.
4) Eutrophic or naturally oligotrophic systems will not be supplemented with nutrients.
5) Each waterway will be individually assessed for available light, water quality, stream gradient and life history of the fish present, and adaptive management will be used to derive the maximum benefits of nutrient enhancement.

1.3.11 Category 7. Irrigation and Water Delivery/Management Actions

The BPA proposes to fund the following activities for Irrigation and Water Delivery Management Actions: (a) Convert delivery system to drip or sprinkler irrigation; (b) convert water conveyance from open ditch to pipeline or line leaking ditches and canals, (c) convert from instream diversions to groundwater wells for primary water sources; (d) install or replace return flow cooling systems; (e) install irrigation water siphon beneath waterway; (f) livestock watering facilities; and (g) install new or upgrade/maintain existing fish screens.

The criteria, plans and specifications, and operation and maintenance protocols of the activity categories shall use the most recent versions of NRCS guidance.

The BPA HIP III will only cover irrigation efficiency actions within this activity category that use state approved regulatory mechanisms (e.g. Oregon ORS 537.455-.500, Washington RCW 90.42) for ensuring that water savings will be protected as instream water rights, or in cases where project implementers identify how the water conserved will remain instream to benefit fish without any significant loss of the instream flows to downstream diversions.

a. Convert Delivery System to Drip or Sprinkler Irrigation

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.

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

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.

c. Convert from Instream Diversions to Groundwater Wells for Primary Water Source

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. If an instream diversion is downsized, it will be covered under this programmatic consultation only by following all criteria outlined in the **Consolidate, or Replace Existing Irrigation Diversions** section. New wells will be located more than ¼ mile from the stream and will not be hydraulically connected to the stream.

d. Install or Replace Return Flow Cooling Systems

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.

e. Install Irrigation Water Siphon Beneath Waterway

Siphons transporting irrigation water will be installed beneath waterways where irrigation ditch water currently enters a stream and commingles with stream water, with subsequent withdrawal of irrigation water back into an irrigation ditch system downstream. Periodic maintenance of the siphon will be conducted. Work may entail use of heavy equipment, power tools, and/or hand tools.

Conservation Measures:

1) Directional drilling to create siphon pathway will be employed whenever possible.
2) Trenching will occur in dry stream beds only; work area isolation will be employed in perennial streams.
3) Stream widths will be maintained at bankfull width or greater.
4) No part of the siphon structure will block fish passage.
5) No concrete will be placed within the bankfull width.
6) Siphon surface structures will be set back from the top of the streambank at least ten feet.
7) Minimum cover over a siphon structure within the streambed shall be three feet of natural substrate.
8) Waterway will be reconstructed to a natural streambed configuration upon completion.

f. Livestock Watering Facilities

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 may include springs and seeps, streams, or groundwater wells. Pipes will generally range from 0.5 to 4 inches, but may not exceed 4 inches in diameter. Placement of the pipes in the ground will typically involve minor trenching using a backhoe or similar equipment. The off-channel watering facility will avoid steep slopes, or ensure that each livestock water development has a float valve or similar device limiting use to demand, a return flow system, a fenced overflow area, or similar means to minimize water withdrawal and potential runoff and erosion.

g. Install New or Upgrade/Maintain Existing Fish Screens (review may be required)

Irrigation diversion intake and return points will be designed or replaced to prevent fish and other aquatic organisms of all life stages from swimming or being entrained into the irrigation system. Fish screens for surface water that is diverted by gravity or by pumping at a rate that exceeds 3 cfs will be submitted to NMFS for review and approval. All other diversions will have a fish screen that utilizes an automated cleaning device with a minimum effective surface area of 2.5 square feet per cfs, and a nominal maximum approach velocity of 0.4 feet per second (fps), or no automated cleaning device, a minimum effective surface area of 1 square foot per cfs, and a nominal maximum approach rate of 0.2 fps; and a round or square screen mesh that is no larger than 2.38 mm (0.094 inches) in the narrow dimension, or any other shape that is no larger than 1.75 mm (0.069 inches) in the narrow dimension. Each fish screen will be installed, operated, and maintained according to NMFS' fish screen criteria (NMFS 2011c). Periodic maintenance, which may include temporary removal, of fish screens will be conducted to ensure their proper functioning, e.g., cleaning debris buildup, and replacement of parts.

State resource agencies may submit one Project Notification Form and Project Completion Form for all anticipated fish screen installation, repairs, and maintenance for each field season. The Project Notification Form shall contain proposed locations (GIS map) and specific activities. Project Completion Forms shall contain actual locations, specific activities undertaken, and a statement of compliance with NMFS fish screen criteria (NMFS 2011c).

1.3.12 Category 8. Fisheries, Hydrologic, and Geomorphologic Surveys.

BPA proposes to fund the collection of information in uplands, floodplains, and streambeds regarding 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. Electro-shocking for research purposes is not included.

Work may entail use of trucks, survey equipment, and crews using hand tools, and includes the following activities: (a) Measuring/assessing and recording physical measurements by visual estimates or with survey instruments; (b) installing rebar or other markers along transects or at reference points; (c) installing piezometers and staff gauges to assess hydrologic conditions and installing recording devices for streamflow and temperature; (d) conducting snorkel surveys to determine species of fish in streams and observing interactions of fish with their habitats; (e) excavating cultural resource test pits, and (f) installing PIT detector arrays on streambeds.

Interrelated and Interdependent Actions

To the extent that the proposed action will result in the maintenance of a preexisting structure, the continued operation and maintenance of those structures, and the use of these structures to support restoration activities are also included here as interrelated and interdependent actions and those effects will also be considered in the following analysis.

NMFS relied on the foregoing description of the proposed action, including all stated project design criteria and reviews, in conducting this consultation. The realities of completing actions funded or approved by action agencies often require changes in design, practices, or methods during implementation. Such changes can bear on the environmental effects of an action, and thus could affect the validity of the conclusion made during consultation, and/or the validity of the Incidental Take Statement. Therefore, BPA should keep NMFS informed of any such changes.

1.4 Action Area

The action area consists of all the areas where the environmental effects of actions authorized under HIP III may occur. HIP III projects can be funded, and will have environmental effects, on Columbia River Basin waters and Oregon Coast tributaries north of Cape Blanco, and land under the jurisdiction of the NWPPC's Columbia River Basin Fish and Wildlife Program Portland District that are within the NMFS Northwest Region's area of responsibility. The action area also includes estuaries and coastal waters where water quality effects of the action may occur (small quantities of herbicides or other contaminants move downstream of where they enter the water, eventually reaching estuaries and coastal waters). There is overlap between the areas impacted by HIP III and the range of ESA listed salmon, steelhead, southern DPS green sturgeon, southern DPS eulachon, eastern DPS Steller sea lion, or designated critical habitat. Seventeen ESA-listed species and 16 designated critical habitats and one critical habitat proposed for designation occur in the action area and were considered in this opinion (Table 7). This includes the following recovery domains within Oregon, Washington and Idaho: Willamette-Lower Columbia, Interior Columbia, and Oregon Coast.

The action area is also designated as EFH for Pacific Coast groundfish (PFMC 2006), coastal pelagic species (PFMC 1998), and Pacific Coast salmon (PFMC 1999), or is in an area where environmental effects of the proposed action may adversely affect designated EFH for those species.

Table 7. Federal Register notices for final rules that list threatened and endangered species, designate critical habitats, or apply protective regulations to listed species considered in this consultation. Listing status: "T" means listed as threatened under the ESA; "E" means listed as endangered; "P" means proposed.

Species	Listing Status	Critical Habitat	Protective Regulations
Marine and Anadromous Fish			
Chinook salmon (*Oncorhynchus tshawytscha*)			
Lower Columbia River	T 6/28/05; 70 FR 37160	9/02/05; 70 FR 52630	6/28/05; 70 FR 37160
Upper Willamette River	T 6/28/05; 70 FR 37160	9/02/05; 70 FR 52630	6/28/05; 70 FR 37160
Upper Columbia River spring-run	E 6/28/05; 70 FR 37160	9/02/05; 70 FR 52630	ESA section 9 applies
Snake River spring/summer run	T 6/28/05; 70 FR 37160	10/25/99; 64 FR 57399	6/28/05; 70 FR 37160
Snake River fall-run	T 6/28/05; 70 FR 37160	12/28/93; 58 FR 68543	6/28/05; 70 FR 37160
Chum salmon *(O. keta*)			
Columbia River	T 6/28/05; 70 FR 37160	9/02/05; 70 FR 52630	6/28/05; 70 FR 37160
Coho salmon (*O. kisutch*)			
Lower Columbia River	T 6/28/05; 70 FR 37160	P 1/14/13; 78 FR 2726	6/28/05; 70 FR 37160
Oregon Coast	T 2/11/08; 73 FR 7816	2/11/08; 73 FR 7816	2/11/08; 73 FR 7816
Sockeye salmon (*O. nerka*)			
Snake River	E 6/28/05; 70 FR 37160	12/28/93; 58 FR 68543	ESA section 9 applies
Steelhead (*O. mykiss*)			
Lower Columbia River	T 1/05/06; 71 FR 834	9/02/05; 70 FR 52630	6/28/05; 70 FR 37160
Upper Willamette River	T 1/05/06; 71 FR 834	9/02/05; 70 FR 52630	6/28/05; 70 FR 37160
Middle Columbia River	T 1/05/06; 71 FR 834	9/02/05; 70 FR 52630	6/28/05; 70 FR 37160
Upper Columbia River	T 8/24/09; 74 FR 42605	9/02/05; 70 FR 52630	2/01/06; 71 FR 5178
Snake River Basin	T 1/05/06; 71 FR 834	9/02/05; 70 FR 52630	6/28/05; 70 FR 37160
Green sturgeon (*Acipenser medirostris*)			
Southern DPS	T 4/07/06; 71 FR 17757	10/09/09; 74 FR 52300	6/02/10; 75 FR 30714
Eulachon (*Thaleichthys pacificus*)			
Southern DPS	T 3/18/10; 75 FR 13012	10/20/11; 76 FR 65324	Not applicable
Marine Mammals			
Steller sea lion (*Eumetopias jubatus*)			
Eastern DPS	T 5/5/1997; 63 FR 24345	8/ 27/93; 58 FR 45269	11/26/90; 55 FR 49204

2. ENDANGERED SPECIES ACT BIOLOGICAL OPINION AND INCIDENTAL TAKE STATEMENT

The ESA 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 the USFWS, NMFS, or both, 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 habitat. Section 7(b)(3) requires that, at the conclusion of consultation, the Service provide an opinion stating how the agencies' actions will affect listed species or their critical habitat. If incidental take is expected, Section 7(b)(4) requires the provision of an incidental take statement (ITS) specifying the impact of any incidental taking, and including reasonable and prudent measures to minimize such impacts.

2.1 Introduction to the Biological Opinion

Section 7(a)(2) of the ESA requires Federal agencies, in consultation with NMFS, to insure that their actions are not likely to jeopardize the continued existence of endangered or threatened species, or adversely modify or destroy their designated critical habitat. The jeopardy analysis considers both survival and recovery of the species. The adverse modification analysis considers the impacts to the conservation value of the designated critical habitat.

This opinion does not rely on the regulatory definition of "destruction or adverse modification" of critical habitat at 50 CFR 402.02. Instead, we have relied upon the statutory provisions of the ESA to complete the following analysis with respect to critical habitat (Hogarth 2005).

We will use the following approach to determine whether the proposed action described in Section 1.3 is likely to jeopardize listed species or destroy or adversely modify critical habitat:

- *Identify the rangewide status of the species and critical habitat likely to be adversely affected by the proposed action*. This section describes the current status of each listed species and its critical habitat relative to the conditions needed for recovery. For listed salmon and steelhead, NMFS has developed specific guidance for analyzing the status of the listed species' component populations in a "viable salmonid populations" paper (VSP; McElhany *et al*. 2000). The VSP approach considers the abundance, productivity, spatial structure, and diversity of each population as part of the overall review of a species' status. For listed salmon and steelhead, the VSP criteria therefore encompass the species' "reproduction, numbers, or distribution" (50 CFR 402.02). In describing the range-wide status of listed species, we rely on viability assessments and criteria in technical recovery team documents and recovery plans, where available, that describe how VSP criteria are applied to specific populations, major population groups, and species. We determine the rangewide status of critical habitat by examining the condition of its physical or biological features (also called "primary constituent elements" or PCEs in some designations) – which were identified when the critical habitat was designated. Species and critical habitat status are discussed in Section 2.2.

- *Describe the environmental baseline for the proposed action*. The environmental baseline includes the past and present impacts of Federal, state, or private actions and other human activities *in the action area*. It includes the anticipated impacts of proposed Federal projects that have already undergone formal or early section 7 consultation and the impacts of state or private actions that are contemporaneous with the consultation in process. The environmental baseline is discussed in Section 2.3 of this opinion.
- *Analyze the effects of the proposed actions*. In this step, NMFS considers how the proposed action would affect the species' reproduction, numbers, and distribution or, in the case of salmon and steelhead, their VSP characteristics. NMFS also evaluates the proposed action's effects on critical habitat features. The effects of the action are described in Section 2.4 of this opinion.
- *Describe any cumulative effects.* Cumulative effects, as defined in NMFS' implementing regulations (50 CFR 402.02), are the effects of future state or private activities, not involving Federal activities, that are reasonably certain to occur within the action area. Future Federal actions that are unrelated to the proposed action are not considered because they require separate section 7 consultation. Cumulative effects are considered in Section 2.5 of this opinion.
- *Integrate and synthesize the above factors to assess the risk that the proposed action poses to species and critical habitat.* In this step, NMFS adds the effects of the action (Section 2.4) to the environmental baseline (Section 2.3) and the cumulative effects (Section 2.5) to assess whether the action could reasonably be expected to: (1) appreciably reduce the likelihood of both survival and recovery of the species in the wild by reducing its numbers, reproduction, or distribution; or (2) reduce the value of designated or proposed critical habitat for the conservation of the species. These assessments are made in full consideration of the status of the species and critical habitat (Section 2.2). Integration and synthesis occurs in Section 2.6 of this opinion.
- *Reach jeopardy and adverse modification conclusions*. Conclusions regarding jeopardy and the destruction or adverse modification of critical habitat are presented in Section 2.7. These conclusions flow from the logic and rationale presented in the Integration and Synthesis Section (2.6).
- *If necessary, define a reasonable and prudent alternative to the proposed action.* If, in completing the last step in the analysis, NMFS determines that the action under consultation is likely to jeopardize the continued existence of listed species or destroy or adversely modify designated critical habitat, NMFS must identify a reasonable and prudent alternative (RPA) to the action. The RPA must not be likely to jeopardize the continued existence of ESA-listed species nor adversely modify their designated critical habitat and it must meet other regulatory requirements.

In this opinion, NMFS concludes that the proposed action is not likely to adversely affect (NLAA) the Eastern DPS of Steller sea lions, Pacific eulachon, and green sturgeon. See Section 2.11 for details.

2.2 Rangewide Status of the Species and Critical Habitat

The summaries that follow describe the status of the 17 ESA-listed species, and their designated critical habitats, that occur within the geographic area of this proposed action and are considered in this opinion. More detailed information on the status and trends of these listed resources, and their biology and ecology, can be found in the listing regulations and critical habitat designations published in the Federal Register (Table 7).

Climate change is likely to play an increasingly important role in determining the abundance of ESA-listed species, and the conservation value of designated critical habitats, in the Pacific Northwest. These changes will not be spatially homogeneous across the Pacific Northwest. Areas with elevations high enough to maintain temperatures well below freezing for most of the winter and early spring will be less affected. Low-elevation areas that historically have received scant precipitation contribute little to total stream flow and are likely to be more affected.

During the last century, average regional air temperatures increased by 1.5°F, and increased up to 4°F in some areas (USGCRP 2009). Warming is likely to continue during the next century as average temperatures increase another 3 to 10°F (USGCRP 2009). Overall, about one-third of the current cold-water fish habitat in the Pacific Northwest is likely to exceed key water temperature thresholds by the end of this century (USGCRP 2009).

Precipitation trends during the next century are less certain than for temperature but more precipitation is likely to occur during October through March and less during summer months, and more of the winter precipitation is likely to fall as rain rather than snow (ISAB 2007, USGCRP 2009). Where snow occurs, a warmer climate will cause earlier runoff so stream flows in late spring, summer, and fall will be lower and water temperatures will be warmer (ISAB 2007, USGCRP 2009).

Higher winter stream flows increase the risk that winter floods in sensitive watersheds will damage spawning redds and wash away incubating eggs (USGCRP 2009). Earlier peak stream flows will also flush some young salmon and steelhead from rivers to estuaries before they are physically mature, increasing stress and the risk of predation (USGCRP 2009). Lower stream flows and warmer water temperatures during summer will degrade summer rearing conditions, in part by increasing the prevalence and virulence of fish diseases and parasites (USGCRP 2009). Other adverse effects are likely to include altered migration patterns, accelerated embryo development, premature emergence of fry, variation in quality and quantity of tributary rearing habitat, and increased competition and predation risk from warm-water, non-native species (ISAB 2007).

The earth’s oceans are also warming, with considerable inter-annual and inter-decadal variability superimposed on the longer-term trend (Bindoff *et al*. 2007). Historically, warm periods in the coastal Pacific Ocean have coincided with relatively low abundances of salmon and steelhead, while cooler ocean periods have coincided with relatively high abundances (Scheuerell and Williams 2005, Zabel *et al*. 2006, USGCRP 2009). Ocean conditions adverse to salmon and steelhead may be more likely under a warming climate (Zabel *et al*. 2006).

2.2.1 Status of the Species

The status of steelhead and salmon species and critical habitat sections below are organized under five recovery domains (Table 8) to better integrate recovery planning information that NMFS is developing on the conservation status of the species and critical habitats considered in this consultation. Recovery domains are the geographically-based areas that NMFS is using to prepare multi-species recovery plans.

Table 8. Recovery planning domains identified by NMFS and their ESA-listed salmon and steelhead species.

Recovery Domain	Species
Willamette-Lower Columbia	LCR Chinook salmon UWR Chinook salmon CR chum salmon LCR coho salmon LCR steelhead UWR steelhead
Interior Columbia	UCR spring-run Chinook salmon SR spring/summer Chinook salmon SR fall-run Chinook salmon LO sockeye salmon SR sockeye salmon UCR steelhead MCR steelhead SRB steelhead
Oregon Coast	OC coho salmon

For each recovery domain, a technical review team (TRT) appointed by NMFS has developed, or is developing, criteria necessary to identify independent populations within each species, recommended viability criteria for those species, and descriptions of factors that limit species survival. Viability criteria are prescriptions of the biological conditions for populations, biogeographic strata, and ESUs that, if met, would indicate that the ESU will have a negligible risk of extinction over a 100-year time frame.

The definition of a population used by each TRT to analyze salmon and steelhead is set forth in the "viable salmonid population" document prepared by NMFS for use in conservation assessments of Pacific salmon and steelhead (McElhany *et al*. 2000). That document defines population viability in terms of four variables: abundance, population growth rate (productivity), population spatial structure, and genetic diversity.

Abundance is of obvious importance since, in general, small populations are at greater risk of extinction than large populations, primarily because many processes that affect population dynamics may operate differently in small populations than in large populations (Shaffer 1987, McElhany *et al.* 2000).

Population growth rate, the productivity over the entire life cycle, and factors that affect population growth rate provide information about how well a population is performing in the various habitats it occupies during the life cycle. Examining population growth rate allows one to assess if populations are able to replace themselves. Populations that consistently fail to replace themselves are at greater risk of extinction than populations that are consistently at or above replacement levels.

Spatial structure refers to the distribution of individuals within a population at a certain life stage throughout the available habitats, recognizing the abiotic and biotic processes that give rise to that structure. McElhany *et al.* (2000) gave two main reasons why spatial structure is important to consider when evaluating population viability: (1) Overall extinction risk at longer time scales may be affected in ways not apparent from short-term observations of abundance and productivity, because there can be a time lag between changes in spatial structure and the resulting population-level effects; and (2) spatial population structure affects the ability of a population to respond to changing environmental conditions and therefore can influence evolutionary processes. Maintaining spatial structure within a population, and its associated benefits to viability, requires appropriate habitat conditions and suitable corridors linking the habitat and the marine environment to be consistently available.

Diversity relates to the variability of phenotypic characteristics such as life histories, individual size, fecundity, run timing, and other attributes exhibited by individuals and populations, as well as the genetic diversity that may underlie this variation. There are many reasons diversity is important in a spatially and temporally varying environment. Three key reasons are: (1) Diversity allows a species to use a wide array of environments; (2) diversity protects a species against short-term spatial and temporal changes in the environment; and (3) genetic diversity provides the raw material for surviving long-term environmental change (McElhany *et al.* 2000).

Although the TRTs operated from this common set of biological principals described in McElhany *et al.* (2000), they worked semi-independently from each other and developed criteria suitable to the species and conditions found in their specific recovery domains. All of the criteria have qualitative as well as quantitative aspects. The diversity of salmonid species and populations makes it impossible to set narrow quantitative guidelines that will fit all populations in all situations. For this and other reasons, viability criteria vary among species, mainly in the number and type of metrics and the scales at which the metrics apply (*i.e.*, population, major population group [MPG], or ESU) (Busch *et al.* 2008). \

Overall viability risk scores (high to low) are based on combined ratings for the abundance and productivity (A/P) and spatial structure and diversity[18] (SS/D) metrics (Table 9). The A/P score considers the TRT's estimate of a populations' minimum threshold population, natural spawning abundance and the productivity of the population. Productivity over the entire life cycle and factors that affect population growth rate provide information on how well a population is "performing" in the habitats it occupies during the life cycle. Estimates of population growth rate that indicate a population is consistently failing to replace itself are an indicator of increased extinction risk. The four metrics (abundance, productivity, spatial structure, and diversity) are not independent of one another and their relationship to sustainability depends on a variety of interdependent ecological processes (Wainwright *et al.* 2008).

Integrated SS/D risk combines risk for likely, future environmental conditions, and diversity (McElhany *et al.* 2000, McElhany *et al.* 2007, Ford *et al.* 2010). Diversity factors include:

- Life history traits: Distribution of major life history strategies within a population, variability of traits, mean value of traits, and loss of traits.
- Effective population size: One of the indirect measures of diversity is effective population size. A population at chronic low abundance or experiencing even a single episode of low abundance can be at higher extinction risk because of loss of genetic variability, inbreeding and the expression of inbreeding depression, or the effects of mutation accumulation.
- Impact of hatchery fish: Interbreeding of wild populations and hatchery origin fish can be a significant risk factor to the diversity of wild populations if the proportion of hatchery fish in the spawning population is high and their genetic similarity to the wild population is low.
- Anthropogenic mortality: The susceptibility to mortality from harvest or habitat alterations will differ depending on size, age, run timing, disease resistance or other traits.
- Habitat diversity: Habitat characteristics have clear selective effects on populations, and changes in habitat characteristics are likely to eventually lead to genetic changes through selection for locally adapted traits. In assessing risk associated with altered habitat diversity, historical diversity is used as a reference point.

[18] The WLC-TRT provided ratings for diversity and spatial structure risks. The IC-TRT provided spatial structure and diversity ratings combined as an integrated SS/D risk.

Table 9. Population persistence categories from McElhany *et al.* (2006). A low or negligible risk of extinction is considered "viable" (Ford *et al.* 2010). Population persistence categories correspond to: 4 = very low (VL), 3 = low (L), 2 = moderate (M), 1 = high (H), and 0 = very high (VH) in Oregon populations, which corresponds to "extirpated or nearly so" (E) in Washington populations (Ford *et al.* 2010).

Population Persistence Category	Probability of population persistence in 100 years	Probability of population extinction in 100 years	Description
0	0-40%	60-100%	Either extinct or "high" risk of extinction
1	40-75%	25-60%	Relatively "high" risk of extinction in 100 years
2	75-95%	5-25%	"Moderate" risk of extinction in 100 years
3	95-99%	1-5%	"Low" (negligible) risk of extinction in 100 years
4	>99%	<1%	"Very low" risk of extinction in 100 years

The boundaries of each population are defined using a combination of genetic information, geography, life-history traits, morphological traits, and population dynamics that indicate the extent of reproductive isolation among spawning groups. To date, the TRT have divided the species of salmon and steelhead considered in this opinion into a total of 304 populations, although the population structure of PS steelhead has yet to be resolved. The overall viability of a species is a function of the VSP attributes of its constituent populations. Until a viability analysis of a species is completed, the VSP guidelines recommend that all populations should be managed to retain the potential to achieve viable status to ensure a rapid start along the road to recovery, and that no significant parts of the species are lost before a full recovery plan is implemented (McElhany *et al.* 2000).

Climate change, as described in Section 2.2, is likely to adversely affect the size and distribution of populations of ESA-listed anadromous fish in the Pacific Northwest. The size and distribution of the populations considered in this opinion generally have declined over the past few decades due to natural phenomena and human activity, including the operation of hydropower systems, over-harvest, hatcheries, and habitat degradation. Enlarged populations of terns, seals, sea lions, and other aquatic predators in the Pacific Northwest have been identified as factors that may be limiting the productivity of some Pacific salmon and steelhead populations (Ford 2011).

Viability status is described below for each of the populations considered in this opinion.

Willamette and Lower Columbia Recovery Domain. Species in the WLC recovery domain include LCR Chinook salmon, UWR Chinook salmon, CR chum salmon, LCR coho salmon, LCR steelhead, and UWR steelhead. The WLC-TRT has identified 107 demographically independent populations of Pacific salmon and steelhead (Table 10). These populations were further aggregated into strata, groupings above the population level that are connected by some degree of migration, based on ecological subregions. All 107 populations use parts of the mainstem of the Columbia River and the Columbia River estuary for migration, rearing, and smoltification.

On August 15, 2011, NMFS announced the results of an ESA 5-year review for salmon and steelhead in the WLC Recovery Domain (76 FR 50448). After reviewing new information on the viability of these species, ESA section 4 listing factors, and efforts being made to protect the species, NMFS concluded that all six species in this domain should retain their 2005 (for salmon) or 2006 (for steelhead) listing classifications.

Table 10. Populations in the WLC recovery domain. Combined extinction risks for salmon and steelhead based on analysis of Oregon populations only.

Species	Populations
LCR Chinook salmon	32
UWR Chinook salmon	7
CR chum salmon	17
LCR coho salmon	24
LCR steelhead	26
UWR steelhead	4

LCR Chinook Salmon.

Spatial Structure and Diversity. This species includes all naturally-spawned populations of Chinook salmon in the Columbia River and its tributaries from its mouth at the Pacific Ocean upstream to a transitional point between Washington and Oregon east of the Hood River and the White Salmon River; the Willamette River to Willamette Falls, Oregon, exclusive of spring-run Chinook salmon in the Clackamas River; and progeny of seventeen artificial propagation programs.[19] LCR Chinook populations exhibit three different life history types base on return timing and other features: fall-run (a.k.a. "tules"), late-fall-run (a.k.a. "brights"), and spring-run. The WLC-TRT identified 32 historical populations of LCR Chinook salmon— seven in the coastal subregion, six in the Columbia Gorge, and 19 in the Cascade Range (Table 11). Spatial structure has been substantially reduced in several populations. Low abundance, past broodstock transfers and other legacy hatchery effects, and ongoing hatchery straying may have reduced genetic diversity within and among LCR Chinook salmon populations. Hatchery-origin fish spawning naturally may also have reduced population productivity (Lower Columbia Fish Recovery Board 2010; ODFW 2010). Out of the 32 populations that make up this ESU, only the two late-fall runs, the North Fork Lewis and Sandy, are considered viable. Most populations (26

[19] In 2009, the Elochoman tule fall Chinook salmon program was discontinued and four new fall Chinook salmon programs have been initiated. In 2011, NMFS recommended removing the Elochoman program from the ESU and adding the new programs to the ESU (NMFS 2011a).

out of 32) have a very low probability of persistence over the next 100 years (and some are extirpated or nearly so) (Ford 2011; Lower Columbia Fish Recovery Board 2010; ODFW 2010). Five of the six strata fall significantly short of the WLC-TRT criteria for viability; one stratum, Cascade late-fall, meets the WLC TRT criteria (NMFS 2012b).

Table 11. LCR Chinook salmon strata, ecological subregions, run timing, populations, and scores for the key elements (A&P, spatial structure, and diversity) used to determine overall net persistence probability of the population (NMFS 2012b). Persistence probability ratings range from very low (VL), low (L), moderate (M), high (H), to very high (VH).

Stratum		Spawning Population (Watershed)	A&P	Spatial Structure	Diversity	Overall Persistence Probability
Ecological Subregion	**Run Timing**					
Cascade Range	Spring	Upper Cowlitz River (WA)	VL	L	M	VL
		Cispus River (WA)	VL	L	M	VL
		Tilton River (WA)	VL	VL	VL	VL
		Toutle River (WA)	VL	H	L	VL
		Kalama River (WA)	VL	H	L	VL
		North Fork Lewis (WA)	VL	L	M	VL
		Sandy River (OR)	M	M	M	M
	Fall	Lower Cowlitz River (WA)	VL	H	M	VL
		Upper Cowlitz River (WA)	VL	VL	M	VL
		Toutle River (WA)	VL	H	M	VL
		Coweeman River (WA)	L	H	H	L
		Kalama River (WA)	VL	H	M	VL
		Lewis River (WA)	VL	H	H	VL
		Salmon Creek (WA)	VL	H	M	VL
		Clackamas River (OR)	VL	VH	L	VL
		Sandy River (OR)	VL	M	L	VL
		Washougal River (WA)	VL	H	M	VL
	Late Fall	North Fork Lewis (WA)	VH	H	H	VH
		Sandy River (OR)	VH	M	M	VH
Columbia Gorge	Spring	White Salmon River (WA)	VL	VL	VL	VL
		Hood River (OR)	VL	VH	VL	VL
	Fall	Lower Gorge (WA & OR)	VL	M	L	VL
		Upper Gorge (WA & OR)	VL	M	L	VL
		White Salmon River (WA)	VL	L	L	VL
		Hood River (OR)	VL	VH	L	VL
Coast Range	Fall	Young Bay (OR)	L	VH	L	L
		Grays/Chinook rivers (WA)	VL	H	VL	VL
		Big Creek (OR)	VL	H	L	VL
		Elochoman/Skamokawa creeks (WA)	VL	H	L	VL
		Clatskanie River (OR)	VL	VH	L	VL
		Mill, Germany, and Abernathy creeks (WA)	VL	H	L	VL
		Scappoose River (OR)	L	H	L	L

Abundance and Productivity. A&P ratings for LCR Chinook salmon populations are currently "low" to "very low" for most populations, except for spring Chinook salmon in the

Sandy River, which are "moderate" and late-fall Chinook salmon in North Fork Lewis River and Sandy River, which are "very high" (NMFS 2012b). Low abundance of natural-origin spawners (100 fish or fewer) has increased genetic and demographic risks. Other LCR Chinook salmon populations have higher total abundance, but several of these also have high proportions of hatchery-origin spawners. Particularly for tule fall Chinook salmon populations, poor data quality prevents precise quantification of population abundance and productivity; data quality has been poor because of inadequate spawning surveys and the presence of unmarked hatchery-origin spawners (Ford 2011).

Limiting Factors include (NMFS 2012b; NOAA Fisheries 2011):

- Degraded estuarine and near-shore marine habitat resulting from cumulative impacts of land use and flow management by the Columbia River hydropower system Degraded freshwater habitat: Floodplain connectivity and function, channel structure and complexity, riparian areas, stream substrate, stream flow, and water quality have been degraded as a result of cumulative impacts of agriculture, forestry, and development.
- Reduced access to spawning and rearing habitat mainly as a result of tributary hydropower projects
- Hatchery-related effects
- Harvest-related effects on fall Chinook salmon
- An altered flow regime and Columbia River plume has altered the temperature regime and estuarine food web, and has reduced ocean productivity
- Reduced access to off-channel rearing habitat in the lower Columbia River
- Reduced productivity resulting from sediment and nutrient-related changes in the estuary
- Juvenile fish strandings that result from ship wakes
- Contaminants affecting fish health and reproduction

CR Chum Salmon.

Spatial Structure and Diversity. This species includes all naturally-spawned populations of chum salmon in the Columbia River and its tributaries in Washington and Oregon, and progeny of three artificial propagation programs. The WLC-TRT identified 17 historical populations of CR chum salmon and aggregated these into four strata (Myers *et al.* 2006)(Table 12). CR chum salmon spawning aggregations identified in the mainstem Columbia River were included in the population associated with the nearest river basin.

Table 12. CR chum salmon strata, ecological subregions, run timing, populations, and scores for the key elements (A&P, spatial structure, and diversity) used to determine current overall net persistence probability of the population (NMFS 2012b). Persistence probability ratings are very low (VL), low (L), moderate (M), high (H), to very high (VH).

Stratum		Spawning Population (Watershed)	A&P	Diversity	Spatial Structure	Overall Persistence Probability
Ecological Subregion	**Run Timing**					
Coast Range	Fall	Young's Bay (OR)	*	*	*	VL
		Grays/Chinook rivers (WA)	VH	M	H	M
		Big Creek (OR)	*	*	*	VL
		Elochoman/Skamakowa rivers (WA)	VL	H	L	VL
		Clatskanie River (OR)	*	*	*	VL
		Mill, Abernathy and Germany creeks (WA)	VL	H	L	VL
		Scappoose Creek (OR)	*	*	*	VL
Cascade Range	Summer	Cowlitz River (WA)	VL	L	L	VL
	Fall	Cowlitz River (WA)	VL	H	L	VL
		Kalama River (WA)	VL	H	L	VL
		Lewis River (WA)	VL	H	L	VL
		Salmon Creek (WA)	VL	L	L	VL
		Clackamas River (OR)	*	*	*	VL
		Sandy River (OR)	*	*	*	
		Washougal River (WA)	VL	H	L	VL
Columbia Gorge	Fall	Lower Gorge (WA & OR)	VH	H	VH	H
		Upper Gorge (WA & OR)	VL	L	L	VL

* No data are available to make a quantitative assessment.

LCR Coho Salmon.

Spatial Structure and Diversity. This species includes all naturally-spawned populations of coho salmon in the Columbia River and its tributaries in Washington and Oregon, from the mouth of the Columbia up to and including the Big White Salmon and Hood rivers; in the Willamette River to Willamette Falls, Oregon; and progeny of 25 artificial propagation programs.[20] Spatial diversity is rated "moderate" to "very high" for all the populations, except the North Fork Lewis River, which has a "low" rating for spatial structure.

Three status evaluations of LCR coho salmon status, all based on WLC-TRT criteria, have been conducted since the last NMFS status review in 2005 (McElhany *et al.* 2007; NMFS 2012b). Out of the 24 populations that make up this ESU (Table 13), 21 are considered to have a very low probability of persisting for the next 100 years, and none is considered viable (Ford 2011; Lower Columbia Fish Recovery Board 2010; NMFS 2012b; ODFW 2010).

[20] The Elochoman Hatchery Type-S and Type-N coho salmon programs were eliminated in 2008. The last adults from these two programs returned to the Elochoman in 2010. NMFS has recommended that these two programs be removed from the ESU (NMFS 2011a).

Table 13. LCR coho salmon strata, ecological subregions, run timing, populations, and scores for the key elements (A&P, spatial structure, and diversity) used to determine current overall net persistence probability of the population (NMFS 2012b). Persistence probability ratings range from very low (VL), low (L), moderate (M), high (H), to very high (VH).

Ecological Subregions	Population (Watershed)	A&P	Spatial Structure	Diversity	Overall Persistence Probability
Coast Range	Young's Bay (OR)	VL	VH	VL	VL
	Grays/Chinook rivers (WA)	VL	H	VL	VL
	Big Creek (OR)	VL	H	L	VL
	Elochoman/Skamokawa creeks (WA)	VL	H	VL	VL
	Clatskanie River (OR)	L	VH	M	L
	Mill, Germany, and Abernathy creeks (WA)	VL	H	L	VL
	Scappoose River (OR)	M	H	M	M
Cascade Range	Lower Cowlitz River (WA)	VL	M	M	VL
	Upper Cowlitz River (WA)	VL	M	L	VL
	Cispus River (WA)	VL	M	L	VL
	Tilton River (WA)	VL	M	L	VL
	South Fork Toutle River (WA)	VL	H	M	VL
	North Fork Toutle River (WA)	VL	M	L	VL
	Coweeman River (WA)	VL	H	M	VL
	Kalama River (WA)	VL	H	L	VL
	North Fork Lewis River (WA)	VL	L	L	VL
	East Fork Lewis River (WA)	VL	H	M	VL
	Salmon Creek (WA)	VL	M	VL	VL
	Clackamas River (OR)	M	VH	H	M
	Sandy River (OR)	VL	H	M	VL
	Washougal River (WA)	VL	H	L	VL
Columbia Gorge	Lower Gorge Tributaries (WA & OR)	VL	M	VL	VL
	Upper Gorge/White Salmon (WA)	VL	M	VL	VL
	Upper Gorge Tributaries/Hood (OR)	VL	VH	L	VL

Abundance and Productivity. In Oregon, the Clatskanie Creek and Clackamas River populations have "low" and "moderate" persistence probability ratings for A&P, while the rest are rated "very low." All of the Washington populations have "very low" A&P ratings. The persistence probability for diversity is "high" in the Clackamas population, "moderate" in the Clatskanie, Scappoose, Lower Cowlitz, South Fork Toutle, Coweeman, East Fork Lewis, and Sandy populations, and "low" to "very low" in the rest (NMFS 2012b). Uncertainty is high because of a lack of adult spawner surveys. Smolt traps indicate some natural production in Washington populations, though given the high fraction of hatchery origin spawners suspected to occur in these populations it is not clear that any are self-sustaining. Overall, the new information considered does not indicate a change in the biological risk category since the last status review (Ford 2011; NMFS 2011a; NMFS 2012b).

Limiting Factors include (NMFS 2012b; NOAA Fisheries 2011):

- Degraded estuarine and near-shore marine habitat resulting from cumulative impacts of land use and flow management by the Columbia River hydropower system

- Fish passage barriers that limit access to spawning and rearing habitats
- Degraded freshwater habitat: Floodplain connectivity and function, channel structure and complexity, riparian areas and large wood supply, stream substrate, stream flow, and water quality have been degraded as a result of cumulative impacts of agriculture, forestry, and development
- Hatchery-related effects
- Harvest-related effects
- An altered flow regime and Columbia River plume has altered the temperature regime and estuarine food web, and has reduced ocean productivity
- Reduced access to off-channel rearing habitat in the lower Columbia River
- Reduced productivity resulting from sediment and nutrient-related changes in the estuary
- Juvenile fish strandings that result from ship wakes
- Contaminants affecting fish health and reproduction

LCR Steelhead.

Spatial Structure and Diversity. Four strata and 23 historical populations of LCR steelhead occur within the DPS: 17 winter-run populations and six summer-run populations, within the Cascade and Gorge ecological subregions (Table 14).[21] The DPS also includes the progeny of ten artificial propagation programs.[22] Summer steelhead return to freshwater long before spawning. Winter steelhead, in contrast, return from the ocean much closer to maturity and spawn within a few weeks. Summer steelhead spawning areas in the Lower Columbia River are found above waterfalls and other features that create seasonal barriers to migration. Where no temporal barriers exist, the winter-run life history dominates.

[21] The White Salmon and Little White Salmon steelhead populations are part of the Middle Columbia steelhead DPS and are addressed in a separate species-level recovery plan, the Middle Columbia River Steelhead Distinct Population Segment ESA Recovery Plan (NMFS 2009b).

[22] In 2007, the release of Cowlitz Hatchery winter steelhead into the Tilton River was discontinued; in 2009, the Hood River winter steelhead program was discontinued; and in 2010, the release of hatchery winter steelhead into the Upper Cowlitz and Cispus rivers was discontinued. In 2011, NMFS recommended removing these programs from the DPS. A Lewis River winter steelhead program was initiated in 2009, and in 2011, NMFS proposed that it be included in the DPS (NMFS 2011a).

Table 14. LCR steelhead strata, ecological subregions, run timing, populations, and scores for the key elements (A&P, spatial structure, and diversity) used to determine current overall net persistence probability of the population (NMFS 2012b). Risk ratings range from very low (VL), low (L), moderate (M), high (H), to very high (VH).

Stratum		Population (Watershed)	A&P	Spatial Structure	Diversity	Overall Persistence Probability
Ecological Subregion	**Run Timing**					
Cascade Range	Summer	Kalama River (WA)	H	VH	M	M
		North Fork Lewis River (WA)	VL	VL	VL	VL
		East Fork Lewis River (WA)	VL	VH	M	VL
		Washougal River (WA)	M	VH	M	M
	Winter	Lower Cowlitz River (WA)	L	M	M	L
		Upper Cowlitz River (WA)	VL	M	M	VL
		Cispus River (WA)	VL	M	M	VL
		Tilton river (WA)	VL	M	M	VL
		South Fork Toutle River (WA)	M	VH	H	M
		North Fork Toutle River (WA)	VL	H	H	VL
		Coweeman River (WA)	L	VH	VH	L
		Kalama River (WA)	L	VH	H	L
		North Fork Lewis River (WA)	VL	M	M	VL
		East Fork Lewis River (WA)	M	VH	M	M
		Salmon Creek (WA)	VL	H	M	VL
		Clackamas River (OR)	M	VH	M	M
		Sandy River (OR)	L	M	M	L
		Washougal River (WA)	L	VH	M	L
Columbia Gorge	Summer	Wind River (WA)	VH	VH	H	H
		Hood River (OR)	VL	VH	L	VL
	Winter	Lower Gorge (WA & OR)	L	VH	M	L
		Upper Gorge (OR & WA)	L	M	M	L
		Hood River (OR)	M	VH	M	M

It is likely that genetic and life history diversity has been reduced as a result of pervasive hatchery effects and population bottlenecks. Spatial structure remains relatively high for most populations Out of the 23 populations, 16 are considered to have a “low” or “very low” probability of persisting over the next 100 years, and six populations have a “moderate” probability of persistence (Ford 2011; Lower Columbia Fish Recovery Board 2010; NMFS 2012b; ODFW 2010). All four strata in the DPS fall short of the WLC-TRT criteria for viability (NMFS 2012b).

Baseline persistence probabilities were estimated to be “low” or “very low” for three out of the six summer steelhead populations that are part of the LCR DPS, moderate for two, and high for one—the Wind, which is considered viable (Lower Columbia Fish Recovery Board 2010; NMFS 2012b; ODFW 2010). Thirteen of the 17 LCR winter steelhead populations have “low” or “very low” baseline probabilities of persistence, and the remaining four are at “moderate” probability of persistence (Table 13) (Lower Columbia Fish Recovery Board 2010; NMFS 2012b; ODFW 2010).

Abundance and Productivity. The "low" to "very low" baseline persistence probabilities of most Lower Columbia River steelhead populations reflects low abundance and productivity (NMFS 2012b). All of the populations increased in abundance during the early 2000s, generally peaking in 2004. Most populations have since declined back to levels within one standard deviation of the long term mean. Exceptions are the Washougal summer-run and North Fork Toutle winter-run, which are still higher than the long term average, and the Sandy, which is lower. In general, the populations do not show any sustained dramatic changes in abundance or fraction of hatchery origin spawners since the 2005 status review (Ford 2011). Although current LCR steelhead populations are depressed compared to historical levels and long-term trends show declines, many populations are substantially healthier than their salmon counterparts, typically because of better habitat conditions in core steelhead production areas (Lower Columbia Fish Recovery Board 2010; NMFS 2012b).

Limiting Factors include (NMFS 2012b; NOAA Fisheries 2011):

- Degraded estuarine and nearshore marine habitat resulting from cumulative impacts of land use and flow management by the Columbia River hydropower system
- Degraded freshwater habitat: Floodplain connectivity and function, channel structure and complexity, riparian areas and recruitment of large wood, stream substrate, stream flow, and water quality have been degraded as a result of cumulative impacts of agriculture, forestry, and development
- Reduced access to spawning and rearing habitat mainly as a result of tributary hydropower projects and lowland development
- Avian and marine mammal predation in the lower mainstem Columbia River and estuary.
- Hatchery-related effects
- An altered flow regime and Columbia River plume has altered the temperature regime and estuarine food web, and has reduced ocean productivity
- Reduced access to off-channel rearing habitat in the lower Columbia River
- Reduced productivity resulting from sediment and nutrient-related changes in the estuary
- Juvenile fish strandings that result from ship wakes
- Contaminants affecting fish health and reproduction

UWR Chinook Salmon. This species includes all naturally spawned populations of spring-run Chinook salmon in the Clackamas River; in the Willamette River and its tributaries above Willamette Falls, Oregon; and progeny of seven artificial propagation programs. All seven historical populations of UWR Chinook salmon identified by the WLC-TRT occur within the action area and are contained within a single ecological subregion, the western Cascade Range (Table 15); only the Clackamas population is characterized as "viable" (McElhany *et al.* 2007).

Table 15. Scores for the key elements (A/P, diversity, and spatial structure) used to determine current overall viability risk for UWR Chinook salmon (ODFW and NMFS 2011). All populations are in the Western Cascade Range ecological subregion. Risk ratings range from very low (VL), low (L), moderate (M), high (H), to very high (VH).

Population (Watershed)	A/P	Diversity	Spatial Structure	Overall Extinction Risk
Clackamas River	M	M	L	M
Molalla River	VH	H	H	VH
North Santiam River	VH	H	H	VH
South Santiam River	VH	M	M	VH
Calapooia River	VH	H	VH	VH
McKenzie River	VL	M	M	L
Middle Fork Willamette River	VH	H	H	VH

Consideration of data collected since the last status review in 2005 has confirmed the high fraction of hatchery origin fish in all of the populations of this species (even the Clackamas and McKenzie rivers have hatchery fractions above WLC-TRT viability thresholds). All of the UWR Chinook salmon populations have "moderate" or "high" risk ratings for diversity. The Clackamas and McKenzie river populations currently have the best risk ratings for A/P, spatial structure, and diversity. Clackamas River Chinook salmon have a "low" risk rating for spatial structure.

The new data have also highlighted the substantial risks associated with pre-spawning mortality. Although recovery plans are targeting key limiting factors for future actions, there have been no significant on-the-ground-actions since the last status review to resolve the lack of access to historical habitat above dams nor have there been substantial actions removing hatchery fish from the spawning grounds. Overall, the new information does not indicate a change in the biological risk category since the last status review (Ford 2011).

Limiting factors and threats to UWR Chinook salmon include (ODFW and NMFS 2011, NOAA Fisheries 2011a):

- Significantly reduced access to spawning and rearing habitat because of tributary dams
- Degraded freshwater habitat, especially floodplain connectivity and function, channel structure and complexity, and riparian areas and large wood recruitment as a result of cumulative impacts of agriculture, forestry, and development
- Degraded water quality and altered temperature as a result of both tributary dams and the cumulative impacts of agriculture, forestry, and urban development
- Hatchery-related effects
- Anthropogenic introductions of non-native species and out-of-ESU races of salmon or steelhead have increased predation on, and competition with, native UWR Chinook salmon
- Ocean harvest rates of approximately 30%

UWR Steelhead. This species includes all naturally-spawned steelhead populations below natural and manmade impassable barriers in the Willamette River, Oregon, and its tributaries upstream from Willamette Falls to the Calapooia River. The WLC-TRT identified five historical populations of UWR steelhead, all with winter run timing (Myers *et al.* 2006). UWR steelhead are currently found in many tributaries that drain the west side of the upper Willamette River Basin. Analysis of historical observations, hatchery records, and genetic analysis strongly suggested that many of these spawning aggregations are the result of recent introductions and do not represent a historical population. Nevertheless, the WLC-TRT recognized that these tributaries may provide juvenile rearing habitat or may be temporarily (for one or more generations) colonized during periods of high abundance. One stratum and five historical populations of UWR steelhead occur within the action area (Table 16), although the west-side tributaries population was included only because it is important to the species as a whole, and not because it is independent. Summer steelhead have become established in the McKenzie River where historically no steelhead existed, although these fish were not considered in the identification of historical populations. Hatchery summer-run steelhead that are produced and released in the subbasins are from an out-of-basin stock and are not part of the DPS (ODFW and NMFS 2011).

Table 16. Scores for the key elements (A/P, diversity, and spatial structure) used to determine current overall viability risk for UWR steelhead (ODFW and NMFS 2011). All populations are in the Western Cascade Range ecological subregion. Risk ratings range from very low (VL), low (L), moderate (M), high (H), to very high (VH).

Population (Watershed)	A/P	Diversity	Spatial Structure	Overall Extinction Risk
Molalla River	VL	M	M	L
North Santiam River	VL	M	H	L
South Santiam River	VL	M	M	L
Calapooia River	M	M	VH	M

Since the last status review in 2005, UWR steelhead initially increased in abundance but subsequently declines and current abundance is at the levels observed in the mid-1990s when the DPS was first listed. The DPS appears to be at lower risk than the UWR Chinook salmon ESU, but continues to demonstrate the overall low abundance pattern that was of concern during the last status review. The elimination of winter run hatchery release in the basin reduces hatchery threats, but non-native summer steelhead hatchery releases are still a concern for species diversity. Overall, the new information considered does not indicate a change in the biological risk category since the last status review (Ford 2011).

Limiting factors and threats to UWR steelhead include (ODFW and NMFS 2011, NOAA Fisheries 2011):

- Degraded freshwater habitat: Floodplain connectivity and function, channel structure and complexity, riparian areas and large wood recruitment, and stream flow have been degraded as a result of cumulative impacts of agriculture, forestry, and development

- Degraded water quality and altered temperature as a result of both tributary dams and the cumulative impacts of agriculture, forestry, and urban development
- Reduced access to spawning and rearing habitats mainly as a result of artificial barriers in spawning tributaries
- Hatchery-related effects: impacts from the non-native summer steelhead hatchery program
- Anthropogenic introductions of non-native species and out-of-ESU races of salmon or steelhead have increased predation and competition on native UWR steelhead.

Interior Columbia (IC) Recovery Domain. Species in the IC recovery domain include UCR spring-run Chinook salmon, SR spring/summer run Chinook salmon, SR fall-run Chinook salmon, SR sockeye salmon, UCR steelhead, MCR steelhead, and SRB steelhead. The IC-TRT identified 82 populations of those species based on genetic, geographic (hydrographic), and habitat characteristics (Table 17). In some cases, the IC-TRT further aggregated populations into "major groupings" based on dispersal distance and rate, and drainage structure, primarily the location and distribution of large tributaries (IC-TRT 2003). All 82 populations identified use the lower mainstem of the Snake River, the mainstem of the Columbia River, and the Columbia River estuary, or part thereof, for migration, rearing, and smoltification.

On August 15, 2011, NMFS announced the results of an ESA 5-year review for salmon and steelhead in the IC Recovery Domain (76 FR 50448). After reviewing new information on the viability of these species, ESA section 4 listing factors, and efforts being made to protect the species, NMFS concluded that all salmon and steelhead in the Mid-Columbia, Upper Columbia, and Snake River sub-domains should retain their 2005 (for salmon) or 2006 (for steelhead) listing classifications.

Table 17. Populations of ESA-listed salmon and steelhead in the IC recovery domain.

Species	Populations
UCR spring-run Chinook salmon	3
SR spring/summer Chinook salmon	28
SR fall-run Chinook salmon	1
SR sockeye salmon	1
UCR steelhead	4
MCR steelhead	17
SRB steelhead	24

The IC-TRT also recommended viability criteria that follow the VSP framework (McElhany *et al.* 2006) and described biological or physical performance conditions that, when met, indicate a population or species has a 5% or less risk of extinction over a 100-year period (IC-TRT 2007; see also NRC 1995).

UCR Spring-run Chinook Salmon. This species includes all naturally-spawned populations of Chinook salmon in all river reaches accessible to Chinook salmon in Columbia River tributaries upstream of the Rock Island Dam and downstream of Chief Joseph Dam in Washington (excluding the Okanogan River), the Columbia River from a straight line connecting the west end of the Clatsop jetty (south jetty, Oregon side) and the west end of the Peacock jetty (north jetty, Washington side) upstream to Chief Joseph Dam in Washington, and progeny of six artificial propagation programs. The IC-TRT identified four independent populations of UCR spring-run Chinook salmon in the upriver tributaries of Wenatchee, Entiat, Methow, and Okanogan (extirpated), but no major groups due to the relatively small geographic area affected (IC-TRT 2003, Ford *et al.* 2010)(Table 18).

Table 18. Scores for the key elements (A/P, diversity, and SS/D) used to determine current overall viability risk for UCR spring-run Chinook salmon (Ford. 2011). Risk ratings range from very low (VL), low (L), moderate (M), high (H), to very high (VH).

Population	A/P	Diversity	Integrated SS/D	Overall Viability Risk
Wenatchee River	H	H	H	H
Entiat River	H	H	H	H
Methow River	H	H	H	H
Okanogan River	n/a	n/a	n/a	extripated

The UCR spring-run Chinook salmon ESU is not currently meeting the viability criteria (adapted from the IC-TRT) in the Upper Columbia Recovery Plan. A/P remains at “high” risk for each of the three extant populations in this MPG/ESU. The 10-year geometric mean abundance of adult natural origin spawners has increased for each population relative to the levels for the 1981-2003 series, but the estimates remain below the corresponding IC-TRT thresholds. Estimated productivity (spawner to spawner return rate at low to moderate escapements) was on average lower over the years 1987-2009 than for the previous period. The combinations of current abundance and productivity for each population result in a “high” risk rating. The composite SS/D risks for all three of the extant populations in this MPG are at “high” risk. The spatial processes component of the SS/D risk is “low” for the Wenatchee River and Methow River populations and “moderate” for the Entiat River (loss of production in lower section increases effective distance to other populations). All three of the extant populations in this MPG are at “high” risk for diversity, driven primarily by chronically high proportions of hatchery-origin spawners in natural spawning areas and lack of genetic diversity among the natural-origin spawners (Ford 2011).

Increases in natural origin abundance relative to the extremely low spawning levels observed in the mid-1990s are encouraging; however, average productivity levels remain extremely low. Overall, the viability of UCR spring-run Chinook salmon ESU has likely improved somewhat since the last status review, but the ESU is still clearly at “moderate-to-high” risk of extinction (Ford 2011).

Limiting factors and threats to the UCR spring-run Chinook salmon ESU include (UCSRB 2007, NOAA Fisheries 2011a):

- Mainstem Columbia River hydropower–related adverse effects: upstream and downstream fish passage, ecosystem structure and function, flows, and water quality
- Degraded freshwater habitat: Floodplain connectivity and function, channel structure and complexity, riparian areas and large woody debris recruitment, stream flow, and water quality have been degraded as a result of cumulative impacts of agriculture, forestry, and development
- Degraded estuarine and nearshore marine habitat
- Hatchery related effects: including past introductions and persistence of non-native (exotic) fish species continues to affect habitat conditions for listed species
- Harvest in Columbia River fisheries

SR Spring/summer-run Chinook Salmon. This species includes all naturally-spawned populations of spring/summer-run Chinook salmon in the mainstem Snake River and the Tucannon River, Grande Ronde River, Imnaha River, and Salmon River subbasins; and progeny of fifteen artificial propagation programs. The IC-TRT identified 28 extant and four extirpated populations of SR spring/summer-run Chinook salmon, and aggregated these into major population groups (IC-TRT 2007, Ford 2011). Each of these populations faces a "high" risk of extinction (Ford. 2011) (Table 19).

Population level status ratings remain at "high" risk across all MPGs within the ESU, although recent natural spawning abundance estimates have increased, all populations remain below minimum natural origin abundance thresholds. Spawning escapements in the most recent years in each series are generally well below the peak returns but above the extreme low levels in the mid-1990s. Relatively low natural production rates and spawning levels below minimum abundance thresholds remain a major concern across the ESU.

The ability of SR spring/summer-run Chinook salmon populations to be self-sustaining through normal periods of relatively low ocean survival remains uncertain. Factors cited by Good *et al.* (2005) remain as concerns or key uncertainties for several populations. Overall, the new information considered does not indicate a change in the biological risk category since the last status review (Ford 2011).

Table 19. SR spring/summer-run Chinook salmon ecological subregions, populations, and scores for the key elements (A/P, diversity, and SS/D) used to determine current overall viability risk for SR spring/summer-run Chinook salmon (Ford. 2011). Risk ratings range from very low (VL), low (L), moderate (M), high (H), to very high (VH) and extirpated (E).

Ecological Subregions	Spawning Populations (Watershed)	A/P	Diversity	Integrated SS/D	Overall Viability Risk
Lower Snake River	Tucannon River	H	M	M	H
	Asotin River				E
Grande Ronde and Imnaha rivers	Wenaha River	H	M	M	H
	Lostine/Wallowa River	H	M	M	H
	Minam River	H	M	M	H
	Catherine Creek	H	M	M	H
	Upper Grande Ronde R.	H	M	H	H
	Imnaha River	H	M	M	H
	Big Sheep Creek				E
	Lookingglass Creek				E
South Fork Salmon River	Little Salmon River	*	*	*	H
	South Fork mainstem	H	M	M	H
	Secesh River	H	L	L	H
	EF/Johnson Creek	H	L	L	H
Middle Fork Salmon River	Chamberlin Creek	H	L	L	H
	Big Creek	H	M	M	H
	Lower MF Salmon	H	M	M	H
	Camas Creek	H	M	M	H
	Loon Creek	H	M	M	H
	Upper MF Salmon	H	M	M	H
	Sulphur Creek	H	M	M	H
	Bear Valley Creek	H	L	L	H
	Marsh Creek	H	L	L	H
Upper Mainstem Salmon	N. Fork Salmon River	H	L	L	H
	Lemhi River	H	H	H	H
	Pahsimeroi River	H	H	H	H
	Upper Salmon-lower mainstem	H	L	L	H
	East Fork Salmon River	H	H	H	H
	Yankee Fork	H	H	H	H
	Valley Creek	H	M	M	H
	Upper Salmon main	H	M	M	H
	Panther Creek				E

* Insufficient data.

Limiting factors and threats to the SR spring/summer-run Chinook salmon ESU include (NOAA Fisheries 2011a):

- Degraded freshwater habitat: Floodplain connectivity and function, channel structure and complexity, riparian areas and large wood supply, stream substrate, elevated water temperature, stream flow, and water quality have been degraded as a result of cumulative impacts of agriculture, forestry, and development
- Mainstem Columbia River and Snake River hydropower impacts
- Harvest-related effects
- Predation

SR Fall-run Chinook Salmon. This species includes all naturally-spawned populations of fall-run Chinook salmon in the mainstem Snake River below Hells Canyon Dam, and in the Tucannon River, Grande Ronde River, Imnaha River, Salmon River, and Clearwater River, and progeny of four artificial propagation programs. The IC-TRT identified three populations of this species, although only the lower mainstem population exists at present, and it spawns in the lower main stem of the Clearwater, Imnaha, Grande Ronde, Salmon and Tucannon rivers. The extant population of Snake River fall-run Chinook salmon is the only remaining population from an historical ESU that also included large mainstem populations upstream of the current location of the Hells Canyon Dam complex (IC-TRT 2003, Ford. 2011).

The recent increases in natural origin abundance are encouraging. However, hatchery origin spawner proportions have increased dramatically in recent years – on average, 78% of the estimated adult spawners have been hatchery origin over the most recent brood cycle. The apparent leveling off of natural returns in spite of the increases in total brood year spawners may indicate that density dependent habitat effects are influencing production or that high hatchery proportions may be influencing natural production rates. The A/P risk rating for the population is "moderate." The population is at moderate risk for diversity and spatial structure. Overall, the new information considered does not indicate a change in the biological risk category since the last status review (Ford. 2011). Given the combination of current A/P and SS/D ratings summarized above, the overall viability rating for Lower SR fall Chinook salmon would be rated as "maintained."[23]

Limiting factors and threats to SR fall-run Chinook salmon include (NOAA Fisheries 2011a):

- Degraded freshwater habitat: Floodplain connectivity and function, and channel structure and complexity have been degraded as a result of cumulative impacts of agriculture, forestry, and development
- Lost access to historic habitat above Hells Canyon and other Snake River dams
- Harvest-related effects
- Mainstem Columbia River and Snake River hydropower impacts
- Hatchery-related effects
- Degraded estuarine and nearshore habitat

[23] "Maintained" population status is for populations that do not meet the criteria for a viable population but do support ecological functions and preserve options for ESU/DPS recovery.

SR Sockeye Salmon. This species includes all anadromous and residual sockeye salmon from the Snake River Basin, Idaho, and artificially-propagated sockeye salmon from the Redfish Lake captive propagation program. The IC-TRT identified historical sockeye salmon production in at least five Stanley Basin and Sawtooth Valley lakes and in lake systems associated with Snake River tributaries currently cut off to anadromous access (*e.g.*, Wallowa and Payette Lakes), although current returns of SR sockeye salmon are extremely low and limited to Redfish Lake (IC-TRT 2007).

This species is still at extremely high risk across all four basic risk measures (abundance, productivity, spatial structure and diversity. Although the captive brood program has been successful in providing substantial numbers of hatchery produced *O. nerka* for use in supplementation efforts, substantial increases in survival rates across life history stages must occur in order to re-establish sustainable natural production (Hebdon *et al.* 2004, Keefer *et al.* 2008). Overall, although the risk status of the Snake River sockeye salmon ESU appears to be on an improving trend, the new information considered does not indicate a change in the biological risk category since the last status review (Ford. 2011).

The key factor limiting recovery of SR sockeye salmon ESU is survival outside of the Stanley Basin. Portions of the migration corridor in the Salmon River are impeded by water quality and temperature (Idaho Department of Environmental Quality 2011). Increased temperatures may reduce the survival of adult sockeye returning to the Stanley River Basin. The natural hydrological regime in the upper mainstem Salmon River Basin has been altered by water withdrawals. In most years, sockeye adult returns to Lower Granite suffer catastrophic losses (*e.g.*, > 50% mortality in one year; Reed *et al.* 2003) before reaching the Stanley Basin, although the factors causing these losses have not been identified. In the Columbia and Lower Snake River migration corridor, predation rates on juvenile sockeye salmon are unknown, but terns and cormorants consume 12% of all salmon smolts reaching the estuary, and piscivorous fish consume an estimated 8% of migrating juvenile salmon (NOAA Fisheries 2011).

MCR Steelhead. This species includes all naturally-spawned steelhead populations below natural and artificial impassable barriers in streams from above the Wind River, Washington, and the Hood River, Oregon (exclusive), upstream to, and including, the Yakima River, Washington, excluding steelhead from the Snake River Basin; and progeny of seven artificial propagation programs. The IC-TRT identified 17 extant populations in this DPS (IC-TRT 2003). The populations fall into four major population groups: the Yakima River Basin (four extant populations), the Umatilla/Walla-Walla drainages (three extant and one extirpated populations); the John Day River drainage (five extant populations) and the Eastern Cascades group (five extant and two extirpated populations) (Table 20) (NMFS 2009, Ford 2011).

Table 20. Ecological subregions, populations, and scores for the key elements (A/P, diversity, and SS/D) used to determine current overall viability risk for MCR steelhead (NMFS 2009, Ford. 2011). Risk ratings range from very low (VL), low (L), moderate (M), high (H), to very high (VH). Maintained (MT) population status indicates that the population does not meet the criteria for a viable population but does support ecological functions and preserve options for recovery of the DPS.

Ecological Subregions	**Population (Watershed)**	**A/P**	**Diversity**	**Integrated SS/D**	**Overall Viability Risk**
Cascade Eastern Slope Tributaries	Fifteenmile Creek	L	L	L	Viable
	Klickitat River	M	M	M	MT?
	Eastside Deschutes River	L	M	M	Viable
	Westside Deschutes River	H	M	M	H*
	Rock Creek	H	M	M	H?
	White Salmon	Extinct	n/a	n/a	Extinct*
	Crooked River	Extinct	n/a	n/a	Extinct*
John Day River	Upper Mainstem	M	M	M	MT
	North Fork	VL	L	L	Highly Viable
	Middle Fork	M	M	M	MT
	South Fork	M	M	M	MT
	Lower Mainstem	M	M	M	MT
Walla Walla and Umatilla rivers	Umatilla River	M	M	M	MT
	Touchet River	M	M	M	H
	Walla Walla River	M	M	M	MT
Yakima River	Satus Creek	M	M	M	Viable/ MT
	Toppenish Creek	M	M	M	Viable/ MT
	Naches River	H	M	M	H
	Upper Yakima	H	H	H	H

* Re-introduction efforts underway (NMFS 2009).

There have been improvements in the viability ratings for some of the component populations, but the MCR steelhead DPS is not currently meeting the viability criteria (adopted from the IC-TRT) in the MCR steelhead recovery plan (NMFS 2009). In addition, several of the factors cited by Good *et al.* (2005) remain as concerns or key uncertainties. Natural origin spawning estimates of populations have been highly variable with respect to meeting minimum abundance thresholds. Straying frequencies into at least the Lower John Day River population are high. Returns to the Yakima River Basin and to the Umatilla and Walla Walla Rivers have been higher over the most recent brood cycle, while natural origin returns to the John Day River have decreased. Out-of-basin hatchery stray proportions, although reduced, remain very high in the Deschutes River Basin. Overall, the new information considered does not indicate a change in the biological risk category since the last status review (Ford. 2011).

The limiting factors and threats to MCR steelhead include (NMFS 2009, NOAA Fisheries 2011a):

- Degraded freshwater habitat: Floodplain connectivity and function, channel structure and complexity, riparian areas, fish passage, stream substrate, stream flow, and water quality have been degraded as a result of cumulative impacts of agriculture, forestry, tributary hydro system activities, and development
- Mainstem Columbia River hydropower–related impacts
- Degraded estuarine and nearshore marine habitat
- Hatchery-related effects
- Harvest-related effects
- Effects of predation, competition, and disease

UCR Steelhead. This species includes all naturally-spawned steelhead populations below natural and manmade impassable barriers in streams in the Columbia River Basin upstream from the Yakima River, Washington, to the U.S.-Canada border, and progeny of six artificial propagation programs. Four independent populations of UCR steelhead were identified by the IC-TRT in the same upriver tributaries as for the UC spring-run Chinook salmon (*i.e.*, Wenatchee, Entiat, Methow, and Okanogan; Table 21) and, similarly, no major population groupings were identified due to the relatively small geographic area involved (IC-TRT 2003, Ford 2011). All extant populations are considered to be at high risk of extinction (Ford. 2011).

Table 21. Summary of the key elements (A/P, diversity, and SS/D) and scores used to determine current overall viability risk for UCR steelhead populations (Ford 2011). Risk ratings range from very low (VL), low (L), moderate (M), high (H), to very high (VH).

Population (Watershed)	A/P	Diversity	Integrated SS/D	Overall Viability Risk
Wenatchee River	H	H	H	H
Entiat River	H	H	H	H
Methow River	H	H	H	H
Okanogan River	H	H	H	H

UCR steelhead populations have increased in natural origin abundance in recent years, but productivity levels remain low. The proportions of hatchery origin returns in natural spawning areas remain extremely high across the DPS, especially in the Methow and Okanogan river populations. The modest improvements in natural returns in recent years are probably primarily the result of several years of relatively good natural survival in the ocean and tributary habitats. With the exception of the Okanogan population, the UCR populations rated as “low” risk for spatial structure. The “high” risk ratings for SS/D are largely driven by chronic high levels of hatchery spawners within natural spawning areas and lack of genetic diversity among the populations. Overall, the new information considered does not indicate a change in the biological risk category since the last status review (Ford. 2011).

The limiting factors and threats to the UCR steelhead DPS include (UCSRB 2007, NOAA Fisheries 2011a):

- Mainstem Columbia River hydropower–related adverse effects.
- Impaired tributary fish passage.
- Degraded freshwater habitat: Floodplain connectivity and function, channel structure and complexity, riparian areas and large woody debris recruitment, stream flow, and water quality have been degraded as a result of cumulative impacts of agriculture, forestry, and development.
- Effects of predation, competition, and disease mortality: Fish management, including past introductions and persistence of non-native (exotic) fish species continues to affect habitat conditions for listed species.
- Hatchery-related effects.
- Harvest-related effects.

SRB Steelhead. This species includes all naturally-spawned steelhead populations below natural and manmade impassable barriers in streams in the Snake River Basin of southeast Washington, northeast Oregon, and Idaho, and progeny of six artificial propagation programs. The IC-TRT identified 25 historical populations in five major groups (Table 22) (IC-TRT 2006, Ford 2011). The IC-TRT has not assessed the viability of this species.

The level of natural production in the two populations with full data series and the Asotin Creek index reaches is encouraging, but the status of most populations in this DPS remains highly uncertain. Population-level natural origin abundance and productivity inferred from aggregate data and juvenile indices indicate that many populations are likely below the minimum combinations defined by the IC-TRT viability criteria. The relative proportion of hatchery fish in natural spawning areas near major hatchery release sites is highly uncertain. There is little evidence for substantial change in ESU viability relative to the previous BRT and IC-TRT reviews. Overall, therefore, the new information considered does not indicate a change in the biological risk category since the last status review (Ford. 2011).

Table 22. Ecological subregions, populations, and scores for the key elements (A/P, diversity, and SS/D) used to determine current overall viability risk for SRB steelhead (Ford 2011). Risk ratings range from very low (VL), low (L), moderate (M), high (H), to very high (VH). Maintained (MT) population status indicates that the population does not meet the criteria for a viable population but does support ecological functions and preserve options for recovery of the DPS.

Ecological subregions	Spawning Populations (Watershed)	A/P	Diversity	Integrated SS/D	Overall Viability Risk*
Lower Snake River	Tucannon River	H??	M	M	H
	Asotin Creek	MT	M	M	MT
Grande Ronde River	Lower Grande Ronde	**	M	M	Not rated
	Joseph Creek	VL	L	L	Highly viable
	Upper Grande Ronde	M	M	M	MT
	Wallowa River	H	L	L	H
Clearwater River	Lower Clearwater	M	L	L	MT
	South Fork Clearwater	H	M	M	H
	Lolo Creek	H	M	M	H
	Selway River	H	L	L	H
	Lochsa River	H	L	L	H
Salmon River	Little Salmon River	M	M	M	MT
	South Fork Salmon	H	L	L	H
	Secesh River	H	L	L	H
	Chamberlain Creek	H	L	L	H
	Lower MF Salmon	H	L	L	H
	Upper MF Salmon	H	L	L	H
	Panther Creek	M	M	H	H
	North Fork Salmon	M	M	M	MT
	Lemhi River	M	M	M	MT
	Pahsimeroi River	M	M	M	MT
	East Fork Salmon	M	M	M	MT
	Upper Main Salmon	M	M	M	MT
Imnaha	Imnaha River	M		M	MT

*There is some uncertainty regarding these ratings due to a lack of population –specific abundance data.

Limiting factors and threats to the SRB steelhead DPS include (IC-TRT 2006, NOAA Fisheries 2011a):

- Mainstem Columbia River hydropower–related adverse effects
- Impaired tributary fish passage
- Degraded freshwater habitat: Floodplain connectivity and function, channel structure and complexity, riparian areas and large woody debris recruitment, stream flow, and water quality have been degraded as a result of cumulative impacts of agriculture, forestry, and development
- Impaired water quality and increased water temperature

- Related harvest effects, particularly for B-run steelhead
- Predation
- Genetic diversity effects from out-of-population hatchery releases

Oregon Coast (OC) Recovery Domain. The OC recovery domain includes OC coho salmon, covering Oregon coastal streams south of the Columbia River and north of Cape Blanco. Streams and rivers in this area drain west into the Pacific Ocean, and vary in length from less than a mile to more than 210 miles in length.

<u>OC Coho Salmon</u>. This species includes all naturally-spawned populations of coho salmon in Oregon coastal streams south of the Columbia River and north of Cape Blanco, including the Cow Creek population, which is stock #37 of Oregon Department of Fish and Wildlife's coho hatchery program. OC coho salmon were first listed in February 2008. As part of a legal settlement agreement in 2008, NMFS completed a new status review for the ESU. In 2011, NMFS issued a final rule re-promulgating the threatened listing for Oregon Coast coho salmon (76 FR 35755).

The OC-TRT identified 56 populations; 21 independent and 35 dependent. The dependent populations were dependent on strays from other populations to maintain them over long time periods. The TRT also identified five biogeographic strata (Table 23) (Lawson *et al.* 2007).

Wainwright *et al.* (2008) determined that the weakest strata of OC coho salmon were in the North Coast and Mid-Coast of Oregon, which had only "low" certainty of being persistent. The strongest strata were the Lakes and Mid-South Coast, which had "high" certainty of being persistent. To increase certainty that the ESU as a whole is persistent, they recommended that restoration work should focus on those populations with low persistence, particularly those in the North Coast, Mid-Coast, and Umpqua strata.

A 2010 BRT (Stout *et al.* 2011) noted significant improvements in hatchery and harvest practices have been made. However, harvest and hatchery reductions have changed the population dynamics of the ESU. It has not been demonstrated that productivity during periods of poor marine survival is now adequate to sustain the ESU. Recent increases in adult escapement do not provide strong evidence that the century-long downward trend has changed. The ability of the OC coho salmon ESU to survive another prolonged period of poor marine survival remains in question.

Current concerns for spatial structure focus on the Umpqua River. Of the four populations in the Umpqua stratum, two, the North Umpqua and South Umpqua, were of particular concern. The North Umpqua is controlled by Winchester Dam and has historically been dominated by hatchery fish. Hatchery influence has recently been reduced, but the natural productivity of this population remains to be demonstrated. The South Umpqua is a large, warm system with degraded habitat. Spawner distribution appears to be seriously restricted in this population, and it is probably the most vulnerable of any population in this ESU to increased temperatures.

Table 23. OC coho salmon populations. Dependent Populations (D) are populations that historically would not have had a high likelihood of persisting in isolation for 100 years. These populations relied upon periodic immigration from other populations to maintain their abundance. Independent Populations are populations that historically would have had a high likelihood of persisting in isolation from neighboring populations for 100 years and are rated as functionally independent (FI) and potentially independent (PI) (McElhany *et al.* 2000, Lawson *et al.* 2007).

Stratum	Population	Type	Stratum	Population	Type
North Coast	Necanicum	PI	Mid-Coast (cont.)	Alsea	FI
	Ecola	D		Big (Alsea)	D
	Arch Cape	D		Vingie	D
	Short Sands	D		Yachats	D
	Nehalem	FI		Cummins	D
	Spring	D		Bob	D
	Watseco	D		Tenmile	D
	Tillamook	FI		Rock	D
	Netarts	D		Big (Siuslaw)	D
	Rover	D		China	D
	Sand	D		Cape	D
	Nestucca	FI		Berry	D
	Neskowin	D		Sutton	D
Mid-Coast	Salmon	PI	Lakes	Siuslaw	FI
	Devils	D		Siltcoos	PI
	Siletz	FI		Tahkenitch	PI
	Schoolhouse	D		Tenmile	PI
	Fogarty	D	Umpqua	Lower Umpqua	FI
	Depoe	D		Middle Umpqua	FI
	Rocky	D		North Umpqua	FI
	Spencer	D		South Umpqua	FI
	Wade	D	Mid-South Coast	Threemile	D
	Coal	D		Coos	FI
	Moolack	D		Coquille	FI
	Big (Yaquina)	D		Johnson	D
	Yaquina	FI		Twomile	D
	Theil	D		Floras	PI
	Beaver	PI		Sixes	PI

Current status of diversity shows improvement through the waning effects of hatchery fish on populations of OC coho salmon. In addition, recent efforts in several coastal estuaries to restore lost wetlands should be beneficial. However, diversity is lower than it was historically because of the loss of both freshwater and tidal habitat loss coupled with the restriction of diversity from very low returns over the past 20 years.

The BRT concluded that there is a moderate certainty of ESU persistence over the next 100 years and a low-to-moderate certainty that the ESU is sustainable for the foreseeable future, assuming no future trends in factors affecting the ESU. The NMFS issued a final determination to retain the ESA listing status, effective June 20, 2011. Thus, the February 2008 critical habitat designation and 4(d) regulations remain in effect (76 FR 35755).

Limiting factors and threats to the OC coho salmon ESU include (Stout *et al.* 2011, NOAA Fisheries 2011a):

- Degraded freshwater habitat: Floodplain connectivity and function, channel structure and complexity, riparian areas and large wood supply, stream substrate, stream flow, and water quality have been degraded as a result of cumulative impacts of agriculture, forestry, instream mining, dams, road crossings, dikes, levees, etc.
- Fish passage barriers that limit access to spawning and rearing habitats
- Adverse climate, altered past ocean/marine productivity, and current ocean ecosystem conditions have favored competitors and predators and reduced salmon survival rates in freshwater rivers and lakes, estuaries, and marine environments

2.2.2 Status of the Critical Habitats

The status of critical habitat was based primarily on a watershed-level analysis of conservation value that focused on the presence of listed ESA-listed species and physical features (*i.e.*, the PCEs) that are essential to their conservation. The analysis for the 2005 designations of salmon and steelhead species was completed by Critical Habitat Analytical Review Teams (CHARTs) that focused on large geographical areas corresponding approximately to recovery domains (NOAA Fisheries 2005). Each watershed was ranked using a conservation value attributed to the quantity of stream habitat with PCEs, the present condition of those PCEs, the likelihood of achieving PCE potential (either naturally or through active restoration), support for rare or important genetic or life history characteristics, support for abundant populations, and support for spawning and rearing populations. In some cases, our understanding of these interim conservation values has been further refined by the work of TRTs and other recovery planning efforts that have better explained the habitat attributes, ecological interactions, and population characteristics important to each species.
NMFS designated or proposed critical habitat for all salmon species considered in this opinion. The CHARTs completed assessed factors of PCEs for 12 species of ESA-listed salmon and steelhead in the WLC, and IC recovery domains. A CHART also did an initial assessment of PCEs for coho salmon in the Oregon Coast recovery domain (NOAA Fisheries 2005). Each CHART consisted of Federal biologists and habitat specialists from NMFS, the Fish and Wildlife Service, the Forest Service, and the Bureau of Land Management, with demonstrated expertise regarding salmon and steelhead habitat and related protective efforts within that domain.

Each CHART assessed biological information pertaining to areas under consideration for designation as critical habitat to identify the areas occupied by listed salmon and steelhead, determine whether those areas contained PCEs essential for the conservation of those species, and whether unoccupied areas existed within the historical range of the listed salmon and steelhead that may also be essential for conservation. The CHARTs assigned a 0 to 3 point score for the PCEs in each HUC5 watershed for:

Factor 1. Quantity,
Factor 2. Quality – Current Condition,
Factor 3. Quality – Potential Condition,
Factor 4. Support of Rarity Importance,
Factor 5. Support of Abundant Populations, and
Factor 6. Support of Spawning/Rearing.

Thus, the quality of habitat in a given watershed was characterized by the scores for Factor 2 (quality - current condition), which considers the existing condition of the quality of PCEs in the HUC5 watershed; and Factor 3 (quality – potential condition), which considers the likelihood of achieving PCE potential in the HUC5 watershed, either naturally or through active conservation/restoration, given known limiting factors, likely biophysical responses, and feasibility. The meaning of these scores is given below:

PCE Quality – Current Condition	**PCE Quality – Potential Condition**
3 = PCEs are in good to excellent condition.	3 = PCEs are highly functioning and are at their historical potential.
2 = PCEs are in fair to good condition.	2 = PCEs are reduced, but have high improvement potential.
1 = PCEs are in fair to poor condition.	1 = PCEs may have some improvement potential.
0 = PCEs are in poor condition.	0 = PCEs have little or no improvement potential.

Each CHART then scored each habitat area based on the quantity and quality of the physical and biological features; rated each habitat area as having a ‘‘high,’’ ‘‘medium,’’ or ‘‘low’’ conservation value; and identified management actions that could affect habitat for salmon and steelhead.

The ESA gives the Secretary of Commerce discretion to exclude areas from designation if he determines that the benefits of exclusion outweigh the benefits of designation. Considering economic factors and information from CHARTs, NMFS partially or completely excluded the following types of areas from the 2005 critical habitat designations:

1. Military areas. All military areas were excluded because of the current national priority on military readiness, and in recognition of conservation activities covered by military integrated natural resource management plans.
2. Tribal lands. Native American lands were excluded because of the unique trust relationship between tribes and the federal government, the federal emphasis on respect for tribal sovereignty and self-governance, and the importance of tribal participation in numerous activities aimed at conserving salmon.
3. Areas With Habitat Conservation Plans. Some lands covered by habitat conservation plans were excluded because NMFS had evidence that exclusion would benefit our relationship with the landowner, the protections secured through these plans outweigh the protections that are likely through critical habitat designation, and exclusion of these lands may provide an incentive for other landowners to seek similar voluntary conservation plans.
4. Areas With Economic Impacts. Areas where the conservation benefit to the species would be relatively low compared to the economic impacts.

In designating these critical habitats, NMFS organized information at scale of the 5th field HUC watershed because it corresponds to the spatial distribution and site fidelity scales of salmon and steelhead populations (McElhany *et al.* 2000). For earlier critical habitat designations for Snake River salmon, similar information was not available at the watershed scale, so NMFS used the scale of the 4th field HUC subbasin to organize critical habitat information.

NMFS reviews the status of designated critical habitat affected by the proposed action by examining the condition and trends of PCEs throughout the designated area. These PCEs vary slightly for some species, due to biological and administrative reasons, but all consist of site types and site attributes associated with life history events (Tables 24 – 27).

Table 24. PCEs of critical habitats designated for ESA-listed salmon and steelhead species considered in the opinion (except SR spring/summer run Chinook salmon, SR fall-run Chinook salmon, and SR sockeye salmon), and corresponding species life history events.

Primary Constituent Elements		Species Life History Event
Site Type	**Site Attribute**	
Freshwater spawning	Substrate Water quality Water quantity	Adult spawning Embryo incubation Alevin growth and development
Freshwater rearing	Floodplain connectivity Forage Natural cover Water quality Water quantity	Fry emergence from gravel Fry/parr/smolt growth and development
Freshwater migration	Free of artificial obstruction Natural cover Water quality Water quantity	Adult sexual maturation Adult upstream migration and holding Kelt (steelhead) seaward migration Fry/parr/smolt growth, development, and seaward migration
Estuarine areas	Forage Free of artificial obstruction Natural cover Salinity Water quality Water quantity	Adult sexual maturation and "reverse smoltification" Adult upstream migration and holding Kelt (steelhead) seaward migration Fry/parr/smolt growth, development, and seaward migration
Nearshore marine areas	Forage Free of artificial obstruction Natural cover Water quantity Water quality	Adult growth and sexual maturation Adult spawning migration Nearshore juvenile rearing
Offshore marine areas	Forage Water quality	Adult growth and sexual maturation Adult spawning migration Subadult rearing

Table 25. PCEs of critical habitats designated for SR spring/summer run Chinook salmon, SR fall-run Chinook salmon, SR sockeye salmon, and corresponding species life history events.

Primary Constituent Elements		Species Life History Event
Site	**Site Attribute**	
Spawning and juvenile rearing areas	Access (sockeye) Cover/shelter Food (juvenile rearing) Riparian vegetation Space (Chinook, coho) Spawning gravel Water quality Water temp (sockeye) Water quantity	Adult spawning Embryo incubation Alevin growth and development Fry emergence from gravel Fry/parr/smolt growth and development
Adult and juvenile migration corridors	Cover/shelter Food (juvenile) Riparian vegetation Safe passage Space Substrate Water quality Water quantity Water temperature Water velocity	Adult sexual maturation Adult upstream migration and holding Kelt (steelhead) seaward migration Fry/parr/smolt growth, development, and seaward migration
Areas for growth and development to adulthood	Ocean areas – not identified	Nearshore juvenile rearing Subadult rearing Adult growth and sexual maturation Adult spawning migration

WLC Recovery Domain. Critical habitat was designated in the WLC recovery domain for UWR spring-run Chinook salmon, LCR Chinook salmon, LCR steelhead, UWR steelhead, and CR chum salmon. Critical habitat was proposed for LCR coho salmon on January 14, 2013 (78 FR 2726). In addition to the Willamette and Columbia river mainstems, important tributaries on the Oregon side of the WLC include Youngs Bay, Big Creek, Clatskanie River, and Scappoose River in the Oregon Coast subbasin; Hood River in the Gorge; and the Sandy, Clackamas, Molalla, North and South Santiam, Calapooia, McKenzie, and Middle Fork Willamette rivers in the West Cascades subbasin.

Land management activities have severely degraded stream habitat conditions in the Willamette River mainstem above Willamette Falls and associated subbasins. In the Willamette River mainstem and lower sub-basin mainstem reaches, high density urban development and widespread agricultural effects have reduced aquatic and riparian habitat quality and complexity, and altered sediment and water quality and quantity, and watershed processes. The Willamette River, once a highly braided river system, has been dramatically simplified through channelization, dredging, and other activities that have reduced rearing habitat by as much as 75%. In addition, the construction of 37 dams in the basin blocked access to more than 435 miles of stream and river spawning habitat. The dams alter the temperature regime of the Willamette River and its tributaries, affecting the timing and development of naturally-spawned eggs and fry. Agriculture, urbanization, and gravel mining on the valley floor logging in the Cascade and Coast ranges contribute to increased erosion and sediment loads throughout the basin.

The mainstem Willamette River has been channelized and stripped of large wood. Development began to encroach on the riparian forest beginning in the 1870s (Sedell and Froggatt 1984). Gregory *et al.* (2002a) calculated that the total mainstem Willamette River channel area decreased from 41,000 to 23,000 acres between 1895 and 1995. They noted that the lower reach, from the mouth of the river to Newberg (River Mile (RM) 50), is confined within a basaltic trench, and that due to this geomorphic constraint, less channel area has been lost than in upstream areas. The middle reach from Newberg to Albany (RM 50 to 120) incurred losses of 12% primary channel area, 16% side channels, 33% alcoves, and 9% islands. Even greater changes occurred in the upper reach, from Albany to Eugene (RM 187). There, approximately 40% of both channel length and channel area were lost, along with 21% of the primary channel, 41% of side channels, 74% of alcoves, and 80% of island areas.

The banks of the Willamette River have more than 96 miles of revetments; approximately half were constructed by the Corps. Generally, the revetments were placed in the vicinity of roads or on the outside bank of river bends, so that while only 26% of the total length is revetted, 65% of the meander bends are revetted (Gregory *et al.* 2002b). The majority of dynamic sections have been armored, reducing adjustments in channel bed and sediment storage by the river, and thereby diminishing both the complexity and productivity of aquatic habitats (Gregory *et al.* 2002c).

Riparian forests have diminished considerably in the lower reaches of the Willamette River (Gregory *et al.* 2002d). Sedell and Froggatt (1984) noted that agriculture and cutting of streamside trees were major agents of change for riparian vegetation, along with snagging of large wood in the channel. The reduced shoreline, fewer and smaller snags, and reduced riparian forest comprise large functional losses to the river, reducing structural features, organic inputs from litter fall, entrained allochthonous materials, and flood flow filtering capacity. Extensive changes began before the major dams were built, with navigational and agricultural demands dominating the early use of the river. The once expansive forests of the Willamette River floodplain provided valuable nutrients and organic matter during flood pulses, food sources for macroinvertebrates, and slow-water refugia for fish during flood events. These forests also cooled river temperatures as the river flowed through its many channels.

Gregory *et al.* (2002d) described the changes in riparian vegetation in river reaches from the mouth to Newberg, from Newberg to Albany, and from Albany to Eugene. They noted that the riparian forests were formerly a mosaic of brush, marsh, and ash tree openings maintained by annual flood inundation. Below the City of Newberg, the most noticeable change was that conifers were almost eliminated. Above Newberg, the formerly hardwood-dominated riparian forests along with mixed forest made up less than half of the riparian vegetation by 1990, while agriculture dominated. This conversion has reduced river shading and the potential for recruitment of wood to the river, reducing channel complexity and the quality of rearing, migration and spawning habitats

Hyporheic flow in the Willamette River has been examined through discharge measurements and found to be significant in some areas, particularly those with gravel deposits (Wentz *et al.* 1998, Fernald *et al.* 2001). The loss of channel complexity and meandering that fosters creations of gravel deposits decreases the potential for hyporheic flows, as does gravel mining. Hyporheic flow processes water and affects its quality on reemerging into the main channel, stabilizing variations in physical and chemical water characteristics. Hyporheic flow is important for ecological functions, some aspects of water quality (such as temperature and dissolved oxygen), and some benthic invertebrate life stages. Alcove habitat, which has been limited by channelization, combines low hydraulic stress and high food availability with the potential for hyporheic flows across the steep hydraulic gradients in the gravel separating them from the main channel (Fernald *et al.* 2001).

On the mainstem of the Columbia River, hydropower projects, including the Federal Columbia River Hydropower System (FCRPS), have significantly degraded salmon and steelhead habitats (Bottom *et al.* 2005, Fresh *et al.* 2005, NMFS 2006, LCFRB 2010). The series of dams and reservoirs that make up the FCRPS block an estimated 12 million cubic yards of debris and sediment that would otherwise naturally flow down the Columbia River and replenish shorelines along the Washington and Oregon coasts.

Industrial harbor and port development are also significant influences on the Lower Willamette and Lower Columbia rivers (Bottom *et al.* 2005, Fresh *et al.* 2005, NMFS 2006, LCFRB 2010). Since 1878, 100 miles of river channel within the mainstem Columbia River, its estuary, and Oregon's Willamette River have been dredged as a navigation channel by the Corps. Originally dredged to a 20-foot minimum depth, the Federal navigation channel of the Lower Columbia River is now maintained at a depth of 43 feet and a width of 600 feet. The Lower Columbia River supports five ports on the Washington State side: Kalama, Longview, Skamania County, Woodland, and Vancouver. In addition to loss of riparian habitat, and disruption of benthic habitat due to dredging, high levels of several sediment chemicals, such as arsenic and polycyclic aromatic hydrocarbons (PAHs), have been identified in Lower Columbia River watersheds in the vicinity of the ports and associated industrial facilities.

The most extensive urban development in the Lower Columbia River subbasin has occurred in the Portland/Vancouver area. Outside of this major urban area, the majority of residences and businesses rely on septic systems. Common water quality issues with urban development and residential septic systems include higher water temperatures, lowered dissolved oxygen, increased fecal coliform bacteria, and increased chemicals associated with pesticides and urban runoff.

The Columbia River estuary has lost a significant amount of the tidal marsh and tidal swamp habitats that are critical to juvenile salmon and steelhead, particularly small or ocean-type species (Bottom *et al.* 2005, Fresh *et al.* 2005, NMFS 2006, LCFRB 2010). Edges of marsh areas provide sheltered habitats for juvenile salmon and steelhead where food, in the form of amphipods or other small invertebrates which feed on marsh detritus, is plentiful, and larger predatory fish can be avoided. Historically, floodwaters of the Columbia River inundated the margins and floodplains along the estuary, allowing juvenile salmon and steelhead access to a wide expanse of low-velocity marshland and tidal channel habitats. In general, the riverbanks were gently sloping, with riparian and wetland vegetation at the higher elevations of the river floodplain becoming habitat for salmon and steelhead during flooding river discharges or flood tides. Sherwood *et al.* (1990) estimated that the Columbia River estuary lost 20,000 acres of tidal swamps, 10,000 acres of tidal marshes, and 3,000 acres of tidal flats between 1870 and 1970. This study further estimated an 80% reduction in emergent vegetation production and a 15% decline in benthic algal production.

Habitat and food-web changes within the estuary, and other factors affecting salmon population structure and life histories, have altered the estuary's capacity to support juvenile salmon (Bottom *et al.* 2005, Fresh *et al.* 2005, NMFS 2006, LCFRB 2010). Diking and filling activities have reduced the tidal prism and eliminate emergent and forested wetlands and floodplain habitats. These changes likely have reduced the estuary's salmon-rearing capacity. Moreover, water and sediment in the Lower Columbia River and its tributaries have toxic contaminants that are harmful to fish and wildlife (LCREP 2007). Contaminants of concern include dioxins and furans, heavy metals, polychlorinated biphenyls (PCBs) and organochlorine pesticides such as DDT. Simplification of the population structure and life-history diversity of salmon possibly is yet another important factor affecting juvenile salmon viability. Restoration of estuarine habitats, particularly diked emergent and forested wetlands, reduction of avian predation by terns, and flow manipulations to restore historical flow patterns may have begun to enhance the estuary's productive capacity for salmon, although historical changes in population structure and salmon life histories may prevent salmon from making full use of the productive capacity of estuarine habitats.

The WLC Recovery Domain CHART determined that very few watersheds have PCEs in good to excellent condition (3), with no potential for additional improvement for salmon and/or steelhead. Only the upper McKenzie River and its tributaries were rated "3" with no potential for improvement for Chinook salmon PCEs. Most HUC5 watersheds are in fair-to-poor (score 1) or fair-to-good (score 2) condition. However, most watersheds with currently low or moderate habitat quality have some (score 1), or high (score 2), potential for improvement (Table 28).

Table 28. WLC Recovery Domain: Current and potential quality of watersheds identified as supporting historically independent populations of ESA- listed Chinook salmon (CK), chum salmon (CM), and steelhead (ST)(NOAA Fisheries 2005). Occupied watersheds within HUC4 watersheds are ranked primarily by "current quality" and secondly by their potential for restoration.

Geo-graphic Regions and HUC4s	Watershed Name(s) and HUC5 Code(s)	Listed Species	Current Quality	Potential Quality
Columbia Gorge #1707010xxx	Wind River (511)	CK/ST	2/2	2/2
	East Fork Hood (506), & Upper (404) & Lower Cispus (405) rivers	CK/ST	2/2	2/2
	Plympton Creek (306)	CK	2	2
	Little White Salmon River (510)	CK	2	0
	Grays Creek (512) & Eagle Creek (513)	CK/CM/ST	2/1/2	1/1/2
	White Salmon River (509)	CK/CM	2/1	1/2
	West Fork Hood River (507)	CK/ST	1/2	2/2
	Hood River (508)	CK/ST	1/1	2/2
	Unoccupied habitat: Wind River (511)	Chum conservation value "Possibly High"		
Cascade & Coast Range #1708000xxx	Lower Gorge Tributaries (107)	CK/CM/ST	2/2/2	2/3/2
	Lower Lewis (206) & North Fork Toutle (504) rivers	CK/CM/ST	1/3/1	2/1/2
	Salmon (101), Zigzag (102), & Upper Sandy (103) rivers	CK/ST	2/2	2/2
	Big Creek (602)	CK/CM	2/2	2/2
	Coweeman River (508)	CK/CM/ST	2/2/1	2/1/2
	Kalama River (301)	CK/CM/ST	1/2/2	2/1/2
	Cowlitz Headwaters (401)	CK/ST	2/2	1/1
	Skamokawa/Elochoman (305)	CK/CM	2/1	2
	Salmon Creek (109)	CK/CM/ST	1/2/1	2/3/2
	Green (505) & South Fork Toutle (506) rivers	CK/CM/ST	1/1/2	2/1/2
	Jackson Prairie (503) & East Willapa (507)	CK/CM/ST	1/2/1	1/1/2
	Grays Bay (603)	CK/CM	1/2	2/3
	Upper Middle Fork Willamette River (101)	CK	2	1
	Germany/Abernathy creeks (304)	CK/CM	1/2	2
	Mid-Sandy (104), Bull Run (105), & Lower Sandy (108) rivers	CK/ST	1/1	2/2
	Washougal (106) & East Fork Lewis (205) rivers	CK/CM/ST	1/1/1	2/1/2
	Upper Cowlitz (402) & Tilton rivers (501) & Cowlitz Valley Frontal (403)	CK/ST	1/1	2/1
	Clatskanie (303) & Young rivers (601)	CK	1	2
	Rifle Reservoir (502)	CK/ST	1	1
	Beaver Creek (302)	CK	0	1
	Unoccupied Habitat: Upper Lewis (201) & Muddy (202) rivers; Swift (203) & Yale (204) reservoirs	CK & ST Conservation Value "Possibly High"		
mette River #1709 000xx	Upper (401) & South Fork (403) McKenzie rivers; Horse Creek (402); & McKenzie River/Quartz Creek (405)	CK	3	3
	Lower McKenzie River (407)	CK	2	3

Geo-graphic Regions and HUC4s	Watershed Name(s) and HUC5 Code(s)	Listed Species	Current Quality	Potential Quality
	South Santiam River (606)	CK/ST	2/2	1/3
	South Santiam River/Foster Reservoir (607)	CK/ST	2/2	1/2
	North Fork of Middle Fork Willamette (106) & Blue (404) rivers	CK	2	1
	Upper South Yamhill River (801)	ST	2	1
	Little North Santiam River (505)	CK/ST	1/2	3/3
	Upper Molalla River (905)	CK/ST	1/2	1/1
	Abernethy Creek (704)	CK/ST	1/1	1/2
	Luckiamute River (306) & Yamhill (807) Lower Molalla (906) rivers; Middle (504) & Lower (506) North Santiam rivers; Hamilton Creek/South Santiam River (601); Wiley Creek (608); Mill Creek/Willamette River (701); & Willamette River/Chehalem Creek (703); Lower South (804) & North (806) Yamhill rivers; & Salt Creek/South Yamhill River (805)	CK/ST	1	1
	Hills (102) & Salmon (104) creeks; Salt Creek/Willamette River (103), Hills Creek Reservoir (105), Middle Fork Willamette/Lookout Point (107); Little Fall (108) & Fall (109) creeks; Lower Middle Fork of Willamette (110), Long Tom (301), Marys (305) & Mohawk (406) rivers	CK	1	1
	Willamina Creek (802) & Mill Creek/South Yamhill River (803)	ST	1	1
	Calapooia River (303); Oak (304) Crabtree (602), Thomas (603) & Rickreall (702) creeks; Abiqua (901), Butte (902) & Rock (903) creeks/Pudding River; & Senecal Creek/Mill Creek (904)	CK/ST	1/1	0/1
	Row River (201), Mosby (202) & Muddy (302) creeks, Upper (203) & Lower (205) Coast Fork Willamette River	CK	1	0
	Unoccupied habitat in North Santiam (501) & North Fork Breitenbush (502) rivers; Quartzville Creek (604) and Middle Santiam River (605)	CK & ST Conservation Value "Possibly High"		
	Unoccupied habitat in Detroit Reservoir/Blowout Divide Creek (503)	Conservation Value: CK "Possibly Medium"; ST Possibly High"		
Lower Willamette #1709001xxx	Collawash (101), Upper Clackamas (102), & Oak Grove Fork (103) Clackamas rivers	CK/ST	2/2	3/2
	Middle Clackamas River (104)	CK/ST	2/1	3/2
	Eagle Creek (105)	CK/ST	2/2	1/2
	Gales Creek (002)	ST	2	1
	Lower Clackamas River (106) & Scappoose Creek (202)	CK/ST	1	2
	Dairy (001) & Scoggins (003) creeks; Rock Creek/Tualatin River (004); & Tualatin River (005)	ST	1	1
	Johnson Creek (201)	CK/ST	0/1	2/2
	Lower Willamette/Columbia Slough (203)	CK/ST	0	2

IC Recovery Domain. Critical habitat has been designated in the IC recovery domain, which includes the Snake River Basin, for SR spring/summer-run Chinook salmon, SR fall-run Chinook salmon, UCR spring-run Chinook salmon, SR sockeye salmon, MCR steelhead, UCR steelhead, and SRB steelhead. Major tributaries in the Oregon portion of the IC recovery domain include the Deschutes, John Day, Umatilla, Walla Walla, Grande Ronde, and Imnaha rivers.

Habitat quality in tributary streams in the IC recovery domain varies from excellent in wilderness and roadless areas to poor in areas subject to heavy agricultural and urban development (Wissmar *et al.* 1994, NMFS 2009). Critical habitat throughout much of the IC recovery domain has been degraded by intense agriculture, alteration of stream morphology (*i.e.*, channel modifications and diking), riparian vegetation disturbance, wetland draining and conversion, livestock grazing, dredging, road construction and maintenance, logging, mining, and urbanization. Reduced summer stream flows, impaired water quality, and reduction of habitat complexity are common problems for critical habitat in developed areas.

Migratory habitat quality in this area has been severely affected by the development and operation of the FCRPS dams and reservoirs in the mainstem Columbia River, Bureau of Reclamation tributary projects, and privately owned dams in the Snake and Upper Columbia River basins. For example, construction of Hells Canyon Dam eliminated access to several likely production areas in Oregon and Idaho, including the Burnt, Powder, Weiser, Payette, Malheur, Owyhee, and Boise river basins (Good *et al.* 2005), and Grand Coulee and Chief Joseph dams completely block anadromous fish passage on the upper mainstem Columbia River. Hydroelectric development modified natural flow regimes, resulting in higher water temperatures, changes in fish community structure leading to increased rates of piscivorous and avian predation on juvenile salmon and steelhead, and delayed migration for both adult and juveniles. Physical features of dams such as turbines also kill migrating fish. In-river survival is inversely related to the number of hydropower projects encountered by emigrating juveniles.

Similarly, development and operation of extensive irrigation systems and dams for water withdrawal and storage in tributaries have drastically altered hydrological cycles. A series of large regulating dams on the middle and upper Deschutes River affect flow and block access to upstream habitat, and have extirpated one or more populations from the Cascades Eastern Slope major population (IC-TRT 2003). Similarly, operation and maintenance of large water reclamation systems such as the Umatilla Basin and Yakima Projects have significantly reduced flows and degraded water quality and physical habitat in this domain.

Many stream reaches designated as critical habitat in the IC recovery domain are over-allocated under state water law, with more allocated water rights than existing streamflow conditions can support. Withdrawal of water, particularly during low-flow periods that commonly overlap with agricultural withdrawals, often increases summer stream temperatures, blocks fish migration, strands fish, and alters sediment transport (Spence *et al.* 1996). Reduced tributary stream flow has been identified as a major limiting factor for all listed salmon and steelhead species in this area except SR fall-run Chinook salmon and SR sockeye salmon (NMFS 2007, NOAA Fisheries 2011).

Many stream reaches designated as critical habitat are listed on the state of Oregon's Clean Water Act section 303(d) list for water temperature. Many areas that were historically suitable rearing and spawning habitat are now unsuitable due to high summer stream temperatures. Removal of riparian vegetation, alteration of natural stream morphology, and withdrawal of water for agricultural or municipal use all contribute to elevated stream temperatures. Contaminants such as insecticides and herbicides from agricultural runoff and heavy metals from mine waste are common in some areas of critical habitat.

The IC Recovery Domain is a very large and diverse area. The CHART determined that few watersheds have PCEs in good to excellent condition (score 3), with no potential for additional improvement for Chinook salmon and/or steelhead. In Washington, the Upper Methow, Lost White and Chiwawa watersheds were rated “3” for current and potential quality. In Oregon, only the Lower Deschutes, Minam, Wenaha, and Upper and Lower Imnaha Rivers HUC5 watersheds were rated “3” with no potential for improvement. In Idaho, a number of watersheds in the Upper Middle Salmon, Upper Salmon/Pahsimeroi, Middle Fork Salmon, Little Salmon, Selway, and Lochsa rivers were rated “3” for current and potential quality for steelhead PCEs. Additionally, several Lower Snake River HUC5 watersheds in the Hells Canyon area, straddling Oregon and Idaho, were highly rated. However, most HUC5 watersheds in the recovery domain are in fair-to-poor (score 1) or fair-to-good (score 2) condition. Most watersheds with currently low or moderate habitat quality have some (1), or high (2), potential for improvement (Table 29).

Table 29. Interior Columbia Recovery Domain: Current and potential quality of watersheds identified as supporting historically independent populations of ESA-listed Chinook salmon (CK) and steelhead (ST) (NOAA Fisheries 2005). Occupied watersheds within HUC4s are ranked primarily by "current quality" and secondly by their potential for restoration.

Geo-graphic Regions and HUC4s	Watershed Name and HUC5 Code(s)	Listed Species	Current Quality	Potential Quality
Upper Columbia # 1702000xxx	White (101), Chiwawa (102), Lost (801) & Upper Methow (802) rivers	CK/ST	3	3
	Upper Chewuch (803) & Twisp rivers (805)	CK/ST	3	2
	Lower Chewuch River (804); Middle (806) & Lower (807) Methow rivers	CK/ST	2	2
	Salmon Creek (603) & Okanogan River/Omak Creek (604)	ST	2	2
	Upper Columbia/Swamp Creek (505)	CK/ST	2	1
	Foster Creek (503) & Jordan/Tumwater (504)	CK/ST	1	1
	Upper (601) & Lower (602) Okanogan River; Okanogan River/Bonaparte Creek (605); Lower Similkameen River (704); & Lower Lake Chelan (903)	ST	1	1
	Unoccupied habitat in Sinlahekin Creek (703)	ST Conservation Value "Possibly High"		
Upper Columbia #1702001xxx	Entiat River (001); Nason/Tumwater (103); & Lower Wenatchee River (105)	CK/ST	2	2
	Lake Entiat (002)	CK/ST	2	1
	Columbia River/Lynch Coulee (003); Sand Hollow (004); Yakima/Hansen Creek (604), Middle Columbia/Priest Rapids (605), & Columbia River/Zintel Canyon (606)	ST	2	1
	Icicle/Chumstick (104)	CK/ST	1	2
	Lower Crab Creek (509)	ST	1	2
	Rattlesnake Creek (204)	ST	0	1
Yakima #1703000xxx	Upper (101) & Middle (102) Yakima rivers; Teanaway (103) & Little Naches (201) rivers; Naches River/Rattlesnake Creek (202); & Ahtanum (301) & Upper Toppenish (303) & Satus (305) creeks	ST	2	2
	Umtanum/Wenas (104); Naches River/Tieton River (203); Upper Lower Yakima River (302); & Lower Toppenish Creek (304)	ST	1	2
	Yakima River/Spring Creek (306)	ST	1	1
Lower Snake River #1706010xxx	Snake River/Granite (101), Getta (102), & Divide (104) creeks; Upper (201) & Lower (205) Imnaha River; Snake River/Rogersburg (301); Minam (505) & Wenaha (603) rivers	ST	3	3
	Grande Ronde River/Rondowa (601)	ST	3	2
	Big (203) & Little (204) Sheep creeks; Asotin River (302); Catherine Creek (405); Lostine River (502); Bear Creek (504); & Upper (706) & Lower (707) Tucannon River	ST	2	3
	Middle Imnaha River (202); Snake River/Captain John Creek (303); Upper Grande Ronde River (401); Meadow (402); Beaver (403); Indian (409), Lookingglass (410) & Cabin (411) creeks; Lower Wallowa River (506); Mud (602), Chesnimnus (604) & Upper Joseph (605) creeks	ST	2	2
	Ladd Creek (406); Phillips/Willow Creek (408); Upper (501) & Middle (503) Wallowa rivers; & Lower Grande Ronde	ST	1	3

Geo-graphic Regions and HUC4s	Watershed Name and HUC5 Code(s)	Listed Species	Current Quality	Potential Quality
	River/Menatche Creek (607)			
	Five Points (404); Lower Joseph (606) & Deadman (703) creeks	ST	1	2
	Tucannon/Alpowa Creek (701)	ST	1	1
	Mill Creek (407)	ST	0	3
	Pataha Creek (705)	ST	0	2
	Snake River/Steptoe Canyon (702) & Penawawa Creek (708)	ST	0	1
	Flat Creek (704) & Lower Palouse River (808)	ST	0	0
Upper Salmon & Pahsimeroi #1706020xxx	Germania (111) & Warm Springs (114) creeks; Lower Pahsimeroi River (201); Alturas Lake (120), Redfish Lake (121), Upper Valley (123) & West Fork Yankee (126) creeks	ST	3	3
	Basin Creek (124)	ST	3	2
	Salmon River/Challis (101); East Fork Salmon River/McDonald Creek (105); Herd Creek (108); Upper East Fork Salmon River (110); Salmon River/Big Casino (115), Fisher (117) & Fourth of July (118) creeks; Upper Salmon River (119); Valley Creek/Iron Creek (122); & Morgan Creek (132)	ST	2	3
	Salmon River/Bayhorse Creek (104); Salmon River/Slate Creek (113); Upper Yankee Fork (127) & Squaw Creek (128); Pahsimeroi River/Falls Creek (202)	ST	2	2
	Yankee Fork/Jordan Creek (125)	ST	1	3
	Salmon River/Kinnikinnick Creek (112); Garden Creek (129); Challis Creek/Mill Creek (130); & Patterson Creek (203)	ST	1	2
	Road Creek (107)	ST	1	1
	Unoccupied habitat in Hawley (410), Eighteenmile (411) & Big Timber (413) creeks	Conservation Value for ST "Possibly High"		
Middle Salmon, Panther & Lemhi #1706020xxx	Salmon River/Colson (301), Pine (303) & Moose (305) creeks; Indian (304) & Carmen (308) creeks, North Fork Salmon River (306); & Texas Creek (412)	ST	3	3
	Deep Creek (318)	ST	3	2
	Salmon River/Cow Creek (312) & Hat (313), Iron (314), Upper Panther (315), Moyer (316) & Woodtick (317) creeks; Lemhi River/Whimpey Creek (402); Hayden (414), Big Eight Mile (408), & Canyon (408) creeks	ST	2	3
	Salmon River/Tower (307) & Twelvemile (311) creeks; Lemhi River/Kenney Creek (403); Lemhi River/McDevitt (405), Lemhi River/Yearian Creek (406); & Peterson Creek (407)	ST	2	2
	Owl (302) & Napias (319) creeks	ST	2	1
	Salmon River/Jesse Creek (309); Panther Creek/Trail Creek (322); & Lemhi River/Bohannon Creek (401)	ST	1	3
	Salmon River/Williams Creek (310)	ST	1	2
	Agency Creek (404)	ST	1	1
	Panther Creek/Spring Creek (320) & Clear Creek (323)	ST	0	3
	Big Deer Creek (321)	ST	0	1
Fork, Lower, &	Lower (501), Upper (503) & Little (504) Loon creeks; Warm Springs (502); Rapid River (505); Middle Fork Salmon River/Soldier (507) & Lower Marble Creek (513); & Sulphur (509), Pistol (510), Indian (511) & Upper Marble (512) creeks; Lower Middle Fork Salmon	ST	3	3

Geo-graphic Regions and HUC4s	Watershed Name and HUC5 Code(s)	Listed Species	Current Quality	Potential Quality
	River (601); Wilson (602), Upper Camas (604), Rush (610), Monumental (611), Beaver (614), Big Ramey (615) & Lower Big (617) creeks; Middle Fork Salmon River/Brush (603) & Sheep (609) creeks; Big Creek/Little Marble (612); Crooked (616), Sheep (704), Bargamin (709), Sabe (711), Horse (714), Cottonwood (716) & Upper Chamberlain Creek (718); Salmon River/Hot Springs (712); Salmon River/Kitchen Creek (715); Lower Chamberlain/McCalla Creek (717); & Slate Creek (911)			
	Marsh (506); Bear Valley (508) Yellow Jacket (604); West Fork Camas (607) & Lower Camas (608) creeks; & Salmon River/Disappointment Creek (713) & White Bird Creek (908)	ST	2	3
	Upper Big Creek (613); Salmon River/Fall (701), California (703), Trout (708), Crooked (705) & Warren (719) creeks; Lower South Fork Salmon River (801); South Fork Salmon River/Cabin (809), Blackmare (810) & Fitsum (812) creeks; Lower Johnson Creek (805); & Lower (813), Middle (814) & Upper Secesh (815) rivers; Salmon River/China (901), Cottonwood (904), McKenzie (909), John Day (912) & Lake (913) creeks; Eagle (902), Deer (903), Skookumchuck (910), French (915) & Partridge (916) creeks	ST	2	2
	Wind River (702), Salmon River/Rabbit (706) & Rattlesnake (710) creeks; & Big Mallard Creek (707); Burnt Log (806), Upper Johnson (807) & Buckhorn (811) creeks; Salmon River/Deep (905), Hammer (907) & Van (914) creeks	ST	2	1
	Silver Creek (605)	ST	1	3
	Lower (803) & Upper (804) East Fork South Fork Salmon River; Rock (906) & Rice (917) creeks	ST	1	2
Little Salmon #176021xxx	Rapid River (005)	ST	3	3
	Hazard Creek (003	ST	3	2
	Boulder Creek (004)	ST	2	3
	Lower Little Salmon River (001) & Little Salmon River/Hard Creek (002)	ST	2	2
Selway, Lochsa & Clearwater #1706030xxx	Selway River/Pettibone (101) & Gardner (103) creeks; Bear (102), White Cap (104), Indian (105), Burnt Knob (107), Running (108) & Goat (109) creeks; & Upper Selway River (106); Gedney (202), Upper Three Links (204), Rhoda (205), North Fork Moose (207), Upper East Fork Moose (209) & Martin (210) creeks; Upper (211), Middle (212) & Lower Meadow (213) creeks; Selway River/Three Links Creek (203); & East Fork Moose Creek/Trout Creek (208); Fish (302), Storm (309), Warm Springs (311), Fish Lake (312), Boulder (313) & Old Man (314) creeks; Lochsa River/Stanley (303) & Squaw (304) creeks; Lower Crooked (305), Upper Crooked (306) & Brushy (307) forks; Lower (308), Upper (310) White Sands, Ten Mile (509) & John's (510) creeks	ST	3	3
	Selway River/Goddard Creek (201); O'Hara Creek (214) Newsome (505) creeks; American (506), Red (507) & Crooked (508) rivers	ST	2	3
	Lower Lochsa River (301); Middle Fork Clearwater River/Maggie Creek (401); South Fork Clearwater River/Meadow (502) & Leggett creeks; Mill (511), Big Bear (604), Upper Big Bear (605), Musselshell (617), Eldorado (619) & Mission (629) creeks, Potlatch	ST	2	2

Geo-graphic Regions and HUC4s	Watershed Name and HUC5 Code(s)	Listed Species	Current Quality	Potential Quality
	River/Pine Creek (606); & Upper Potlatch River (607); Lower (615), Middle (616) & Upper (618) Lolo creeks			
	South Fork Clearwater River/Peasley Creek (502)	ST	2	1
	Upper Orofino Creek (613)	ST	2	0
	Clear Creek (402)	ST	1	3
	Three Mile (512), Cottonwood (513), Big Canyon (610), Little Canyon (611) & Jim Ford (614) creeks; Potlatch River/Middle Potlatch Creek (603); Clearwater River/Bedrock (608), Jack's (609) Lower Lawyer (623), Middle Lawyer (624), Cottonwood (627) & Upper Lapwai (628) creeks; & Upper (630) & Lower (631) Sweetwater creeks	ST	1	2
	Lower Clearwater River (601) & Clearwater River/Lower Potlatch River (602), Fivemile Creek (620), Sixmile Creek (621) and Tom Taha (622) creeks	ST	1	1
Mid-Columbia #1707010xxx	Wood Gulch (112); Rock Creek (113); Upper Walla Walla (201), Upper Touchet (203), & Upper Umatilla (301) rivers; Meacham (302) & Birch (306) creeks; Upper (601) & Middle (602) Klickitat River	ST	2	2
	Glade (105) & Mill (202) creeks; Lower Klickitat River (604); Mosier Creek (505); White Salmon River (509); Middle Columbia/Grays Creek (512)	ST	2	1
	Little White Salmon River (510)	ST	2	0
	Middle Touchet River (204); McKay Creek (305); Little Klickitat River (603);Fifteenmile (502) & Fivemile (503) creeks	ST	1	2
	Alder (110) & Pine (111) creeks; Lower Touchet River (207), Cottonwood (208), Pine (209) & Dry (210) creeks; Lower Walla Walla River (211); Umatilla River/Mission Creek (303) Wildhorse Creek (304); Umatilla River/Alkali Canyon (307); Lower Butter Creek (310); Upper Middle Columbia/Hood (501); Middle Columbia/Mill Creek (504)	ST	1	1
	Stage Gulch (308) & Lower Umatilla River (313)	ST	0	1
John Day #170702xxx	Middle (103) & Lower (105) South Fork John Day rivers; Murderers (104) & Canyon (107) creeks; Upper John Day (106) & Upper North Fork John Day (201) rivers; & Desolation Creek (204)	ST	2	2
	North Fork John Day/Big Creek (203); Cottonwood Creek (209) & Lower NF John Day River (210)	ST	2	1
	Strawberry (108), Beech (109), Laycock (110), Fields (111), Mountain (113) & Rock (114) creeks; Upper Middle John Day River (112); Granite (202) & Wall (208) creeks; Upper (205) & Lower (206) Camas creeks; North Fork John Day/Potamus Creek (207); Upper Middle Fork John Day River (301) & Camp (302), Big (303) & Long (304) creeks; Bridge (403) & Upper Rock (411) creeks; & Pine Hollow (407)	ST	1	2
	John Day/Johnson Creek (115); Lower Middle Fork John Day River (305); Lower John Day River/Kahler Creek (401), Service (402) & Muddy (404) creeks; Lower John Day River/Clarno (405); Butte (406), Thirtymile (408) & Lower Rock (412) creeks; Lower John Day River/Ferry (409) & Scott (410) canyons; & Lower John Day River/McDonald Ferry (414)	ST	1	1

Geo-graphic Regions and HUC4s	Watershed Name and HUC5 Code(s)	Listed Species	Current Quality	Potential Quality
Deschutes #1707030xxx	Lower Deschutes River (612)	ST	3	3
	Middle Deschutes River (607)	ST	3	2
	Upper Deschutes River (603)	ST	2	1
	Mill Creek (605) & Warm Springs River (606)	ST	2	1
	Bakeoven (608) & Buck Hollow (611) creeks; Upper (701) & Lower (705) Trout Creek	ST	1	2
	Beaver (605) & Antelope (702) creeks	ST	1	1
	White River (610) & Mud Springs Creek (704)	ST	1	0
	Unoccupied habitat in Deschutes River/McKenzie Canyon (107) & Haystack (311); Squaw Creek (108); Lower Metolius River (110), Headwaters Deschutes River (601)	ST Conservation Value “Possibly High”		

OC Recovery Domain. In this recovery domain, critical habitat has been designated for OC coho salmon. Many large and small rivers supporting significant populations of coho salmon flow through this domain, including the Nehalem, Nestucca, Siletz, Yaquina, Alsea, Siuslaw, Umpqua, Coos, and Coquille.

The historical disturbance regime in the central Oregon Coast Range was dominated by a mixture of high and low-severity fires, with a natural rotation of approximately 271 years. Old-growth forest coverage in the Oregon Coast Range varied from 25 to 75% during the past 3,000 years, with a mean of 47%, and never fell below 5% (Wimberly *et al.* 2000). Currently, the Coast Range has approximately 5% old-growth, almost all of it on Federal lands. The dominant disturbance now is logging on a cycle of 30 to 100 years, with fires suppressed.

The State of Oregon (2005) completed an assessment of habitat conditions in the range of OC coho salmon in 2005. Oregon’s assessment mapped how streams with high intrinsic potential for coho salmon rearing are distributed by land ownership categories. Agricultural lands and private industrial forests have by far the highest percentage of land ownership in high intrinsic potential areas and along all coho salmon stream miles. Federal lands have only about 20% of coho salmon stream miles and 10% of high intrinsic potential stream reaches. Because of this distribution, activities in lowland agricultural areas are particularly important to the conservation of OC coho salmon.

The OC coho salmon assessment concluded that at the scale of the entire domain, pools are generally abundant, although slow-water and off-channel habitat (which are important refugia for coho salmon during high winter flows) are limited in the majority of streams when compared to reference streams in minimally-disturbed areas. Amounts of large wood in streams are low in all four ODFW monitoring areas and land-use types relative to reference conditions. Amounts of fine sediment are high in three of the four monitoring areas, and were comparable to reference conditions only on public lands. Approximately 62 to 91% of tidal wetland acres (depending on estimation procedures) have been lost for functionally and potentially independent populations of coho salmon.

As part of the coastal coho salmon assessment, the Oregon Department of Environmental Quality analyzed the status and trends of water quality in the range of OC coho salmon using the Oregon water quality index, which is based on a combination of temperature, dissolved oxygen, biological oxygen demand, pH, total solids, nitrogen, total phosphates, and bacteria. Using the index at the species scale, 42% of monitored sites had excellent to good water quality, and 29% show poor to very poor water quality. Within the four monitoring areas, the North Coast had the best overall conditions (6 sites in excellent or good condition out of 9 sites), and the Mid-South coast had the poorest conditions (no excellent condition sites, and only 2 out of 8 sites in good condition). For the 10-year period monitored between 1992 and 2002, no sites showed a declining trend in water quality. The area with the most improving trends was the North Coast, where 66% of the sites (6 out of 9) had a significant improvement in index scores. The Umpqua River Basin, with one out of 9 sites (11%) showing an improving trend.

2.3 Environmental Baseline

The "environmental baseline" includes the past and present impacts of all Federal, state, or private actions and other human activities in the action area, the anticipated impacts of all proposed Federal projects in the action area that have already undergone formal or early section 7 consultation, and the impact of state or private actions which are contemporaneous with the consultation in process (50 CFR 402.02).

The Status of the Species and Critical Habitats sections provided above describe the factors that limit the recovery of salmon and steelhead vary with the overall condition of aquatic habitats on private, state, and Federal lands. Within the tri-state action area, many stream, estuarine and riparian areas have been degraded by the effects of land and water use, including road construction, forest management, agriculture, mining, urbanization, and water development. Each of these economic activities has contributed to a myriad of interrelated factors for the decline of salmon and steelhead. Among the most important of these are changes in stream channel morphology, degradation of spawning substrates, reduced instream roughness and cover, loss and degradation of estuarine rearing habitats, loss of wetlands, loss and degradation of riparian areas, water quality (*e.g.*, temperature, sediment, dissolved oxygen, contaminants) degradation, blocked fish passage, direct take, and loss of habitat refugia.

Anadromous salmonids have been affected by the development and operation of dams. Dams, without adequate fish passage systems, have extirpated anadromous fish from their pre-development spawning and rearing habitats. Dams and reservoirs, within the currently accessible migratory corridor, have greatly altered the river environment and have affected fish passage. The operation of water storage projects has altered the natural hydrograph of many rivers. Water impoundment and dam operations also affect downstream water quality characteristics, vital components to anadromous fish survival. In recent years, high quality fish passage is being restored where it did not previously exist, either through improvements to existing fish passage facilities or through dam removal (*e.g.*, Marmot Dam on the Sandy River and Powerdale Dam on the Hood River).

Within the habitat currently accessible by salmon and steelhead, dams have negatively affected spawning and rearing habitat. Floodplains have been reduced, off-channel habitat features have been eliminated or disconnected from the main channel, and the amount of large wood in the mainstem has been greatly reduced. Remaining habitats often are affected by flow fluctuations associated with reservoir water management for power peaking, flood control, and other operations.

The development of hydropower and water storage projects within the Columbia River Basin have resulted in the inundation of many mainstem spawning and shallow-water rearing areas (loss of spawning gravels and access to spawning and rearing areas); altered water quality (reduced spring turbidity levels), water quantity (seasonal changes in flows and consumptive losses resulting from use of stored water for agricultural, industrial, or municipal purposes), water temperature (including generally warmer minimum winter temperatures and cooler maximum summer temperatures), water velocity (reduced spring flows and increased cross-sectional areas of the river channel), food (alteration of food webs, including the type and availability of prey species), and safe passage (increased mortality rates of migrating juveniles) (Williams *et al*. 2005; Ferguson *et al*. 2005).

Salmon and steelhead are exposed to high rates of predation during all life stages. Fish, birds, and marine mammals, including harbor seals, sea lions, and killer whales all prey on juvenile and adult salmon. The Columbia River Basin has a diverse assemblage of native and introduced fish species, some of which prey on salmon and steelhead. The primary resident fish predators of salmonids in many areas of the action area are northern pikeminnow (native), smallmouth bass (introduced), and walleye (introduced). Other predatory resident fish include channel catfish (introduced), Pacific lamprey (native), yellow perch (introduced), largemouth bass (introduced), and bull trout (native). Increased predation by non-native predators has and continues to decrease population abundance and productivity.

Avian predation is another factor limiting salmonid recovery in the Columbia River Basin. Throughout the basin, piscivorous birds congregate near hydroelectric dams and in the estuary near man-made islands and structures. Avian predation has been exacerbated by environmental changes associated with river developments. Water clarity caused by suspended sediments settling in impoundments increases the vulnerability of migrating smolts. Delay in project reservoirs, particularly immediately upstream from the dams increases smolt exposure to avian predators, and juvenile bypass systems concentrate smolts, creating potential feeding stations for birds. Dredge spoil islands, associated with maintaining the Columbia River navigation channel, provide habitat for nesting Caspian terns and other piscivorous birds. Caspian terns, double-crested cormorants, glaucous-winged/western gull hybrids, California gulls, and ring-billed gulls are the principal avian predators in the basin. As with picscivorous predators, predation by birds has and continues to decrease population abundance and productivity.

The environmental baseline also includes the anticipated impacts of all Federal actions in the action area that have already undergone formal consultation. For example, from 2001 through 2006, the USACE authorized 118 restoration actions in Oregon under programmatic consultations, and more than 800 other actions related to transportation features, over and in-water structures, and bank stabilization. The USACE, Bonneville Power Administration, and Bureau of Reclamation have also consulted on large water management actions, such as operation of the Federal Columbia River Power System, the Umatilla Basin Project, the

Willamette River Project and the Deschutes Project. The U.S. Forest Service and U.S. Bureau of Land Management consult on Federal land management throughout Oregon, Washington and Idaho, including restoration actions, forest management, livestock grazing, and special use permits. Impacts to the environmental baseline from these previous actions vary from short-term adverse effects to long-term beneficial effects. When considered collectively, these actions have a slight beneficial effect on the abundance and productivity of affected salmon and steelhead populations. After going through consultation, many ongoing actions, such as water management, have less impact on listed salmon and steelhead. Restoration actions may have short term adverse effects, but generally result in long-term improvements to habitat condition and population abundance, productivity, and spatial structure.

Climate change also poses significant hazards to the survival and recovery of salmonids. Ongoing global climate change has implications for the current and likely future status of salmon, but particularly so in the Pacific Northwest, where snow melt into the Columbia River Basin has significant influence on regional hydrology. Recent studies, particularly by the Independent Scientific Advisory Board (ISAB), describe the potential impacts of climate change in the Columbia River Basin. These effects may decrease snowfall, increase early-year runoff, decrease summer and fall flow, and generally increase water temperatures. The ISAB (2007) identified the following list of likely effects of projected climate changes on Columbia Basin salmon:

1. Water temperature increase resulting in loss of cold-water habitat (temperatures exceed upper thermal limits for a species). Projected salmon habitat loss would be most severe in Oregon and Idaho, possibly higher than 40% of 2007 by 2090. Habitat loss would be less extreme in Washington at 22% by 2090. However, this assumes a high rate of greenhouse gas emissions and used a climate model that projected a 5º C in global temperatures by 2090, a value that is higher than the scenarios considered most likely (ISAB 2007). Although a liberal estimate of change, this does not account for changes to hydrology that could further imbalance salmon habitat.
2. Variations in rainfall intensity may alter seasonal hydrography. With reduced snowpack and greater rainfall, the timing of stream flow will likely change, reducing spring and summer stream flow and increasing peak river flows (ISAB 2007). This reduction in stream flow may impact the quality and quantity of tributary rearing habitat, greatly affecting spring and summer salmon and steelhead runs. In addition, the Pacific Northwest's low late-summer and early-fall stream flows are likely to be further reduced, which will limit juvenile fall Chinook and chum salmon shallow mainstem rearing habitat.
3. Considering both the water temperature and hydrologic effects of climate change, abundance Snake River spring/summer Chinook populations would be substantially decreased (20-50% decline from simulated average abundance based on historical 1915-2002 climate; (Crozier *et al.* 2008). This significantly increases extinction risks in the long term.
4. Eggs of fall and winter spawning fish, including Chinook, coho, chum, and sockeye salmon, may suffer higher levels of mortality when exposed to increased flood flows.
5. Increases in seasonal mainstem Snake and Columbia River water temperature would accelerate the rate of egg development of fall Chinook that spawn in the mainstem of the Snake and Columbia rivers and lead to earlier (smaller size) hatching. Potential effects of

increased water temperatures on adult salmon include delay in dam passage, failure to enter fish ladders, increased fallback, and loss of energy reserves due to elevated metabolic demand. Thermal stress may also lead to increased risk of parasitism and disease.

6. Earlier snowmelt and higher spring flows, warmer temperatures, more rain, and less snow may cause spring Chinook and steelhead yearlings to smolt and emigrate to the estuary and ocean earlier in spring. The early emigration coupled with a projected delay in the onset of coastal upwelling could cause these fish to enter the ocean before foraging conditions are optimal. The first few weeks in the ocean are thought to be critical to the survival of salmon off Oregon and Washington, so a growing mismatch between smolt migrations and coastal upwelling would likely have significant negative impacts on early ocean survival rates.
7. Within the Columbia estuary, increased sea levels in conjunction with higher winter river flows could degrade estuary habitats. Numerous warm-adapted fish species, including several non-indigenous species, normally found in freshwater have been reported from the estuary and might expand their populations with the warmer water. Climate change also may affect the trophic dynamics of the estuary due to upstream extension of the salt wedge in spring-early summer caused by reduced river flows. Changes in the upstream extension of the salt wedge will influence the location of fish prey, but it is difficult to forecast the effect this change will have on juvenile salmon.
8. Physical changes in the ocean associated with warming include increases in temperature, increased water column stratification, and changes in the intensity and timing of coastal upwelling. These changes will alter primary and secondary productivity, the structure of marine communities, and, in turn, the growth, productivity, survival, and migrations of salmonids.
9. Changing ocean temperatures may alter salmon behavior, distribution, and migrations, increasing the distance from home streams to ocean feeding areas. Energetic demands increase at warmer temperatures, requiring increased feeding to maintain growth. This could lead to intensified competition for food and reduction in growth rates, further exacerbating the prey/predator relationship.
10. Increasing concentrations of carbon dioxide in the oceans lowers pH, which reduces the availability of carbonate for shell-forming marine animals. Pteropods are expected to be negatively affected, and they can comprise more than 40% of some salmon diets. If salmon migrate farther to the north and/or food is less available, longer times may be required to reach maturity, delaying the usual times of adult migrations into coastal water and rivers.

2.4 Effects of the Action on the Species and its Designated Critical Habitat

The actions covered by this consultation have predictable effects. The NMFS has conducted individual and programmatic consultations on these activities throughout Oregon, Washington and Idaho over the past 15 years, and the information gained from monitoring and feedback has been applied by NMFS and BPA to refine design criteria and minimization measures for this consultation. Habitat improvement activities that are less predictable will either be reviewed by the RRT prior to approval, or will require an individual consultation.

The implementation of the program is intended to benefit habitat over the long term. In general, ephemeral effects are expected to last for hours or days, short-term effects are expected to last for weeks, and long-term effects are expected to last for months, years or decades. The activities covered by this program will have some ephemeral or minor, unavoidable, short-term adverse effects such as increased stream turbidity and riparian disturbance, in order to gain the more permanent habitat improvements. The NMFS worked closely with BPA to incorporate minimization measures into the proposed action to reduce these short-term effects. However, short-term adverse effects are reasonably certain to occur, and are generally associated with near- and instream construction or the application of chemical herbicides. The direct physical and chemical effects of the construction of each project will vary depending on the type of action being performed, but will all be based on a common set of effects related to construction. The effects to habitat that are common to many of the activity categories are discussed first, followed by a discussion of habitat effects specific to each activity category.

2.4.1 Effects to the Environment

The habitat improvement actions will have long-term beneficial effects to the habitat of listed fish species at the project-site scale and the watershed scale. As stated above, many of the actions will include activities that result in short-term adverse effects to habitat. Some projects proposed for authorization under this opinion require one or more actions related to pre-construction, construction, operation and maintenance, and site restoration. The direct chemical and physical effects of these activities typically begin with pre-construction activity, such as surveying, minor vegetation clearing, placement of stakes and flagging guides, and minor movements of machines and personnel within the action area. The next stage, site preparation, typically requires development of access roads, construction staging areas, and materials storage areas that affect more of the project area, and clear vegetation that will allow rainfall to strike the bare earth surface. Additional earthwork follows to clear, excavate, fill and shape the site for its eventual use, frequently with activity in the active channel, and reshaping banks as necessary for successful revegetation.

The effects associated with construction, operation or maintenance depend on the purpose and location of each activity category, and will be analyzed in subsequent sections. The final stage for actions that involve construction is site restoration; this stage involves the restoration of ecological function and habitat-forming processes to maintain or promote the site along a trajectory toward conditions that support functional aquatic habitats.

Pre-construction. Pre-construction activity includes planning, design, permit acquisition, and surveying. Vegetation and fluvial geomorphic processes at a project site provide for natural creation and maintenance of habitat function. Pre-construction activities that result in removal of vegetation 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. The microclimate becomes drier and warmer with a corresponding increase in soil and water temperatures. Loose soil can temporarily accumulate in the construction areas and, in dry weather, this soil can be dispersed as dust. In wet weather, loose soil is transported to stream by erosion and runoff, particularly in steep areas. Erosion and runoff increase the supply of soil to lowland areas, and eventually to aquatic habitats where they increase turbidity and sedimentation. This effect is amplified during high frequency and high duration flow events.

Loss of vegetation on the project site will increase the rate of transport of water to streams during rain events, which can lead to higher peak flows. Higher stream flows increase stream energy that scours stream bottoms and transport greater sediment loads farther downstream than 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 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. Continued operations when the construction site is inundated can significantly increase the likelihood of severe erosion and contamination.

Implementation of conservation measures can reduce, but not eliminate, the risk of soil erosion and increased sediment inputs to streams, thus reducing the likelihood of impacts to stream habitats. At a watershed scale, this risk is not expected to be significant because of the localized nature of the impacts and the dispersed location of project sites in multiple watersheds across the landscape.

Construction, Operation and Maintenance Activities. The effects of construction, operation, and maintenance activities are similar to those described above for pre-construction, but involve significantly greater use of heavy equipment for vegetation removal and earthwork. New impervious surfaces allow for faster and more delivery of soil and contaminants in stormwater runoff, causing impaired water quality. It also likely that in-water work will be required to complete some activities (fish passage restoration, river, stream restoration, etc) ; isolation of the work area may result in the injury or death of fish due to handling.

Heavy equipment. Additional heavy equipment use compacts soil, thus reducing soil permeability and infiltration of stormwater. Use of heavy equipment also creates a risk that accidental spills of fuel, lubricants, and hydraulic fluid and similar contaminants may occur. 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.

***Pilings*.** Piles are removed using a vibratory hammer, direct pull, clam shell grab, or cutting/breaking the pile below the mudline. Vibratory pile removal causes sediments to slough off at the mudline, resulting in some suspension of sediments and, possibly, contaminants. Old and brittle piles may break under the vibrations and require use of another method. The direct pull method involves placing a choker around the pile and pulling upward with a crane or other equipment. When the piling is pulled from the substrate, sediments clinging to the piling slough off as it is raised through the water column, producing a plume of turbidity, contaminants, or both. The use of a clamshell may suspend additional sediment if it penetrates the substrate while grabbing the piling. If a piling breaks, the stub is often removed with a clam shell and crane. Sometimes, pilings are cut, broken, or driven below the mudline, and the buried section left in place. This may suspend small amounts of sediment, providing the stub is left in place and little digging is required to reach the pile. Direct pull or use of a clamshell to remove broken piles is likely to suspend more sediment and contaminants.

***In-water work*.** Although the most lethal biological effects of the proposed actions on individual listed species will likely be caused by the isolation of in-water areas, lethal and sublethal effects would be greater than without isolation. In-water 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.

Post-construction Site Restoration. 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. Bare earth is protected by seeding, planting woody shrubs and trees, and mulching. 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.

Besides revegetation, site restoration may include restoring or repairs to streambanks. Streambank restoration activities require bioengineered solutions that include vegetation and large wood as the major structural elements to increase bank strength and resistance to erosion stabilization (Mitsch 1996, WDFW *et al.* 2003). The intent of these activities is to restore riparian function and allow habitat to develop, and allow the banks to respond more favorably to hydraulic disturbance than conventional hard alternatives.

Fish Passage Restoration Effects (Category 1). BPA has divided this activity category into two sections: transportation infrastructure and profile discontinuities. Under transportation infrastructure, BPA has proposed activities to improve fish passage, prevent bank erosion, and facilitate natural sediment and wood movement. Included activities are bridge and culvert removal or replacement, bridge and culvert maintenance, and the installation of fords. The effects related to general pre-construction and construction described above apply.

In addition, the periodic maintenance of culverts and ditches will ensure fish passage and floodplain connectivity; allow for dynamic flow conditions; and maintain access to spawning, rearing and resting habitats for salmon and steelhead.

The installation of properly designed culverts and bridges will increase the fluvial transport of sediment that is needed to form diverse habitats. The culverts will enable additional recruitment of wood to downstream reaches compared to current conditions. The new culverts will reduce the probability of catastrophic damage to aquatic habitats that is often associated with undersized culverts during extreme high flows and large movement of wood. The installation of new culverts should also increase the stability of the streambed.

Fish passage restoration activities that address profile discontinuities include: removal of a dam, water control, or legacy structure; consolidation or replacement of existing irrigation diversions; headcut and grade stabilization; removal of trash, artificial debris dams, sediment bars or terraces that block or delay fish passage; low flow consolidation; and providing fish passage an existing facility. These activities involve significant in-water work, and general pre-construction and construction effects to habitat are discussed above. However, increases in irrigation system efficiencies will result in increased consumptive use (Upendram and Peterson 2007; Samani and Skaggs 2008; Ward and Pulido-Velazquez 2008) which will reduce flow in downstream reaches, which will impair the quality and availability of habitat.

In addition, these activities will benefit habitat by removing impediments to passage for flow, sediment, wood, and fish. Removing barriers allows access to unoccupied spawning and rearing habitat, or allows occupancy during more flow conditions. Removing or consolidating large instream structures will facilitate the release of bedload materials as the structures are notched or removed; this will cause immediate increases in suspended sediment and turbidity, and may degrade downstream habitat for a short period of time. Long-term effects include increased access to spawning, rearing and migration habitat above the site, increased gravel recruitment for spawning downstream of the diversion site, and increased floodplain connectivity and channel migration capacity.

River, Stream, Floodplain, and Wetland Restoration (Category 2). BPA proposes to fund improvements to secondary channels and wetland habitats; set back or remove existing berms, dike, and levees; protect streambanks using bioengineering methods; install habitat-forming instream structures using native materials; plant riparian vegetation; and reconstruct channels. These activities will aid in the re-establishment of hydrologic regimes, increase the area available for rearing habitat, improve access to rearing habitat, increase the hydrologic capacity of side channels, increase channel diversity and complexity, provide resting areas for fish at various levels of inundation, provide flood water attenuation, nutrient and sediment storage, and establish and augment native plant communities. General construction-related effects are described above, and will be short-term.

The long-term effects of this activity category will be improved habitat conditions, and habitat-forming processes. Increased vegetation and habitat complexity will improve thermal regulation, hydrologic and nutrient cycling, channel formation and sediment storage, floodplain development and energy dissipation. Streambank stabilization will use large wood and vegetation to improve bank strength and resistance to erosion (Mitsch 1996, WDFW *et al*. 2000). Bioengineered bank treatments develop root systems that are flexible and regenerative, and respond more favorably to hydraulic disturbance than conventional hard alternatives. This type of bank treatment and the installation on instream wood structures promote channel complexity, through pool formation, gravel and organic material retention, velocity disruption, and cover (Carlson *et al*. 1990, Bilby and Ward 1989, Beechie and Sibley 1997). Instream structures dissipate stream energy, thus reducing the erosive force of the stream on vulnerable banks, and provide areas for pools and gravel bars to form.

Excavating new channels or reconnecting historic stream channels risk failure during high flows; they could be filled with sediment, or supporting structures washed downstream. The risk of channel avulsion will be greatest during the first year after channel construction, and will decrease as riparian vegetation becomes established and floodplain roughness increases. These projects will be reviewed by the RRT to ensure strong designs to achieve restoration goals and to minimize the risk of failure. Also, all projects that involve streambank excavation resulting in bare earth exposure must include erosion controls, revegetation plans, and riparian fencing if appropriate. All in-water construction will occur during the site-specific, in-water work windows to minimize effects to spawning and migration. Despite implementation of minimization measures, these projects will likely cause minor pulses of suspending sediment which could result in localized areas of fine sediment deposition.

Invasive and Non-native Plant Control (Category 3). BPA proposes to fund activities to control or eliminate non-native, invasive plant species that compete with or displace native plant communities. The goal of this activity category is to maximize habitat processes and functions through diverse communities of native plants. This was the most common activity category funded under HIP II; 35% of all project activities funded and implemented were vegetation management projects. A total of 23,887 acres were treated with herbicides (primarily eastern Oregon, eastern Washington, and Idaho), and of these, 3,186 acres were within riparian areas. The herbicides and adjuvants that are proposed for use are provided in Tables 3 and 4, respectively, in this opinion.

BPA's proposed use of chemicals to control non-native plants is designed to minimize the risk of adverse effects on aquatic habitat. Chemical (including fuel) transport, storage, and emergency spill plans will be implemented to reduce the risk of an accidental spill of fuel or chemicals. A catastrophic spill would have the potential for significant adverse effects to water quality. No spills occurred during the implementation of HIP I or HIP II, and NMFS considers the risk of an accidental spill to be low as long as conservation measures are followed strictly.

In Appendix B, BPA provides an environmental fate and transport analysis to evaluate the risk of effects to water quality from this vegetation management program. In addition, NMFS has recently analyzed the effects of these activities using the similar active ingredients and conservation measures for proposed Forest Service and BLM invasive plant control programs (NMFS 2010, NMFS 2012). The types of plant control actions analyzed here are a conservative (*i.e.*, less aggressive) subset of the types of actions considered in those analyses, and the effects presented here are summarized from those analyses. Each type of treatment is likely to affect fish and aquatic macrophytes through a combination of pathways, including disturbance, chemical toxicity, dissolved oxygen and nutrients, water temperature, sediment, instream habitat structure, forage, and riparian and emergent vegetation (Table 30).

Table 30. Potential pathways of effects of invasive and non-native plan control.

Treatment Methods	Pathways of Effects							
	Disturbance*	Chemical toxicity	Dissolved oxygen and nutrients	Water temperature	Fine sediment and turbidity	Instream habitat structure	Forage	Riparian and emergent vegetation
Manual	X					X	X	X
Mechanical	X			X	X		X	X
Biological				X	X			
Herbicides		X	X	X	X	X	X	X

*Stepping on redds, displacing fish, interrupting fish feeding, or disturbing banks.

Mechanical and herbicidal treatments of invasive plant species in riparian areas are not likely to substantially decrease shading of streams. Significant shade loss is likely to be rare, occurring primarily from treating streamside knotweed and blackberry monocultures, and possibly from cutting streamside woody species (tree of heaven, scotch broom, etc.). Most invasive plants are understory species of streamside vegetation that do not provide the majority of streamside shade and furthermore and will be replaced by planted native vegetation or vegetation. The loss of shade would persist until native vegetation reaches and surpasses the height of the invasive plants that were removed. Shade recovery may take one to several years, depending on the success of invasive plant treatment, stream size and location, topography, growing conditions for the replacement plants, and the density and height of the invasive plants when treated. However, short-term shade reduction is likely to occur due to removal of riparian weeds, which could slightly affect stream temperatures or dissolved oxygen levels. NMFS did not identify adverse effects to macroinvertebrates from herbicide applications that follow the proposed conservation measured. Effects pathways are described in detail below.

Manual and mechanical treatments are likely to result in mild restoration construction effects (discussed above). Hand pulling of emergent vegetation is likely to result in localized turbidity and mobilization of fine sediments. Treatment of knotweed and other streamside invasive species with herbicides (by stem injection or spot spray) or heavy machinery is likely to result in short-term increases in fine sediment deposition or turbidity when treatment of locally extensive streamside monocultures occurs. Thus, these treatments are likely to affect a definite, broad area, and to produce at least minor damage to riparian soil and vegetation. In some cases, this will decrease stream shade, increase suspended sediment and temperature in the water column, reduce organic inputs (*e.g.*, insects, leaves, woody material), and alter streambanks and the composition of stream substrates. However, these circumstances are likely to occur only in rare circumstances, such as treatment of an invasive plant monoculture that encompasses a small stream channel. This effect would vary depending on site aspect, elevation, and amount of topographic shading, but is likely to decrease over time at all sites as shade from native vegetation is reestablished.

Herbicide applications. NMFS identified three scenarios for the analysis of herbicide application effects: (1) Runoff from riparian application; (2) application within perennial stream channels; and (3) runoff from intermittent stream channels and ditches. 2,4-D and triclopyr, which are proposed, as well as many other herbicides and pesticides are detected frequently in freshwater habitats within the four western states where listed Pacific salmonids are distributed (NMFS 2011).

Spray and vapor drift are important pathways for herbicide entry into aquatic habitats. Several factors influence herbicide drift, including spray droplet size, wind and air stability, humidity and temperature, physical properties of herbicides and their formulations, and method of application. For example, the amount of herbicide lost from the target area and the distance the herbicide moves both increase as wind velocity increases. Under inversion conditions, when cool air is near the surface under a layer of warm air, little vertical mixing of air occurs. Spray drift is most severe under these conditions, since small spray droplets will fall slowly and move to adjoining areas even with very little wind. Low relative humidity and high temperature cause more rapid evaporation of spray droplets between sprayer and target. This reduces droplet size, resulting in increased potential for spray drift. Vapor drift can occur when herbicide volatilizes. The formulation and volatility of the compound will determine its vapor drift potential. The potential for vapor drift is greatest under high air temperatures and low humidity and with ester formulations. For example, ester formulations of triclopyr are very susceptible to vapor drift, particularly at temperatures above 80°F. When temperatures go above 75˚F, 2,4-D ester chemicals evaporate and drift as vapor. Even a few days after spraying, ester-based phenoxy-type herbicides still release vapor from the leaf surface of the sprayed weed (DiTomaso *et al.* 2006).

When herbicides are applied with a sprayer, nozzle height controls the distance a droplet must fall before reaching the weeds or soil. Less distance means less travel time and less drift. Wind velocity is often greater as height above ground increases, so droplets from nozzles close to the ground would be exposed to lower wind speed. The higher that an application is made above the ground, the more likely it is to be above an inversion layer that will not allow herbicides to mix with lower air layers and will increase long distance drift. Several proposed conservation measures address these concerns by ensuring that herbicide treatments will be made using ground equipment or by hand, under calm conditions, preferably when humidity is high and temperatures are relatively low. Ground equipment reduces the risk of drift, and hand equipment nearly eliminates it.

Surface water contamination with herbicides can occur when herbicides are applied intentionally or accidentally into ditches, irrigation channels or other bodies of water, or when soil-applied herbicides are carried away in runoff to surface waters. Direct application into water sources is generally used for control of aquatic species. Accidental contamination of surface waters can occur when irrigation ditches are sprayed with herbicides or when buffer zones around water sources are not wide enough. In these situations, use of hand application methods will greatly reduce the risk of surface water contamination.

The contribution from runoff will vary depending on site and application variables, although the highest pollutant concentrations generally occur early in the storm runoff period when the greatest amount of herbicide is available for dissolution (Stenstrom and Kayhanian 2005, Wood 2001). Lower exposures are likely when herbicide is applied to smaller areas, when intermittent stream channel or ditches are not completely treated, or when rainfall occurs more than 24 hours after application. Under the proposed action, some formulas of herbicide can be applied within the bankfull elevation of streams, in some cases up to the water's edge. Any juvenile fish in the margins of those streams are more likely to be exposed to herbicides as a result of overspray, inundation of treatment sites, percolation, surface runoff, or a combination of these factors. Overspray and inundation will be minimized through the use of dyes or colorants.

Groundwater contamination is another important pathway. Most herbicide groundwater contamination is caused by "point sources," such as spills or leaks at storage and handling facilities, improperly discarded containers, and rinses of equipment in loading and handling areas, often into adjacent drainage ditches. Point sources are discrete, identifiable locations that discharge relatively high local concentrations. Proposed conservation measures minimize these concerns by ensuing proper calibration, mixing, and cleaning of equipment. Non-point source groundwater contamination of herbicides is relatively uncommon but can occur when a mobile herbicide is applied in areas with a shallow water table. Proposed conservation measures minimize this danger by restricting the formulas used, and the time, place and manner of their application to minimize offsite movement.

Piling Removal (Category 4). BPA proposes to fund projects that may include piling removal. Turbidity generated during piling removal will be temporary will only extend a few meters downstream (the distance will depend on flow and size fraction of streambed material). If sediment in the vicinity of a piling is contaminated, or if the piling had been treated with creosote, PAH will be released during removal, particularly if the piling breaks. To minimize the potential for adverse effects, BPA has imposed measures that will limit the extent of sediment plumes or surface debris and contaminant exposure. The potential long-term benefits of piling removal include reduced predation from piscivorous birds and fish; reduced ongoing contamination from treated pilings; and increased area for benthic production and juvenile salmon rearing.

Road and Trail Erosion Control, Maintenance, and Decommissioning (Category 5). BPA proposes to fund projects that include activities that maintain or decommission roads and trails with the goal of eliminating or reducing erosion and mass wasting of sediment. Roads and their drainage systems cause accelerated runoff of sediment. However, with proper maintenance and design, the amount of sediment that enters a stream from roads and trails can be small, infrequent, and of short duration.

Asphalt used during road resurfacing leach hydrocarbons, which can be toxic if it reaches a stream. Maintenance activities in this category would be patches to small road segments applied during dry conditions. Therefore, the potential for hydrocarbons impacting water quality is very low.

Likewise, dust abatement programs can affect water quality if not applied properly. The most common dust abatement compounds are calcium chloride, magnesium chloride and ligninsulfonates (oil-based products cannot be used in this program). Proper implementation of conservation measures (no application within 25 feet of a water body, or before or during rainfall) will minimize the risk of these chemicals reaching streams or negatively affecting riparian vegetation. Thus the risk of effects to water quality from dust abatement activities is insignificant.

Road maintenance activities are expected to benefit stream channels because these activities will minimize the risk of catastrophic road failure, and mass wasting of soil into stream channels, and will minimize the risk of more minor types of erosion and sediment delivery to channels. Road obliteration and decommissioning will also benefit streams because nearly all sediment delivery from road surfaces should be eliminated from those areas. Long-term benefits include reduced risk of washouts and landslides and improved fish passage by removing fish barriers caused by roads. Watershed conditions will be improved as road densities are reduced and riparian areas at old road crossings are revegetated. Floodplain connectivity may also be improved when the road had been built in the floodplain. Decommissioning a road reconnects natural habitat, and allows for the recolonization of native vegetation.

In-channel Nutrient Enhancement (Category 6). This category includes the addition of salmon carcasses, processed fish cakes or placement of inorganic fertilizers into stream channels. In-channel nutrient supplementation may introduce piscine diseases into streams as well as the chemicals applied that are used to control those diseases, and may also introduce too many nutrients to stream channels causing algal blooms or other eutrophication problems downstream (Compton *et al*. 2006). Because of the lack of science associated with the ecosystems effects from nutrient enhancements, BPA-funded nutrients enhancements will follow minimization measures to minimize the risk of adverse effects. For example, projects will not place carcasses in naturally oligotrophic systems where nutrient levels would be natural low, and they will not add nutrients to eutrophic systems where nutrient levels are anthropogenically elevated.

The benefit of nutrient supplementation includes the delivery of marine nutrients into freshwater that will enhance primary and secondary production in the channels, thus enhancing the prey base for juvenile salmon (Reeves *et al*. 1991, Ward *et al*. 2003).

Irrigation and Water Delivery/Management Actions (Category 7). BPA proposes to fund the following activities in this category: convert water delivery system to drip or sprinkler irrigation; convert water conveyance from an open ditch to a pipeline or line-leaking ditch/canal; convert from instream diversion to a groundwater well for primary water source; install or replace return flow cooling systems; install irrigation water siphon beneath the waterway; install livestock water facilities; and; maintain, upgrade, or install a new fish screen. The purpose of all these activities is to increase the amount of instream flow and to improve riparian function through irrigation efficiencies. Less water is needed to irrigate crops via drip or sprinkler irrigation than via flood irrigation because less water is lost through evaporation, and the application is more precise. The delivery of water can be controlled to meet the needs of plants with less waste. 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 (Trooien *et al*. 2000, Venhuizen 1998). Drip and sprinkler irrigation can also reduce the amount of soil erosion, and nutrient and pesticide runoff that is normally associated with furrow irrigation systems (Ebbert and Kim 1998).

However, converting from flood to drip or sprinkler irrigation may enable a water user to conduct more irrigation events with less water applied per event. This could increase the amount of water consumptively used per acre of irrigation (Upendram and Peterson 2007; Ward and Pulido-Velazquez 2008). Conversion from flood to drip irrigation could increase consumptive use by 22% to 29% (Ward and Pulido-Velazquez 2008) and conversion from flood to sprinkler irrigation could increase consumptive use by 24% to 39% (Upendram and Peterson 2007). Assuming a consumptive use of 1.45 acre feet per acre for flood irrigation (Lemhi Decree), an acre converted from flood irrigation to drip or sprinkler irrigation could reduce the amount of water flowing downstream to the ocean by 0.32 acre feet to 0.56 acre feet.

Irrigation water delivery via pipes or lined ditches/canals also uses less water, although the reduction in water loss is less than described above. The replacement of canals with pipelines will 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).

If these activities require instream construction the general effects of construction on stream and riparian habitat discussed above are applicable.

Fisheries, Hydrologic, and Geomorphologic Surveys (Category 8). BPA will fund activities that collect habitat information; collect data on fish presence, abundance, and habitat use; and conservation, protection and rehabilitation opportunities or effects. NMFS expects these activities could cause minor erosion and sedimentation, and minor compaction and disturbance to the streambed. Some riparian vegetation may be trampled, and excavated material from cultural resource excavation may contribute sediment to streams and increase turbidity. Implementation of conservation measures, and the limited extent of this work will minimize the potential for effects to stream channels. The amount of soil disturbed will be negligible.

2.4.2. Effects on ESA-Listed Salmon and Steelhead

The biological effects included as part of the proposed action are primarily the result of physical and chemical changes in the environment caused by activities funded under the HIP III program. These effects are complex, and vary in magnitude and severity between individual organism, population, ESU/DPS, and community scales.

Preconstruction Activities. The primary habitat effect from preconstruction activities is a temporary and localized increased in turbidity and suspended sediment. Turbidity may have beneficial or detrimental effects on fish, depending on the intensity, duration, and frequency of exposure (Newcombe and MacDonald 1991). Salmonids have evolved in systems that periodically experience short-term pulses (days to weeks) of high suspended sediment loads, often associated with flood events, and are presumably adapted to high pulse exposures. Adult and larger juvenile salmonids may be little affects by the high concentrations of suspended sediments that occur during storm and snowmelt runoff (Bjorn and Reiser 1991), although these events may produce behavioral effects, such as gill flaring and feeding changes (Berg and Northcote 1985).

Deposition of fine sediments reduces egg incubation success (Bell 1991), interferes with primary and secondary production (Spence *et al*. 1996), and degrades cover for juvenile salmonids (Bjornn and Reiser 1991). Chronic, moderate turbidity can harm new-emerged salmonid fry, juveniles, and even adults by causing physiological stress that reduces feeding and growth, and increases basal metabolic requirements (Redding *et al*. 1987, Lloyd 1987, Bjornn and Reiser 1991, Servizi and Martens 1991, Spence *et al*. 1996). Juveniles avoid chronically turbid streams, such as glacial streams or those disturbed by human activities, unless those streams must be traversed along a migration route (Lloyd *et al*. 1987). Older salmonids typically move laterally and downstream to avoid turbidity plumes (McLeay et al. 1984, 1987, Sigler *et al*. 1984, Lloyd 1987, Scannel 1988, Servizi and Martens 1991). Fish exposed to moderately high turbidity levels in natural settings are able to feed, although at a lower rate and with increased energy expenditure due to a more active foraging strategy. Over a period of several days or more, reduced feeding resulting from increased turbidity can translate into reduced growth rates.

Turbidity also limits fish vision, which can interfere with social behavior (Berg and Northcote 1985), foraging (Gregory and Northcote 1993, Vogel and Beauchamp 1999) and predator avoidance (Miner and Stein 1996, Meager *et al*. 2006). This can have varying effects on fish growth and survival, depending on a range factors such as ambient light levels and depth; relative visual sensitivities of predators and prey; and non-visual sensory abilities. Conversely, salmon may benefit from increased turbidity; predation on salmonids may be reduced in water turbidity equivalent to 23 Nephalometric Turbidity Units (NTU) (Gregory 1993, Gregory and Levings 1998) which may improve survival.

Therefore, fish will be exposed to elevated turbidity and suspended sediment during pre-construction activities. Some juvenile salmonids may decrease feeding, experience increased stress, or may be unable to use the action area, depending on the severity of the increase in suspended sediments.

Construction, Operation and Maintenance Activities. All of the activity categories require some level of construction, operation, and/or maintenance adjacent to, or within, streams or rivers with listed fish. These activities can have direct biological effects on individual salmon and steelhead by altering development, bioenergetics, growth and behavior. Actions that increase flows can disturb gravel in salmon or steelhead redds, and can also agitate or dislodge developing young, which can impair survival. Similarly, actions that result in water quality changes can result in altered behavior and death. Actions 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). Salmon that survive incubation in 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. BPA has imposed conservation measures to minimize the risk of direct or indirect impact to redds. If any redds are impacted, scope of the impacted will be very limited in space and time, and is not expected to affect population viability.

Heavy Equipment. Heavy equipment used in spawning areas will disturb or compact gravel and other channel materials, making it harder for fish to excavate redds and decrease the oxygen concentration in existing redds. Heavy equipment used in streams in any occupied habitat may inhibit fish passage, or kill or injure individual fish; because of the scale of the program (HIP II had 114 construction projects with in-water work from 2008 through March of 2012 in the Columbia Basin) this effect is not expected to be significant at the population scale. Cederholm *et al*. (1997) recommend that heavy equipment work should be performed from the bank and that work within bedrock or boulder/cobble bedded channels should be viewed as a last resort. They also recommended using equipment such as spider harvesters and log loaders that are less disturbing to the streambed. BPA has incorporated similar measures into their proposed action.

The effects on salmon and steelhead from increased turbidity and suspended sediment are discussed above. As suspended fine sediment settles out downstream from the construction areas, minor increases in stream substrate embeddedness occurs. Suttle *et al*. (2004) report that increases in fine sediments in stream substrates can decrease productivity and habitat quality for juvenile salmonids. Waters (1995) described how elevated fine sediment in streams impair both physical and biological processes; significant increases in fine sediment reduces interstitial spaces between substrate particles, leads to shifts in invertebrate community structure, fills pools, and can entomb redds. In such cases, eggs are smothered, and prey availability for juveniles is reduced.

When heavy equipment is operating within a stream or in a riparian area, there is always the potential for fuel or other contaminant spills. Operation of bulldozers, excavators, and other equipment requires the use of fuel and lubricants which, if spilled, can injure or kill aquatic organisms. Petroleum-based contaminants such as fuel, oil and some hydraulic fluids contain PAHs, which can be acutely toxic to salmonids at high levels of exposure and can cause acute and chronic sublethal effects to aquatic organisms (Neff 1985). BPA will require an erosion and pollution control plan for all projects that require soil disturbance; this includes all projects using heavy equipment near streams and rivers. This measure will minimize the risk of a hazardous spill, and if a spill occurs, will minimize the risk of it reaching the water. BPA reports from the implementation of HIP I and HIP II demonstrate the effectiveness of the conservation measures; a spill has never been reported. Therefore, the risk of a spill during the implementation of HIP III is low, and no population level effects from hazardous spills are expected from the implementation of this program.

Pilings**.** Turbidity from piling removal is temporary and confined to the area close to the activity. NMFS expects that some individual salmon and steelhead, both adult and juvenile, may be harassed by turbidity plumes resulting from pile removal. Indirect lethal take can occur if individual juvenile fish are preyed on when they leave the work area to avoid turbidity plumes. The proposed requirements for completing the work during the preferred in-water work window will minimize the effects of turbidity on listed species.

In-water work**.** Adverse effects to listed fish from in-water work are generally avoided and minimized through use of: (1) In-water work isolation strategies that often involve capture and release of trapped fish, and (2) performing the work during work windows when the fewest individuals of a species are present.

Direct effects on juvenile salmonids from work area isolation and fish relocation include mechanical injury during capture, holding, or release, and potential horizontal transmission of disease and pathogens and stress-related phenomena. Stress approaching or exceeding the physiological tolerance limits of individual fish can impair reproductive success, growth, resistance to infectious diseases, and survival (Wedemeyer *et al*. 1990). If electrofishing is used to salvage fish, it will add to increased stress loads. Harmful effects of electrofishing are detailed by Snyder (2003) and include internal and external hemorrhage, fractured spines, and death. The primary contributing factors to stress and death from handling are differences in water temperatures (between the river and the holding tank), dissolved oxygen concentrations, 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 18ºC 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. Although some listed salmonids will die from electroshocking, fish will only be exposed to the stress caused by work area isolation once, and the fish relocation is only expected to last a few hours for each project. The risk of injury or death to individual fish would be greater if construction occurred without work area isolation.

The BA reported the observed incidental take associated with work area isolation for the first 4.3 years of implementation of HIP II. A total of 358 projects were implemented, with 114 of those projects requiring work area isolation. A total of 1306 salmon and steelhead were captured and eight fish died during handling. A typical project could affect several hundred feet of stream channel, or may affect several miles of stream. For HIP III, NMFS is assuming that a similar number of projects requiring work area isolation will be funded over a similar time period.

Post-construction Site Restoration. Most direct and indirect effects of proposed streambank restoration activities are the same as those for general construction discussed above, and these activities will follow the conservation measures for general construction, as applicable.

Fish Passage Restoration (Category 1 Activities). Activities in this category will provide a net long-term beneficial effect to ESA-listed salmon and steelhead. Improved habitat conditions and fish passage will provide greater access to rearing and spawning habitat, less energy expenditure in movement, greater access to diverse habitats that fosters the development and maintenance of locally adapted subpopulations. These positive changes will contribute to improvements in all four VSP parameters for affected ESUs. Negative effects to salmon and steelhead are related to general construction activities. These effects will be short-term, and will not affect fish at the population or ESU or DPS scale.

River, Stream, Floodplain, and Wetland Restoration (Category 2 Activities). Activities in this category will improve access to off-channel and floodplain habitats, improve the ecological function of streambanks, improve hydrological regimes, improve channel diversity and complexity, and provide resting and rearing areas for fish at a variety of flows. Greater diversity of habitat, and the presence and abundance of large wood is positively related to growth, abundance, and survival of juvenile salmonids (Spalding *et al*. 1995, Fausch and Northcote 1992). Similarly, greater access to rearing habitat, and improved rearing conditions through improved habitat complexity will contribute to increased distribution and abundance of juvenile salmonids (Beechie and Sibley 1997, Spalding *et al*. 1995). Instream complexity will provide overhead cover for both adults and rearing juveniles, reducing predation risk.

Negative effects related to this activity are primarily related to construction and are discussed above. In addition, there is a potential for negative effects associated with the construction of new channels. Newly-constructed channels may fill during subsequent high flows, and the risk of channel failure, avulsion, or accelerated bank erosion is greatest the first year following construction. Sediment pulses from channel failures or increased erosion may affect migrating adults and rearing juveniles; however, the effect is likely minor and short term. Project design review and adherence to fish work windows will minimize the risk to vulnerable life stages (e.g., spawning).

The overall effect of this proposed activity category will be beneficial, with improvements expected to productivity, survival, spatial structure, and diversity at the population scale where projects are implemented.

Invasive and Non-native Plant Control (Category 3 Activities). Activities in this category are designed to control or eliminate non-native, invasive plant communities where a benefit to habitat processes and functions are possible. Methods of plant control include both physical control and the use of herbicides. Effects of plant management using physical controls may include effects similar to general construction. BPA's proposed funding of chemicals to control invasive plans is designed to have no toxic effects on fish. Conservation measures such as the restriction to ground-based application methods and spot treatment will minimize the risk of effects. If a catastrophic spill of fuels or chemicals reaches water with listed fish, the potential for mortality to those fish is high. No accidental spill of fuels or chemicals has occurred with HIP I or HIP II, and with continued vigilant implementation of proposed conservation measures, that trend is expected to continue.

When used according to the EPA label and the proposed conservation measures, BPA concluded that because of the uncertainty associated with the effectiveness of the conservation measures, it is reasonably likely that chemicals will reach streams with listed fish. BPA asserts that there may be some sub-lethal effects to listed fish as a result of herbicide and adjuvant exposure. It is reasonable to expect that effects will include direct and indirect mortality, an increase or decrease in growth, changes in reproductive behavior, reduction in number of eggs produced, fertilized or hatched, developmental abnormalities, reduction in ability to osmoregulate or adapt to salinity gradients, reduced ability to respond to stressors, increase in susceptibility to disease and predation, and changes in migratory behavior. The consequence of these effects is reasonably likely to result in reduced survival, reproductive success and/or migration.

BPA proposes to fund projects that use 2,4-D and triclopyr as well as many other herbicides and pesticides are detected frequently in freshwater habitats within the four western states where listed Pacific salmonids are distributed (NMFS 2011b). Stream margins often provide shallow, low-flow conditions, have a slow mixing rate with mainstem waters, and are the site at which subsurface runoff is introduced. Juvenile salmon and steelhead, particularly recently emerged fry, often use low-flow areas along stream margins. Wild Chinook salmon rear near stream margins until they reach about 60 mm in length. As juveniles grow, they migrate away from stream margins and occupy habitats with progressively higher flow velocities. Nonetheless, stream margins continue to be used by larger salmon and steelhead for a variety of reasons, including nocturnal resting, summer and winter thermal refuge, predator avoidance, and flow refuge. It is these stream margin habitats that the potential for exposure of the herbicides to fish is the greatest.

Lower exposures are likely when herbicide is applied to smaller areas, when intermittent stream channel or ditches are not completely treated, or when rainfall occurs more than 24 hours after application. Under the proposed action, some formulas of herbicide can be applied within the bankfull elevation of streams, in some cases up to the water's edge. Any juvenile fish in the margins of those streams are reasonably likely to be exposed to herbicides as a result of overspray, inundation of treatment sites, percolation, surface runoff, or a combination of these factors. Overspray and inundation will be minimized through the use of dyes or colorants.

Herbicide toxicity. Herbicides included in this activity were selected due to their low to moderate aquatic toxicity to listed salmonids. The risk of adverse effects from the toxicity of herbicides and other compounds present in formulations to listed aquatic species is mitigated by reducing stream delivery potential by restricting application methods. Only aquatic labeled herbicides are to be applied within wet stream channels. Aquatic glyphosate and aquatic imazapyr can be applied up to the waterline using spot spray or hand selective application methods in both perennial and intermittent channels. Triclopyr TEA and 2,4-D amine can be applied up to the waterline, but only using hand selective techniques. The associated application methods were selected for their low risk of contaminating soils and subsequently introducing herbicides to streams. However, direct and indirect exposure and toxicity risks are inherent in some application scenarios.

Generally, herbicide active ingredients have been tested on only a limited number of species and mostly under laboratory conditions. While laboratory experiments can be used to determine acute toxicity and effects to reproduction, cancer rates, birth defect rates, and other effects to fish and wildlife, laboratory experiments do not typically account for species in their natural environments and little data is available from studies focused specifically on the listed species in this opinion. This leads to uncertainty in risk assessment analyses. Environmental stressors increase the adverse effects of contaminants, but the degree to which these effects are likely to occur for various herbicides is largely unknown.

In previous opinions (NMFS 2010, NMFS 2012), NMFS analyzed the effects of herbicide applications to various representative groups of species have been evaluated for each proposed herbicide. The effects of herbicide applications using spot spray, hand/select, and broadcast spray methods were evaluated under several exposure scenarios: (1) runoff from riparian (above HWM) application along streams, lakes and ponds, (2) runoff from treated ditches and dry intermittent streams, and (3) application within perennial streams (dry areas within channel and emergent plants). The potential for herbicide movement from broadcast drift was also evaluated.

Herbicide delivery to surface water is likely to result in mortality to fish during incubation, or lead to altered development of embryos. Stehr *et al*. (2009) found that the low levels of herbicide delivered to surface waters are unlikely to be toxic to the embryos of ESA-listed salmon, steelhead and trout. However, mortality or sub-lethal effects to juveniles are likely to occur; these effects include reduced growth and development, decreased predator avoidance, or other modified behaviors. Herbicides are likely to also negatively impact the food base for listed salmonids and other fish, which includes terrestrial organisms of riparian origin, aquatic macroinvertebrates and forage fish.

Adverse effect threshold values for each species group were defined as either 1/20th of the LC50 value for listed salmonids, 1/10th of the LC50 value for non-listed aquatic species, or the lowest acute or chronic “no observable effect concentration,” whichever was lower, found in Syracuse Environmental Research Associates, Inc. risk assessments that were completed for the USFS.[24] Generally, effect threshold values for listed salmonids were lower than values for other fish species groups. In the case of sulfometuron-methyl, threshold values for fathead minnow were lower than salmonid values, so threshold values for minnow were used to evaluate effects to listed fish.

Data on toxicity to wild fish under natural conditions are limited and most studies are conducted on lab specimens. Adverse effects could be observed in stressed populations of fish, and it is less likely that effects would be noted in otherwise healthy populations of fish. Chronic studies or even long-term studies on fish egg-and-fry are seldom conducted. Risk characterizations for both terrestrial and aquatic species are limited by the relatively few animal and plant species on which data are available, compared to the large number of species that could potentially be exposed. This limitation and consequent uncertainty is common to most if not all ecological risk assessments. Additionally, in laboratory studies, test animals are exposed to only a single chemical. In the environment, humans and wildlife may be exposed to multiple toxicants simultaneously, which can lead to additive or synergistic effects.

[24] http://www.fs.fed.us/foresthealth/pesticide/risk.shtml

Given their long residency period and use of freshwater, estuarine, and nearshore areas, juveniles and migrating adults have a high probability of exposure to herbicides that are applied near their habitats. The risk of exposure from herbicides applied under HIP III is low; however, in both HIP I and HIP II, this is the most commonly implemented activity category, and over 23,000 acres were treated with herbicides in the Columbia Basin under HIP II. Therefore, there is a risk of exposure to herbicides as a consequence of HIP III, and negative effects to listed salmonids would be a consequence of that exposure.

Because of the large size of the action area relative to the area treated with herbicides, it is unlikely that the effects would be measureable at the population or ESU scale.

Summary. The proposed conservation measures, including limitations on the herbicides, adjuvants, carriers, handling procedures, application methods, drift minimization measures, and riparian buffers, will greatly reduce the likelihood that significant amounts of herbicide will be transported to aquatic habitats, although some herbicides are still likely to enter streams through aerial drift, in association with eroded sediment in runoff, and dissolved in runoff, including runoff from intermittent streams and ditches. Some individual fish are likely to be negatively impacted as a consequence of that exposure. The indirect effects or long-term consequences of invasive, non-native plant control will depend on the long-term progression of climatic factors and the success of follow-up management actions to exclude undesirable species from the action area, provide early detection and rapid response before such species establish a secure position in the plant community, eradicate incipient populations, and control existing populations.

Piling Removal (Category 4 Activities). Piling removal will re-suspend sediment, and if the piling had been treated creosote or if the adjacent sediments had been contaminated, then there is a reasonable likelihood for exposure to those contaminants. This effect would be short term, and extend for a few days during construction. The long term effect of piling removal is a net beneficial effect for listed salmon and steelhead because it will reduce the number of resting sites for piscivorous birds. It will also reduce cover for aquatic predators such as large and smallmouth bass. It may also reduce the amount of creosote exposure by removing treated pilings.

Road and Trail Erosion Control, Maintenance, and Decommissioning (Category 5 Activities). Effects associated with general construction are discussed above. Individual fish may be exposed to hydrocarbons during small resurfacing activities using asphalt. However, implementation of conservation measures (conducting this activity during dry weather, and limiting the scope to minor repairs) will limit the opportunity for exposure, and this activity will be a net benefit for listed salmonid populations in watersheds that implement these activities.

In-channel Nutrient Enhancement (Category 6 Activities). The goal of this activity is to enhance primary and secondary production in streams, thus enhancing the prey base of juvenile salmon and steelhead. If successful, the consequence will be increased growth and survival, which contribute to increase productivity for listed salmon populations. Potential negative effects include the introduction of piscine diseases into stream as well as the chemicals applied that are used to control those diseases. In-channel nutrient enhancement may also introduce too many nutrients to stream channels causing algal blooms or other eutrophication problems downstream (Compton *et al*. 2006). These adverse effects are not reasonably likely to occur because of the conservation measures that will be implemented with this activity, and the remote likelihood of this activity category being implemented under HIP III.[25]

Irrigation and Water (Category 7 Activities). These activities will maintain or increase the amount of instream flow for fish, and improve riparian complexity and processes. Improved flow, particularly in late summer when flows are typically the lowest, will improve juvenile survival, thus enhancing productivity at the reach scale. However, unless conservation measures are adequate to ensure no increase in consumptive use of water, these activities could result in decreases in streamflow downstream of the project site.

Construction work will cause minor disturbances to individual fish over the short term, or a short exposure to a sediment pulse.

Fisheries, Hydrologic, and Geomorphologic Surveys (Category 8 Activities). These activities will be implemented to support aquatic restoration, but over the short term, could cause minor disturbances to individual fish, or a short exposure to a sediment pulse. ESA-listed fish would be observed in-water (*e.g.*, by snorkel surveys or from the banks). Direct observation is the least disruptive method for determining a species' presence/absence and estimating their relative numbers. Its effects are also generally the shortest-lived and least harmful of the monitoring activities discussed in this section because a cautious observer can effectively obtain data while only slightly disrupting the fishes' behavior. Fry and juveniles frightened by the turbulence and sound created by observers are likely to seek temporary refuge in deeper water or behind or under rocks or vegetation. In extreme cases, some individuals may leave a particular pool or habitat type and then return when observers leave the area. Harassment is the primary effect associated with these observation activities, and few if any injuries (and no deaths) are expected to occur—particularly in cases where monitoring is observed from the stream banks rather than in the water.

Summary of Effects to Salmonids. The purpose of the proposed action is to fund activities that improve fish and wildlife habitat. These activities will have negative, short-term construction related effects, but will provide a net benefit to listed salmon and steelhead in the long term. Many environmental conditions can cause incremental differences in feeding, growth, movements, and survival of salmon and steelhead during the juvenile life stage. Construction actions 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, the frequency and duration of exposure to the

[25] No in-channel nutrient enhancement projects were implemented under HIP II.

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. Other threats to salmon and steelhead include exposure to herbicides and loss of habitat because of increased consumptive use of water because of irrigation efficiency activities. However, given the full range of mandatory conservation measures in the HIP III program outlined above, the threat is low that the environmental changes caused by events at any single site associated with the proposed action, or even any combination of such sites, 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. That is too few to influence population abundance. Similarly, small to intermediate reductions in juvenile population density in the action area caused by individuals moving out of HIP III activity areas to avoid dying as a result of exposure to short-term physical and chemical effects of the proposed construction are expected to be transitory and are not expected to alter juvenile survival rates. Over the long term, the sum of the HIP III activities may result in measurable improvements to population characteristics, particularly if a project is of large enough scale (provides access to many miles of habitat), or if enough projects are implemented within the range of a population.

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 (Gregory 1988, Servizi and Martens 1991, Sigler 1988). Given the full range of mandatory conservation measures in the HIP III program outlined above, it is unlikely that physical and chemical changes caused by construction events at any single site associated with the proposed action, or even any combination of such sites, 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 biological effects of implementing the activities within the HIP III program will negatively affect the characteristics of salmon or steelhead populations. The proposed action will have long-term beneficial effects on population abundance, productivity, and spatial structure (improvements in fish passage).

2.4.3 Effects on Critical Habitat

Completion of each restoration project is expected to have the following set of effects on the PCEs or habitat qualities essential to the conservation of each species. These effects will vary somewhat in severity between projects because of differences in the scope of both construction and restoration at each, and the current condition of PCEs and the factors responsible for those conditions. This assumption is based on the fact that all of the projects are based on the same set of underlying construction actions and the PCEs and conservation needs identified for each species are also essentially the same. In general, ephemeral effects are expected to last for hours or days, short-term effects are expected to last for weeks, and long-term effects are expected to last for months, years or decades. Actions with more significant construction component are likely to have direct adverse effects to a larger area, and to take a longer time to recover, than actions based in restoration of a single habitat element. However, they are also likely to have correspondingly greater conservation benefits.

Effects on ESA-Listed Salmon and Steelhead Critical Habitat. Essential habitat for listed salmonids includes summer and winter rearing areas, juvenile migration corridors, areas for growth and development to adulthood, and adult migration corridors, and spawning areas. Juvenile summer and winter rearing areas and spawning areas are often in small headwater streams and side channels, while juvenile migration corridors and adult migration corridors include tributaries, mainstem river reaches and estuarine areas. Growth and development to adulthood occurs primarily in near- and off-shore marine water, although final maturation takes place in freshwater tributaries when the adults return to spawn. Of these, the action area has been designated as essential for spawning and rearing, juvenile migration, and adult migration. The Pacific Ocean areas used by listed salmon for growth and development to adulthood are not well understood, and essential areas and features have not been identified for this life stage. The essential features of critical habitat for listed salmonids are substrate, water quality, water quantity, water temperature, water velocity, cover/shelter, food, riparian vegetation, space, access and safe passage conditions.

1. Freshwater spawning sites
    a. Water quantity –Ephemeral eduction due to construction effects including reduced riparian soil permeability, and increased riparian runoff; longer-term improvement based on restoration actions targeting irrigation improvements, reconnection of side channels and alcoves, and improved riparian function and floodplain connectivity. Improved irrigation and conveyance efficiency will likely reduce flow.

b. Water quality – Short-term increase in turbidity, dissolved oxygen demand, and temperature due to riparian and channel disturbance, and nutrient enrichment as a result of placement of carcasses in nutrient-poor streams. Water quality may be impaired by inputs of herbicides and fertilizers. Concentrations of herbicides in the stream depend on the rate of application, methodology and size of the receiving water body. Effects are likely to be short-term, with attenuation, dilution and thermal and microbial breakdown. While this is likely to be the most common type of restoration activity, the analysis conducted by BPA in Appendix B of the BA indicates that the proposed conservation measures and buffers will keep herbicide concentrations in streams to nearly insignificant levels.

c. Substrate – Short-term reduction due to increased compaction and sedimentation, with a long-term improvement because of reduced sediment transport as a consequence of restoration activities designed to store sediment in the channels, increase channel complexity, and increase the shoreline length.

2. Freshwater rearing sites

a. Water quantity – as above. Improved irrigation efficiencies will reduce flow in the mainstem portions of the migration corridor.

b. Floodplain connectivity – Short-term negative impacts during construction, but significant long-term benefits as side channels and alcoves are reconnected, and riparian function improved.

c. Water quality – as above.

d. Forage – Minor, short-term decrease at a localized scale is expected due to construction effects (riparian and channel disturbance). In the long term, restoration activities will improve riparian function and reduce inputs of fine sediments. Secondary productivity is expected to increase because of nutrient enrichment, improvements in habitat diversity and complexity, riparian function and floodplain connectivity and leaf litter retention. If herbicides reach the water, then reduction in both primary and secondary productivity is expected; the scale of the effect would depend on the amount (concentration and length of time) of the herbicide in the water, but is expected to be short term.

e. Natural cover – Short-term decrease due to riparian and channel disturbance; long-term improvements as a consequence of restoration action to improve channel complexity, riparian function and off-channel and alcove habitats.

3. Freshwater migration corridors

a. Free passage – Short-term decrease due to in-water work isolation; long-term improvement due to restoration actions.

b. Water quantity – as above.

c. Water quality – as above.

d. Forage – as above.

e. Natural cover – as above.

4. Estuarine areas
    a. Free passage – as above. Long-term improvements due to restoration of an estuarine transition zone, restoration of estuarine functions such as temperature, tidal currents and salinity; reduced number of sites for avian predators to rest and hunt; removal of tide gates.
    b. Water quality – as above.
    c. Water quantity – as above.
    d. Natural cover – as above. Long-term improvements due to shift in vegetative community composition and distribution toward more native species including salt marsh species; reestablishment of cover in historical distributary channels; increase in riparian vegetation and habitat complexity; increase fish access for cover habitat in tributaries and floodplain habitats; and reduced filling of estuaries by fine sediment.
    e. Juvenile forage – as above. Long-term improved foraging habitat abundance from reestablishing historical distributary channels that increase in size after tidal flows are allowed to inundate and scour twice a day; increased access into tributaries and floodplain habitats to forage.
    f. Adult forage – Short-term decrease due to riparian and channel disturbance; long-term improvements due to restoration activities that improve habitat quality
5. Nearshore marine areas. No effects are anticipated because no projects will be implemented in these areas.
    a. Free passage – no effect.
    b. Water quality – no effects.
    c. Water quantity – no effects.
    d. Forage – no effects.
    e. Natural cover – no effects.
6. Offshore marine areas. No effects are anticipated because no projects will be implemented in these areas.
    a. Water quality – no effects.
    b. Forage – no effects.

Summary of effects to critical habitat. HIP III projects are being funded because of their expected improvements in ecosystem functions for aquatic habitat for listed salmon and steelhead. While short-term declines in habitat quality will occur during project construction, these effects will be of low intensity and extend over a short time period. The frequency of the disturbance will usually be limited to a single event or, at most, a few projects within the same watershed. Therefore, the temporary negative effects will have adverse effects on the function of PCEs at the watershed scale. Irrigation efficiencies without appropriate conservation measures to protect the conserved water as an instream water right will result in reduced flows. However, the net effect at the water scale of the targeted habitat improvements should result in improvements in the function of PCEs or the conservation value of critical habitat, depending on how many projects are implemented in a watershed.

Synthesis of Effects. The scope of each type of activity that could be authorized under the HIP III program is narrowly proscribed, and is further limited by conservation measures tailored to avoid direct and indirect adverse effects of those actions on properly functioning habitat conditions, and to ensure that the proposed projects are designed and implemented in a way that maximizes the potential for long-term habitat benefits. Administrative measures are in place to ensure that requirements related to the scope of actions allowed and the mandatory conservation measures (*i.e*., design criteria) operate to limit direct lethal effects on listed fish to a few deaths associated with in-water work areas, an action necessary to avoid greater environmental harm. All other direct adverse effects will likely be transitory and within the ability of both juveniles and adult fish to avoid by bypassing or temporarily leaving the proposed action area. Such behavioral avoidance will probably be the only significant biological response of listed fish to the HIP III program. This is because areas affected by the specific projects undertaken pursuant to the HIP III program are likely to be widely distributed (the frequency of the disturbance will be limited to a single event or, at most, a few projects within the same watershed) and small compared with the total habitat area; the intensity and severity of environmental effects for each project will be comprehensively minimized by targeted design criteria; and the recovery timeframe for proper functioning habitat conditions is unlikely to be appreciably reduced by the adverse effects, and will be increased by the habitat benefits as a result of project implementation. Finally, the long-term benefits to habitat will positively affect VSP parameters for listed salmon and steelhead.

2.5 Cumulative Effects

"Cumulative effects" are 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 (50 CFR 402.02). Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the ESA.

The contribution of non-Federal activities to the current condition of ESA-listed species and designated critical habitats within the program-level action area was described in the Status of the Species and Critical Habitats and Environmental Baseline sections, above. Among those activities were agriculture, forest management, mining, road construction, urbanization, water development, and river restoration. Those actions were driven by a combination of economic conditions that characterized traditional natural resource-based industries, general resource demands associated with settlement of local and regional population centers, and the efforts of social groups dedicated to the river restoration and use of natural amenities, such as cultural inspiration and recreational experiences.

Resource-based industries caused many long-lasting environmental changes that harmed ESA-listed species and their critical habitats, such as state-wide loss or degradation of stream channel morphology, spawning substrates, instream roughness and cover, estuarine rearing habitats, wetlands, riparian areas, water quality (*e.g.*, temperature, sediment, dissolved oxygen, contaminants), fish passage, and habitat refugia. Those changes reduced the ability of populations of ESA-listed species to sustain themselves in the natural environment by altering or interfering with their behavior in ways that reduce their survival throughout their life cycle. The environmental changes also reduced the quality and function of critical habitat PCEs that are necessary for successful spawning, production of offspring, and migratory access necessary for adult fish to swim upstream to reach spawning areas and for juvenile fish to proceed downstream and reach the ocean. Without those features, the species cannot successfully spawn and produce offspring. As noted above, however, the declining level of resource-based industrial activity and rapidly rising industry standards for resource protection are likely to reduce the intensity and severity of those impacts in the future.

The economic and environmental significance of natural resource-based economy is currently declining in absolute terms and relative to a newer economy based on mixed manufacturing and marketing with an emphasis on high technology (Brown 2011). Nonetheless, resource-based industries are likely to continue to have an influence on environmental conditions within the program-action area for the indefinite future. However, over time those industries have adopted management practices that avoid or reduce many of their most harmful impacts, as is evidenced by the extensive conservation measures included with the proposed action, but which were unknown or in uncommon use until even a few years ago.

While natural resource extraction within Oregon may be declining, general resource demands are increasing with growth in the size and standard of living of the local and regional human population. The percentage increase in population growth may provide the best estimate of general resource demands because as local human populations grow, so does the overall consumption of local and regional natural resources. Between April 2010 and July 2011, the population of Oregon and Idaho both grew by 1.1% and the population of Washington State grew by 1.6%.[26] The population is expected to continue to grow at a similar rate. The NMFS assumes that private and state actions that have routinely occurred in the past will continue within the action area, increasing as population rises.

Similarly, demand for cultural and aesthetic amenities continues to grow with human population, and is reflected in decades of concentrated effort by Tribes, states, and local communities to restore an environment that supports flourishing wildlife populations, including populations of species that are now ESA-listed (CRITFC 1995; NWPCC 2012). Reduced economic dependence on traditional resource-based industries has been associated with growing public appreciation for the economic benefits of river restoration, and growing demand for the cultural amenities that river restoration provides. Thus, many non-Federal actions have become responsive to the recovery needs of ESA-listed species. Those actions included efforts to ensure that resource-based industries adopt improved practices to avoid, minimize, or offset their adverse impacts. Similarly, many actions focused on completion of river restoration projects specifically designed to broadly reverse the major factors now limiting the survival of ESA-listed species at all stages of their life cycle. Those actions have improved the availability and quality of estuarine and nearshore habitats, floodplain connectivity, channel structure and complexity, riparian areas and large wood recruitment, stream substrates, stream flow, water quality, and fish passage. In this way, the goal of ESA-species recovery has become institutionalized as a common and accepted part of the State's economic and environmental culture. We expect this trend to continue into the future as awareness of environmental and at-risk species issues increases among the general public.

[26] http://quickfacts.census.gov/qfd/states/16000.html, accessed December 18, 2012.

It is not possible to predict the future intensity of specific non-Federal actions related to resource-based industries at this program scale due to uncertainties about the economy, funding levels for restoration actions, and individual investment decisions. However, the adverse effects of resource-based industries in the action area are likely to continue in the future, although their net adverse effect is likely to decline slowly as beneficial effects spread from the adoption of industry-wide standards for more protective management practices. These effects, both negative and positive, will be expressed most strongly in rural areas where these industries occur, and therefore somewhat in contrast to human population density. The future effects of river restoration are also unpredictable for the same reasons, but their net beneficial effects may grow with the increased sophistication and size of projects completed and the additive effects of completing multiple projects in some watersheds.

In summary, resource-based activities such as timber harvest, agriculture, mining, shipping, and energy development are likely to continue to exert an influence on the quality of freshwater and estuarine habitat in the action area. The intensity of this influence is difficult to predict and is dependent on many social and economic factors. However, the adoption of industry-wide standards to reduce environmental impacts and the shift away from resource extraction to a mixed manufacturing and technology based economy should result in a gradual decrease in influence over time. In contrast, the populations of Oregon, Washington and Idaho are expected to increase in the next several decades with a corresponding increase in natural resource consumption. Additional residential and commercial development and a general increase in human activities are expected to cause localized degradation of freshwater and estuarine habitat. Interest in restoration activities is also increasing as is environmental awareness among the public. This will lead to localized improvements to freshwater and estuarine habitat. When these influences are considered collectively, we expect trends in habitat quality to remain flat or improve gradually over time. This will, at best, have positive influence on population abundance and productivity for the species affected by this consultation. In a worst cases scenario, we expect cumulative effects would have a relatively neutral effect on population abundance trends. Similarly, we expect the quality and function of critical habitat PCEs or physical and biological features to express a slightly positive to neutral trend over time as a result of the cumulative effects.

2.6 Integration and Synthesis

The Integration and Synthesis section is the final step of NMFS' assessment of the risk posed to species and critical habitat as a result of implementing the proposed action. In this section, we add the effects of the action (Section 2.4) to the environmental baseline (Section 2.3) and the cumulative effects (Section 2.5) to formulate the agency's biological opinion as to whether the proposed action is likely to: (1) Result in appreciable reductions in the likelihood of both survival and recovery of the species in the wild by reducing its numbers, reproduction, or distribution; or (2) reduce the value of designated or proposed critical habitat for the conservation of the species. These assessments are made in full consideration of the status of the species and critical habitat (Section 2.2).

Within the action area, many stream, estuarine and riparian areas have been degraded by the effects of land and water use, including road construction, forest management, agriculture, mining, urbanization, and water development. Dams and reservoirs, within the currently accessible migratory corridor, have altered the river environment and affected fish passage. The operation of water storage projects has altered the natural hydrograph of many rivers. Water impoundment and dam operations affect downstream water quality characteristics. Salmon and steelhead are exposed to high rates of natural predation during all life stages from fish, birds, and marine mammals, including harbor seals, sea lions, and killer whales. Avian and introduced fish predation on salmonids has been exacerbated by environmental changes associated with river developments. The Corps, Bonneville Power Administration, and Bureau of Reclamation have also consulted on large water management actions, such as operation of the Federal Columbia River Power System, the Umatilla Basin Project, the Willamette River Project and the Deschutes Project. The U.S. Forest Service and U.S. Bureau of Land Management consult on Federal land management throughout Oregon, including restoration actions, forest management, livestock grazing, and special use permits. Impacts to the environmental baseline from these previous actions vary from short-term adverse effects to long-term beneficial effects.

Considered in the context of this baseline, and as described above, the aggregated biological effects of all projects undertaken pursuant to the HIP III program will have a measurable effect on listed fish population abundance or productivity. The HIP III projects will have minor, short-term negative effects as a result of implementing the projects, but the long-term quality and function of critical habitat will be enhanced. The conservation measures and design criteria proposed by BPA ensure that these effects remain minor, and are scheduled to occur at times that are least sensitive to salmon and steelhead life cycles.

SR sockeye salmon are at critically low abundance levels, but no take or direct effects will occur for this species. The other listed species, although currently well below historic levels, are distributed widely enough and are presently at high enough abundance levels that any short-term adverse effects resulting from the habitat improvement projects will not have an observable effect on population abundance or productivity. Long-term beneficial effects from improving habitat conditions will result in increased population productivity and abundance. Spatial structure of salmon and steelhead populations will improve as a result of the proposed habitat improvement actions. The actions that will provide the most positive benefit to VSP parameters are the fish passage improvement projects.

The condition of critical habitat in the action area for species addressed in the consultation varies, but for the most part at least one physical or biological feature of critical habitat is likely to be degraded at sites where projects authorized under HIP III are likely to occur. The conservation value of critical habitat (identified at the watershed scale) also varies from high to low, but for the purposes of our analysis we assume that conservation value is high at all sites where projects may be authorized under HIP III. The conservation role of critical habitat within the action area is either to support successful migration of juvenile and adult life stages or to support successful spawning and rearing.

Considered in the context of this baseline, and as described in our effects analysis, implementation of the HIP III program will cause short-term degradation of some critical habitat physical and biological features such as water quality and fish passage. We expect all of these short-term effects to be minor and transient. The physical and biological features of critical habitat will fully and quickly recover from these minor disturbances. The short-term effects will not appreciably impair the ability of this critical habitat to serve its intended conservation role.

Some projects carried out under this program will also cause longer-term beneficial effects on critical habitat physical and biological features. These effects will persist for decades or longer. The conservation value of critical habitat will increase as a result of the actions implemented under this opinion.

The effects of the action must be taken together with the cumulative effects. As mentioned above, population growth in Oregon, Washington and Idaho will continue resulting in future private and state actions commensurate with population increases. Some of these actions will have a Federal nexus and be subject to ESA consultation. Those not subject to ESA consultation could result in some adverse effects to listed fish, and their habitat, dependent on the caliber and extent of local and state oversight. Some restoration activities ongoing throughout the state will result in benefits to listed fish. Those activities that result in negative effects will impact abundance, productivity, and spatial structure of fish at the population scale, and result in some degradation of the condition of critical habitat PCEs.

Our conclusions for all species addressed by this opinion are based on these, as well as the following considerations: (1) Individual review is required of medium and high-risk projects that will be covered by HIP III to ensure that its effects, combined with the aggregated effects of other HIP III projects, fall within the range of actions analyzed in this opinion and meet the intended purpose of HIP III, that interrelated and interdependent effects are evaluated, and that each applicable conservation measure is included as a project element or an enforceable condition of the permit document; (2) taken together, the conservation measures applied to each project 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 scheduled to occur at times that are least sensitive for the species' lifecycle; (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; and (4) the frequency of the disturbance will be limited to a single event or a few projects within the same watershed and thus there is not expected to be any significant aggregate or synergistic impact of the construction-related impacts of project implementation; and (5) the individual and combined effects of all actions permitted in this way, when taken together with cumulative effects, are not expected to impair currently properly functioning habitats, or appreciably reduce the functioning of already impaired habitats (and, in fact, should improve ecological functions in habitat within or downstream of proposed projects). The effects of program implementation should enhance the long-term progress of impaired habitats toward proper functioning condition essential to the long-term survival and recovery at the population, ESU, or DPS scale.

2.7 Conclusion

After reviewing the current status of the listed species, the environmental baseline within the action area, the effects of the proposed action, and cumulative effects, it is NMFS' biological opinion that the proposed action is not likely to jeopardize the continued existence of the following 17 species considered in this opinion, or result in the destruction or adverse modification of their designated or proposed critical habitat:

- Lower Columbia River Chinook salmon
- Upper Willamette River spring-run Chinook salmon
- Upper Columbia River spring-run Chinook salmon
- Snake River spring/summer-run Chinook salmon
- Snake River fall-run Chinook salmon
- Columbia River chum salmon
- Lower Columbia River coho salmon (critical habitat proposed)
- Oregon Coast coho salmon
- Southern Oregon/Northern California coasts coho salmon
- Snake River sockeye salmon
- Lower Columbia River steelhead
- Upper Willamette River steelhead
- Middle Columbia River steelhead
- Upper Columbia River steelhead
- Snake River Basin steelhead

We also conclude that the proposed action will not adversely modify critical habitat proposed for LCR coho salmon. The BPA may ask NMFS to adopt the conference opinion as a biological opinion when critical habitat for LCR coho salmon [or PS steelhead] is designated. The request must be in writing. If we review the proposed action and find there have been no significant changes to the action that would alter the contents of the opinion and no significant new information has been developed (including during the rulemaking process), we may adopt the conference opinion as the biological opinion on the proposed action and no further consultation will be necessary.

2.8. Incidental Take Statement

Section 9 of the ESA and Federal regulation pursuant to section 4(d) of the ESA prohibit the take of endangered and threatened species, respectively, without a special exemption. Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. Harm is further defined by regulation to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering. Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. For purposes of this consultation, we interpret "harass" to mean an intentional or negligent action that has the potential to injure an animal or disrupt its normal behaviors to a point where such behaviors are abandoned or significantly altered.[27] Section 7(b)(4) and Section 7(o)(2) provide that taking that is incidental to an otherwise lawful agency action is not considered to be prohibited taking under the ESA, if that action is performed in compliance with the terms and conditions of this incidental take statement.

2.8.1 Amount or Extent of Take

Constructing or maintaining barriers which eliminate or impede a listed species' access to habitat or ability to migrate, and any water withdrawal or other alteration of streamflow when it significantly impairs spawning, migration, feeding, or other essential behavioral pattern, is a habitat-modifying activity that may harm listed species and therefore may be considered a take under the ESA. However, NMFS does not consider any take that may be associated with existing passage impairments or withdrawals to be incidental to the proposed action and compliance with these terms and conditions will not remove the prohibition against any take that may occur due to those withdrawals or passage impairments.

The habitat that will be affected by the proposed action will not be limited at the site-specific or watershed scale. Nonetheless, the proposed action is likely to cause the injury or death of salmon and steelhead of the species considered in this Opinion as a result of:

1. Short-term impacts to water quality (*e.g*., suspended sediment, temperature, dissolved oxygen demand and contaminants).
2. Short-term impacts to water quality (e.g., due to application of chemical herbicides).
3. Short-term decreases in function of physical habitat features (*e.g*. floodplain connectivity, natural cover, riparian vegetation, instream flow, stream substrate, space, and safe passage conditions).
4. Juvenile fish handling and dewatering during work area isolation.

Juvenile life stages are most likely to be affected, although adults will sometimes also be present when in-water work windows do not exclude the entire adult migration period for all species.

Take caused by the habitat-related effects of this action cannot be accurately quantified as a number of fish because the distribution and abundance of fish that occur within an action area are affected by habitat quality, competition, predation, and the interaction of processes that influence genetic, population, and environmental characteristics. These biotic and environmental processes interact in ways that may be random or directional and operate across far broader temporal and spatial scales than will be affected by the proposed action. Thus, the distribution and abundance of fish within each action area cannot be predicted precisely based on existing habitat conditions, nor can NMFS precisely predict the number of fish that are reasonably certain to be harmed or harassed if their habitat is modified or degraded by the proposed action. In such circumstances,

[27] NMFS has not adopted a regulatory definition of harassment under the ESA. The World English Dictionary defines harass as "to trouble, torment, or confuse by continual persistent attacks, questions, etc." The U.S. Fish and Wildlife Service defines "harass" in its regulations as "an intentional or negligent act or omission which creates the likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt normal behavioral patterns which include, but are not limited to, breeding, feeding, or sheltering (50 CFR 17.3). The interpretation we adopt in this consultation is consistent with our understanding of the dictionary definition of harass and is consistent with the Service's interpretation of the term.

NMFS uses the causal link established between the activity and the likely changes in habitat conditions affecting the listed species to describe the extent of take as a numerical level of habitat disturbance.

Short-term impacts to water quality (suspended sediment, temperature, etc.) and physical habitat features. Here, the best available indicators for the extent of incidental take associated with short-term impacts to water quality and physical habitat features are as follows:

1. The total length of stream reach that will be modified by construction each year.
2. The visible increase in suspended sediment associated with construction activities.

These variables are proportional to the amounts of harm and harassment that the proposed action is likely to cause through degradation of water quality or physical habitat. Suspended sediment is proportional to the water quality impairment that the proposed action will cause, including increased sediment, temperature, and contaminants, and reduced dissolved oxygen. Stream length is proportional to the amount of habitat that will be physically altered, including natural cover, floodplain connectivity, riparian vegetation, forage and safe passage conditions.

NMFS assumes that up 150 projects per year may be funded or carried out under this opinion; many of these projects will involve multiple activity categories. At most, half of these projects will involve in-water work. The proposed action may be much localized (e.g., culvert replacement), or much larger in scope (e.g., channel reconstruction). Because we do not want to limit the scope of large, beneficial restoration projects, the extent of take is best identified by the maximum number of projects requiring near and in-water construction in any given year. Therefore, implementation of more than 90 (i.e., 15 projects more than the expected 75 projects per year with in-water work) projects per year that include near or in-water construction is a threshold for reinitiating consultation.

In addition, NMFS assumes that an increase in sediment will be visible in the immediate vicinity of construction associated with the proposed action as well as a distance downstream, and the distance that increased sediment will be visible is proportionate both to the size of the disturbance and to the width of the wetted stream as follows (see Rosetta 2005), and whether the area is subject to tidal or coastal scour. Therefore, a further threshold for reinitiating consultation is a visible increase in suspended sediment:

1. up to 50 feet from the project area in streams that are 30 feet wide or less;
2. up to 100 feet from the discharge point or nonpoint source of runoff for streams between 30 and 100 feet wide;
3. up to 200 feet from the discharge point or nonpoint source for streams greater than 100 feet wide; and
4. up to 300 feet from the discharge point or nonpoint source for areas subject to tidal or coastal scour.

If an exceedance of either the total linear stream feet limit occurs, the project sponsor must modify the activity and continue to monitor every two hours. If an exceedance over the background level continues after the second monitoring interval, the activity must stop until the turbidity levels return to background. Exceeding either the total linear stream feet limit or any of the suspended sediment limits at the second monitoring interval for more than two projects a year will trigger the reinitiation provisions of this opinion.

Short-term water quality impacts from chemical herbicide application. Application of chemical herbicides will result in short-term degradation of water quality which will cause injury to fish in the form of sublethal adverse physiological effects. This is particularly true for herbicide applications in riparian areas or in ditches that may deliver herbicides to stream occupied by listed salmonids. These sublethal effects, described fully in the effects analysis for this opinion, will include increased respiration, reduced feeding success, and subtle behavioral changes that can result in increased susceptibility to predation. The future abundance and distribution of listed fish in relation to the effects of herbicide applications within HIP III is indeterminate and so a specific number of individuals taken cannot be predicted. For herbicide application, the extent of take is best identified by the total number of riparian acres treated each year. The BPA shall reinitiate consultation if more than 1,000 total riparian acres are treated in a calendar year under this programmatic consultation.

Capture. Juvenile fish will be captured during work area isolation necessary to minimize construction-related disturbance of streambank and channel areas. Some of those fish will be injured or killed. It is possible to estimate a numeric amount of take.

Based on the type and number of projects funded under HIP II, NMFS assumes that of the 150 actions per year that are likely to be funded or carried out under this opinion: (a) At most 50% (*i.e.*, 75 actions per year) will require in-water work area isolation; (b) each action requiring in-water work area isolation is likely to result in the capture of l00 or fewer of the ESA-listed marine fish species considered in this opinion, and (c) of those, less than 5% are likely to be injured or killed, including by delayed mortality (McMichael *et al*. 1998), and the remainder are likely to survive with no long-term adverse effects. NMFS anticipates that up to 7,500 juvenile individuals of the fish species considered in the consultation will be captured, per year, and up to 375 juvenile individuals will be injured or killed, per year, (*i.e.*, 150 projects x 0.50 project with in-water work x 100 fish captured = 7,500 fish; and 7,500 fish x 0.05 rate of injury or death = 375) as a result of work necessary to isolate in-water construction areas. Because these fish are from different species that are similar to each other in appearance and life history, and to unlisted species that occupy the same area, it is not possible to assign this take to individual species. NMFS does not anticipate that any adult fish will be taken in this manner. Thus, the threshold for reinitiating consultation is 7,500 juveniles captured and 375 injured or killed per calendar year. For HIP II, 18% of the projects with in-water work were in the WLC recovery domain and 82% of the projects were in the IC recovery domain (projects in the OC recovery domain were not included in HIP II). BPA expects a similar trend in the location of projects being funded for HIP III, with only a few projects funded in the OC recovery domain. Therefore, the extent of take indicator for fish capture by recovery domain is as follows: for the WLC recovery domain, 1,200 juvenile fish captured and 60 injured or killed per calendar year; for the IC recovery domain, 5,925 juvenile fish captured with 296 fish injured or killed per calendar year; and for the OC recovery domain, 375 juvenile fish captured and 19 injured or killed per calendar year. Exceeding these limits will trigger the reinitiation provisions of this opinion.

2.8.2 Effect of the Take

In the accompanying biological opinion, NMFS determined that this level of anticipated take is not likely to result in jeopardy to the species.

2.8.3 Reasonable and Prudent Measures and Terms and Conditions

"Reasonable and prudent measures" are nondiscretionary measures to minimize the amount or extent of incidental take (50 CFR 402.02). "Terms and conditions" implement the reasonable and prudent measures (50 CFR 402.14). These terms and conditions must be implemented for the exemption in section 7(o)(2) to apply.

Reasonable and Prudent Measures

The following measures are necessary and appropriate to minimize the impact of incidental take of listed species from the proposed action.

The BPA shall:

1. Minimize incidental take due to funding of restoration projects through BPA by ensuring that all projects implement conservation measures described in the proposed action for project design and implementation, as appropriate.
2. Minimize incidental take due to funding of restoration projects through BPA by implementing the additional conservation measures provided below.
3. Ensure completion of a monitoring and reporting program to confirm that the take exemption for the proposed action is not exceeded, and that the terms and conditions in this incidental take statement are effective in minimizing incidental take.

Terms and Conditions

The measures described below are non-discretionary, and must be undertaken by BPA or, if an applicant is involved, must become binding conditions of any grant or funds issued to the applicant. The BPA has a continuing duty to regulate the activity covered by this incidental take statement. If BPA (1) fails to assume and implement the terms and conditions or (2) fails to require an applicant to adhere to the terms and conditions of the incidental take statement through enforceable terms that are added to the funding or grant document, the protective coverage of section 7(o)(2) will likely lapse.

1. To implement reasonable and prudent measure #1 (proposed conservation measures for project design and implementation), the BPA shall ensure that:

    a. Every action authorization or completed under this opinion will be administered by BPA consistent with conservation measures 1 through 6.
    b. For each action involving construction, conservation measures 7 through 9, plus all conservation measures listed in section 1.3.5 through 1.3.12 will be added as conditions of funding.

2. To implement reasonable and prudent measure #2 (additional conservation measures), the BPA shall ensure that:
    a. Activity category 1.d. (section 1.3.5), Low Flow Consolidation, will only be implemented if required to implement another restoration action funded through HIP III, and if that restoration action is designed to alleviate the need for low flow consolidation actions over the long term.
    b. Vehicle fords will only be allowed in intermittent streams with no anadromous fish spawning.
    c. Vegetable based hydraulic fluids will be used in any vehicle that will be operated near the water.
    d. Water drafting/pumping (for dust suppression or other needs) will be done in accordance with the following criteria: (A) Non-stream sources will be used prior to the use of stream sources whenever feasible; (B) when non-stream sources are unavailable, streams with the greatest flow will be used whenever feasible; (C) water withdrawal will not reduce stream flow by more than 1/10th (stream flow may be estimated visually). For pumps with adjustable pump rates, pumping rates will be adjusted to avoid drafting more than 1/10th of the current stream flow; (D) streams with less than 5 cfs are used for drafting, no more than 18,000 gallons will be removed in one day; (E) if streams with less than 5 cfs are used for drafting, no more than one pump will operate at one time at any one drafting site; (F) no water will be drafted from sites where adult salmonids are visibly present, to prevent interference with spawning activities; (G) no dams or channel alterations will be made for pumping in streams occupied by listed fish species.
    e. The adverse effects of increasing irrigation efficiency are addressed by only funding irrigation and water delivery/management actions (Category 7, section 1.3.11) that use state-approved regulatory mechanisms for ensuring that water savings will be protected as instream water rights, or when project implementers identify how the water conserved will remain instream to benefit fish without any significant loss of the instream flows to downstream diversions.
    f. The following additional measures will be applied to road maintenance activities (Category 5a, section 1.3.8):
        i. Waste material generated from road maintenance activities and slides will be disposed on if stable, nonfloodplain sites approved by a geotechnical engineer or other qualified personnel.
        ii. Disturbance of existing vegetation in ditches and at stream crossings will be minimized to the greatest extent possible.
        iii. Ditches and culverts will be promptly cleaned of materials resulting from slides or other debris.

iv. Dust-abatement 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. Petroleum-based products will not be used for dust abatement.

v. 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.

vi. Ditch back slopes will not be undercut, to avoid slope destabilization and erosion acceleration.

vii. When blading and shaping roads, excess material will not be sidecast onto the fill. All excess material that cannot be bladed into the surface will be hauled to an appropriate site. Haul and prohibition of sidecasting 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 or smaller) from slides, ditch maintenance, or blading may be worked into the road. Scattered clean rocks (1 inch or larger) may be raked or bladed off the road except within 300 feet of perennial or 100 feet of intermittent streams.

viii. Road grading material will not be sidecast along roads within ¼ mile of perennial streams and from roads onto fill slopes having a slope greater than 45%.

ix. Road maintenance will not be attempted when surface material is saturated with water and erosion problems could result.

x. Large woody (LW >9 m in length and >50 cm in diameter) present on roads will be moved intact to downslope of the road, subject to site-specific considerations. Movement down-slope will be subject to the guidance of a natural resource specialist with experience in fish biology.

xi. Unsurfaced roads that can directly contribute sediment to streams will be identified and closed during the wet season.

xii. Snowplowing will be performed in accordance with the following criteria: (A) No chemical additives such as salt or de-icing chemicals will be used in conjunction with snowplowing; (B) drainage holes will be placed in snow berms to provide drainage; (C) a minimum of two inches of snow will be left on gravel roads during plowing; paved roads may be scraped to the surface; (D) no gravel or surfacing material will be bladed off the road (E) no deliberate sidecasting of snow into or over drainage structures will be permitted; (F) plowing will not be allowed on gravel roads during thaw periods when the road is wet.

g. Provide stormwater management for any project that will: increase the contributing impervious area within the project area; construct new pavement that increases capacity or widens the road prism; construct pavement down to subgrade; rehabilitate or restore a bridge to repair structural or functional deficiencies that are too complicated to be corrected through normal maintenance, except for seismic retrofits that make a bridge more resistant to earthquake damage (e.g., external post-tensioning, supplementary dampening) but do not affect the bridge deck or drainage; replace a stream crossing; change stormwater conveyance Stormwater management is not required for the following pavement actions: minor repairs, patching, chip seal, grind/inlay, overlay or resurfacing (i.e., non-structural pavement preservation, a single lift or inlay).

Stormwater management consists of:

i. Water quality (pollution reduction) treatment for post-construction stormwater runoff from all contributing impervious area.
ii. Water quantity treatment
    a. Water quantity (flow) management for runoff from all contributing impervious area that will discharge into an intermittent or perennial water body in a watershed that is smaller than 100 mi^2, unless the outfall discharges directly into a lake, reservoir, or estuary.

    OR

    b. Water quantity (flow) management for runoff from all contributing impervious area that will discharge more than 0.5 cfs during the 2-year, 24-hour storm into an intermittent or perennial water body in a watershed smaller than 100 mi^2, unless the outfall discharges directly into a lake, reservoir, or estuary.

Stormwater management plans must:

iii. Explain how highway runoff from all contributing impervious area that is within or contiguous with the project area will be managed using site sketches, drawings, specifications, calculations, or other information commensurate with the scope of the action.
iv. Identify the pollutants of concern.
v. Identify all contributing and non-contributing impervious areas that are within and contiguous with the project area.
vi. Describe the BMPs that will be used to treat the identified pollutants of concern, and the proposed maintenance activities and schedule for the treatment facilities.
vii. Provide a justification for the capacity of the facilities provided based on the expected runoff volume, including, e.g., the design storm, BMP geometry, analyses of residence time, as appropriate.
viii. Include the name, email address, telephone number of a person responsible for designing the stormwater management facilities so that NMFS may contact that person if additional information is necessary.

All stormwater quality treatment practices and facilities must be designed to accept 50% of the cumulative rainfall from the 2-year, 24-hour storm for that site, except as follows: climate zone 4 – 67%; climate zone 5 – 75%; and climate zone 9 – 67%. (ESA-listed species considered in this opinion are unlikely to occur in

Zones 5 or 9.) A continuous rainfall/runoff model may be used instead of the above runoff depths to calculate water quality treatment depth.

Use low impact development practices to infiltrate or evaporate runoff to the maximum extent feasible. For runoff that cannot be infiltrated or evaporated and therefore will discharge into surface or subsurface waters, apply one or more of the following specific primary treatment practices, supplemented with appropriate soil amendments:

i. Bioretention cell
ii. Bioslope, also known as an "ecology embankment"
iii. Bioswale
iv. Constructed wetlands
v. Infiltration pond
vi. Media filter devices with demonstrated effectiveness
vii. Porous pavement, with no soil amendments and appropriate maintenance

All stormwater flow control treatment practices and facilities must be designed to maintain the frequency and duration of flows generated by storms within the following end-points:

viii. Lower discharge endpoint, by USGS flood frequency zone:
    1. Western Region = 42% of 2-year event
    2. Eastern Region
        a. Southeast, Northeast, North Central = 48% of 2-year event
        b. Eastern Cascade = 56% of 2-year event
ix. Upper discharge endpoint
    1. Entrenchment ratio <2.2 = 10-year event, 24-hour storm
    2. Entrenchment ratio >2.2 = bank overtopping event

When conveyance is necessary to discharge treated stormwater directly into surface water or a wetland, the following requirements apply:

x. Maintain natural drainage patterns.
xi. To the maximum extent feasible, ensure that water quality treatment for highway runoff from all contributing impervious area is completed before commingling with offsite runoff for conveyance.

h. Within 10 days of completing a capture and release as part of an action completed under the HIP III programmatic opinion the applicant or BPA must submit a complete a Salvage Reporting Form, or its equivalent, with the following information to NMFS at hip.nwr@noaa.gov.

3. To implement reasonable and prudent measure #3 (monitoring and reporting), the BPA shall ensure that:

   a. The BPA will provide an annual monitoring report to NMFS by April 1 each year that describes BPA's implementation of HIP III under the terms of this opinion. The report will include an assessment of overall program activity, a list of any actions which BPA funded or carried out using this opinion, and any other data or analyses that BPA deems necessary or helpful to assess habitat trends as a result of actions funded or carried out under this opinion.[28]
   b. The BPA will host an annual meeting with NMFS by April 15 of each year to discuss the annual monitoring report and any actions that will improve conservation under this opinion, or make the program more efficient or more accountable.

2.9. Conservation Recommendations

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. Specifically, conservation recommendations are suggestions regarding 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). The following conservation recommendation is a discretionary measure that NMFS believes is consistent with this obligation and therefore should be carried out by the Federal action agency:

1. NMFS strongly encourages the BPA to use recovery plans and related recovery implementation plans and priorities as a primary consideration when planning, funding, and implementing habitat improvement projects.

2. Advise applicants for irrigation and water delivery/management actions that compliance with terms and conditions in the incidental take statement issued with this biological opinion does not remove the prohibition against take that may result from impairing fish passage or withdrawing water during times or in a way that will significantly impair essential salmon or steelhead behavior patterns.

3. Encourage applicants for irrigation and water delivery/management actions to work with appropriate agencies to identify and protect minimum instream flows in streams where flow is identified as a factor limiting the recovery of species considered in this biological opinion.

Please notify NMFS if BPA carries out any of this recommendation so that we will be kept informed of actions that are intended to improve the conservation of listed species or their designated critical habitats.

[28] This report should also include all the monitoring data that is relevant to take, i.e. number of fish injured or killed in connection with juvenile capture.

2.10 Reinitiation of Consultation

As provided in 50 CFR 402.16, reinitiation of formal consultation is required where discretionary Federal action agency involvement or control over the action has been retained, or is authorized by law, and if: (1) The amount or extent of incidental take is exceeded; (2) new information reveals effects of the agency action on listed species or designated critical habitat in a manner or to an extent not considered in this opinion; (3) the agency action is subsequently modified in a manner that causes an effect on the listed species or critical habitat not considered in this opinion; or (4) a new species is listed or critical habitat designated that may be affected by the action.

2.11 "Not Likely to Adversely Affect" Determinations

Green Sturgeon. Two DPSs have been defined for green sturgeon: a northern DPS (spawning populations in the Klamath and Rogue rivers) and a southern DPS (spawners in the Sacramento River). The southern DPS of green sturgeon were listed as threatened in 2006, and includes all naturally-spawned populations of green sturgeon that occur south of the Eel River in Humboldt County, California. When not spawning, this anadromous species is broadly distributed in nearshore marine areas from Mexico to the Bering Sea. Although it is commonly observed in bays, estuaries, and sometimes the deep riverine mainstem in lower elevation reaches of non-natal rivers along the west coast of North America, the distribution and timing of estuarine use are poorly understood. Within the action area, southern green sturgeon occur in the WLC recovery domain and the OC recovery domain.

The principal factor for the decline of southern green sturgeon is the reduction of its spawning area to a single known population limited to a small portion of the Sacramento River. It is currently at risk of extinction primarily because of human-induced ''takes'' involving elimination of freshwater spawning habitat, degradation of freshwater and estuarine habitat quality, water diversions, fishing, and other causes (USDC 2010). Adequate water flow and temperature are issues of concern. Water diversions pose an unknown but potentially serious threat within the Sacramento and Feather Rivers and the Sacramento River Delta. Poaching also poses an unknown but potentially serious threat because of high demand for sturgeon caviar. The effects of contaminants and nonnative species are also unknown but potentially serious threats. Retention of green sturgeon in both recreational and commercial fisheries is now prohibited within the western states, but the effect of capture/release in these fisheries is unknown. There is evidence of fish being retained illegally, although the magnitude of this activity likely is small (NOAA Fisheries 2011). Climate change, as described in Section 2.2, is likely to reduce the conservation value of designated critical habitats in the Pacific Northwest.

Critical habitat was designated in 2009, and the designation includes coastal U.S. marine waters within 60 fathoms depth from Monterey Bay, California (including Monterey Bay), north to Cape Flattery, Washington. Within the action area, this includes Lower Columbia River estuary and certain coastal bays and estuaries in Oregon (Coos Bay, Winchester Bay, Yaquina Bay, and Nehalem Bay), and Washington (Willapa Bay and Grays Harbor) (USDC 2009). Table 27 delineates PCEs for southern DPS green sturgeon.

Table 27. PCEs of critical habitat for southern green sturgeon and corresponding species life history events.

Primary Constituent Elements		Species Life History Event
Site Type	**Site Attribute**	
Freshwater riverine system	Food resources Migratory corridor Sediment quality Substrate type or size Water depth Water flow Water quality	Adult spawning Embryo incubation, growth and development Larval emergence, growth and development Juvenile metamorphosis, growth and development
Estuarine areas	Food resources Migratory corridor Sediment quality Water flow Water depth Water quality	Juvenile growth, development, seaward migration Subadult growth, development, seasonal holding, and movement between estuarine and marine areas Adult growth, development, seasonal holding, movements between estuarine and marine areas, upstream spawning movement, and seaward post-spawning movement
Coastal marine areas	Food resources Migratory corridor Water quality	Subadult growth and development, movement between estuarine and marine areas, and migration between marine areas Adult sexual maturation, growth and development, movements between estuarine and marine areas, migration between marine areas, and spawning migration

In the case of southern green sturgeon, subadult and adult individuals enter the action area for non-breeding, non-rearing purposes. Impacts from construction to green sturgeon are the same as those described above for salmonids. Because of their age, location, and life history, these individuals are relatively distant from, and insensitive to, the effects of a majority of the actions described above, and those effects are unrelated to the principal factor for the decline of this species, *i.e.*, the reduction of its spawning area in the Sacramento River. Adult and subadult green sturgeon are likely to be far less sensitive to turbidity and suspended solids than salmonids, and will not be present in the tributaries where the vast majority of the activities will occur. The NMFS is also reasonably certain elevated suspended sediment concentrations will result in insignificant behavioral and physical response due to the higher tolerance of green sturgeon, which usually inhabit much more turbid environments than do salmonids.

NMFS does not expect green sturgeon to be present in the vicinity of most of the actions. Information from fisheries-dependent sampling suggests that green sturgeon only occupy large estuaries during the summer and early fall, and would not be present during the in-water work period (Moser and Lindley 2007). A majority of the restoration projects funded by BPA through HIP III will occur in the upper reaches and tributaries of the larger rivers, or in riparian and wetland areas along the water's edge for estuarine and coastal areas; green sturgeon congregate in deeper mid-channel areas.

NMFS believes that it is unlikely that green sturgeon will be encountered during work area isolation and fish salvage for implementation of HIP III projects based on: 1) monitoring information from previous fish salvage operations associated with HIP I and HIP II projects; 2) the large size of subadult and adult southern green sturgeon; and 3) the type and location of projects typically funded.

Effects to green sturgeon will primarily result from impacts associated with general disturbance related to in-water construction. Green sturgeon are unlikely to occur in the vicinity of any projects implemented under HIP III, and are accustomed to the level of background activity associated with the proposed action. NMFS does not expect impacts to accrue from the other activities considered in this opinion.

Based on this analysis, NMFS finds that the effects of the proposed action are expected to be insignificant and/or discountable, and thus are not likely to adversely affect the southern DPS of green sturgeon and their critical habitat.

Eulachon. Two of the four recovery domains of the southern DPS of eulachon occur in the action area:, WLC and OC. The ESA-listed population of eulachon includes all naturally-spawned populations that occur in rivers south of the Nass River in British Columbia to the Mad River in California. Core populations for this species include the Fraser River, Columbia River and (historically) the Klamath River. Eulachon leave saltwater to spawn in their natal streams late winter through early summer, and typically spawn at night in the lower reaches of larger rivers fed by snowmelt. After hatching, larvae are carried downstream and widely dispersed by estuarine and ocean currents. Eulachon movements in the ocean are poorly known although the amount of eulachon bycatch in the pink shrimp fishery seems to indicate that the distribution of these organisms overlap in the ocean.

In the early 1990s, there was an abrupt decline in the abundance of eulachon returning to the Columbia River with no evidence of returning to their former population levels since then (Drake *et al*. 2008). Persistent low returns and landings of eulachon in the Columbia River from 1993 to 2000 prompted the states of Oregon and Washington to adopt a Joint State Eulachon Management Plan in 2001 that provides for restricted harvest management when parental run strength, juvenile production, and ocean productivity forecast a poor return (WDFW and ODFW 2001). Despite a brief period of improved returns in 2001–2003, the returns and associated commercial landings have again declined to the very low levels observed in the mid-1990s (JCRMS 2010), and since 2005, the fishery has operated at the most conservative level allowed in the management plan (JCRMS 2010). Large commercial and recreational fisheries have occurred in the Sandy River in the past. The most recent commercial harvest in the Sandy River was in 2003. No commercial harvest has been recorded for the Grays River from 1990 to the present, but larval sampling has confirmed successful spawning in recent years (USDC 2011).

The primary factors responsible for the decline of the southern DPS of eulachon are changes in ocean conditions due to climate change (Gustafson *et al.* 2010, Gustafson *et al*. 2011), particularly in the southern portion of its range where ocean warming trends may be the most pronounced and may alter prey, spawning, and rearing success. Additional factors include climate-induced change to freshwater habitats, dams and water diversions (particularly in the

Columbia and Klamath Rivers where hydropower generation and flood control are major activities), and bycatch of eulachon in commercial fisheries (NOAA Fisheries 2011a). Other limiting factors include adverse effects related to dams and water diversions, artificial fish passage barriers, increased water temperatures, insufficient streamflow, altered sediment balances, water pollution, over-harvest, and predation (Gustafson *et al.* 2010, Gustafson *et al*. 2011). The viability of this species is still under assessment.

Critical habitat was designated for eulachon on October 20, 2011 (76 FR 65324).Critical habitat for eulachon includes portions of 16 rivers and streams in California, Oregon, and Washington. All of these areas are designated as migration and spawning habitat for this species. In Oregon, 24.2 miles of the lower Umpqua River, 12.4 miles of the lower Sandy River, and 0.2 miles of Tenmile Creek have been designated. The mainstem Columbia River from the mouth to the base of Bonneville Dam, a distance of 143.2 miles is also designated as critical habitat. The lateral extent of critical habitat is defined by the USACE in 33 CFR 329.11. The PCEs for eulachon critical habitat is provided in Table 28.

The physical or biological features of freshwater spawning and incubation sites, include water flow, quality and temperature conditions and suitable substrate for spawning and incubation, as well as migratory access for adults and juveniles. These features are essential to conservation because without them the species cannot successfully spawn and produce offspring. The physical or biological features of freshwater migration corridors associated with spawning and incubation sites include water flow, quality and temperature conditions supporting larval and adult mobility, abundant prey items supporting larval feeding after the yolk sac is depleted, and free passage (no obstructions) for adults and juveniles. These features are essential to conservation because they allow adult fish to swim upstream to reach spawning areas and they allow larval fish to proceed downstream and reach the ocean.

Table 28. Primary constituent elements of critical habitats designated for eulachon and corresponding species life history events.

Primary Constituent Elements		Species Life History Event
Site Type	**Site Attribute**	
Freshwater spawning and incubation	Flow, Water quality Water temperature Substrate	Adult spawning Incubation
Freshwater migration	Flow, Water quality Water temperature, Food	Adult and larval mobility Larval feeding
Nearshore and offshore marine areas	Food Water quality	Adult and juvenile growth, survival and maturation

Eulachon are also limited to a relatively few subtidal and intertidal areas and the mainstem Columbia River below Bonneville Dam, but they return to those areas with a presumed fidelity that indicates close association between a particular stock and its spawning environment (Gustafson *et al.* 2008). Moreover, eulachon face numerous potential threats throughout every stage of their life cycle, although the severity of shoreline construction effects and water quality, the most significant effects described above, have been ranked as "very low" and "low," respectively (Gustafson *et al.* 2008). The habitat improvements will improve ecosystem functions, and these improvements may benefit eulachon as well through greater habitat complexity and enhanced feeding opportunities.

Eulachon are likely to be temporally and spatially distant from where restoration activities and their construction-related effects will take place. Eulachon adult migrations in the Columbia River system usually begin in December, peak in February, and continue through May (WDFW and ODFW 2001). Adult eulachon runs are likely to proceed directly to spawning areas and use the Lower Columbia River as a migration corridor. These adult migrations occur through deeper waters in the mid-channel, as that is the most direct route to spawning areas in the lower reaches of tidally influenced larger rivers such as the Cowlitz, Grays, Elochoman, Kalama, Lewis and Sandy rivers. A majority of the restoration projects funded by BPA through HIP III will occur in the upper reaches and tributaries of these larger rivers, and will not be near the eulachon spawning areas.

However, improvement of habitat conditions in the estuary is a priority in the FCRPS opinion; it is likely that several restoration projects will be proposed in the lower reaches of rivers where eulachon may spawn. Restoration projects will not result in any significant impairment of migration corridors for eulachon. As well, work window restrictions will limit impacts to this species, and the proposed action is not expected to result in any measurable population level effects for Pacific eulachon.

Based on monitoring information from previous fish salvage operations associated with HIP I and HIP II projects, NMFS believes that it is unlikely that eulachon will be encountered during work area isolation and fish salvage for implementation of HIP III projects because of the type and location of projects typically funded.

Effects to eulachon will primarily result from impacts associated with general disturbance related to in-water construction. Eulachon are unlikely to occur in the vicinity of any projects implemented under HIP III, and are accustomed to the level of background activity associated with the proposed action. NMFS does not expect impacts to accrue from the other activities considered in this opinion.

Based on this analysis, NMFS finds that the effects of the proposed action are expected to be insignificant and/or discountable, and thus are not likely to adversely affect the southern DPS of eulachon.

Steller Sea Lion. The eastern DPS of the Steller sea lion ranges from southeast Alaska south through California with an abundance estimated between 45,000 and 51,000 animals, an increase of 3% per year for 30 years. The northern portion of the Steller sea lion's range, Southeast Alaska and British Columbia, account for 82% of total pup production while the southern and central California portion has experienced large declines (-90%). In Oregon, the total number of non-pup sea lions at the two rookeries (Rogue Reef and Orford Reef) and eight haulout sites has increased from 1,461 in 1977 to 4,169 in 2002, an annual rate of increase of 3.7%. As of 2002, the Oregon Steller sea lion abundance is approximately 5,000 animals (NMFS 2006b). Because of the current abundance of Steller sea lions and population increase over the last 30 years, current threats to recovery have not been identified. However, there are concerns regarding global climate change and the potential for the southern California range of sea lions to be adversely affected. The May 2006 draft of the Steller Sea Lion Recovery Plan suggests initiating a status review for the eastern DPS for consideration of removing it from the federal List of Endangered Wildlife and Plants (NMFS 2006b).

Steller sea lions spend most of their time at sea feeding on a variety of fish species. The Steller sea lion is not known to migrate, but they disperse widely outside the breeding season (late May to early July) (Angliss & Outlaw 2005). Primary terrestrial habitats include remote islands, rocks, reefs, and beaches, often in areas exposed to wind and waves, where access by terrestrial predators is limited (NMFS 1992). Females appear to select birthing areas (known as rookeries) that are gently sloping and protected from waves; they will frequently return to the same pupping site in successive years. Pups normally stay on land for about two weeks (NMFS 1992), then spend an increasing amount of time in waters adjacent to rookeries, as will post-parturient females whose foraging range (usually in shallow waters within 20 nautical miles of the rookery) is restricted by the need to return to the rookery to nurse pups (58 FR 45269).

In addition to rookeries, haulouts are essential habitat for Steller sea lions. In Oregon, Steller sea lions may be found hauled out at Astoria East Mooring Basin and at the end of the South Jetty of the Columbia River, and also at Tillamook Rock, Three Arch Rocks, Cascade Head, Seal Rock, Sea Lion Caves, Cape Arago, Rogue Reef, Blacklock Point, Blanco Reef, Orford Reef, and Mack Reef. These haulouts can be used any time of the year. In addition, Steller sea lions have been observed foraging up to 8 miles upriver on the Rogue River during the spring and fall Chinook salmon runs. Small numbers of Steller sea lions may be found in the lower Rogue River at any time of the year since the largest rookery in the State is located just 2 miles northwest of the river mouth. Steller sea lions have also been observed foraging in the Columbia River as far upriver as Bonneville Dam (RM 146), primarily during the fall and spring salmon migration periods and during the winter smelt run. In Oregon, Steller sea lions may be found at any of the above-listed rookeries, haulout areas, or river mouths at any time of year; however, most occurrences in Oregon are during June and July, which corresponds with the Steller sea lion's reproduction period.

The Columbia River south jetty is used only as a haulout site with no known reproductive activity occurring there. Use has been observed only at the far west end of the jetty. Use can occur anytime of the year with the lowest abundance (approximately 200 to 300 individuals) from April through October. In winter, Steller sea lion abundance on the south jetty may be as high as 1,500 animals.

Critical habitat for the Steller sea lion was designated on September 27, 1993 and includes (in Oregon and the Columbia River Basin) an air and aquatic zone that extends 3,000 feet from any historically occupied sea lion rookery (58 FR 45269). In Oregon, the major rookeries designated as critical habitat are the Rogue Reef Pyramid Rock Site, the Orford Reef Long Brown Rock Site, and the Seal Rock Site (58 FR 45269). Not all known Steller sea lion locations in Oregon have been designated as critical habitat. The Three Arch National Wildlife Refuge in Tillamook County has a smaller, less successful rookery that is not designated, but is protected by a 500-foot buffer enforced by the Oregon Marine Board. Haulouts in Oregon are not included in critical habitat designation (58 FR 45269). For regulatory purposes, rookeries and haulout boundaries are defined as the mean lower-water mark (58 FR 45269).

Effects to Steller sea lions will primarily result from impacts associated with general disturbance related to in-water construction. Steller sea lions are accustomed to this level of background activity. Projects will not involve pile driving, or other activities causing percussive sounds. NMFS does not expect impacts to accrue from the other activities considered in this opinion.

Based on this analysis, NMFS finds that the effects of the proposed action are expected to be insignificant and/or discountable, and thus are not likely to adversely affect Steller sea lions.

3. MAGNUSON-STEVENS FISHERY CONSERVATION AND MANAGEMENT ACT

The consultation requirement of section 305(b) of the MSA directs Federal agencies to consult with NMFS on all actions or proposed actions that may adversely affect EFH. The MSA (section 3) defines EFH as "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity. Adverse effects include the direct or indirect physical, chemical, or biological alterations of the waters or substrate and loss of, or injury to, benthic organisms, prey species and their habitat, and other ecosystem components, if such modifications reduce the quality or quantity of EFH. Adverse effects on EFH may result from actions occurring within EFH or outside EFH, and may include site-specific or EFH-wide impacts, including individual, cumulative, or synergistic consequences of actions (50 CFR 600.810). Section 305(b) also requires NMFS to recommend measures that can be taken by the action agency to conserve EFH.

This analysis is based, in part, on the EFH assessment provided by the Federal action agency and descriptions of EFH contained in the fishery management plans developed by the Pacific Fishery Management Council (PFMC) and approved by the Secretary of Commerce for coastal pelagic species (PFMC 1998), Pacific Coast groundfish (PFMC 2005), or Pacific Coast salmon (1999)

3.1 Essential Fish Habitat Affected by the Project

The proposed action will affect EFH designated for coastal pelagic species, Pacific Coast groundfish, and Pacific Coast salmon, including estuaries designated as habitats areas of particular concern (HAPCs).

3.2 Adverse Effects on Essential Fish Habitat

While the proposed action may result in various short-term adverse effects to essential fish habitat in the action area, the net effect is expected to be a long-term improvement to habitat across the landscape as a result of local actions to improve ecological function. The short-term adverse effects identified in the biologiocal opinion include the following:

- Preconstruction surveys may remove vegetation that will reduce or eliminate habitat, and increase turbidity.
- Construction activities may result in increased turbidity, contaminant release from fuel spills (short-term).
- Water quality may have an ephemeral reduction due to short-term construction needs, reduced riparian permeability, and increased riparian runoff; longer-term increase based on improved riparian function and floodplain connectivity.
- Water quality may be affected by a short-term increase in turbidity, dissolved oxygen demand, and temperature due to riparian and channel disturbance.
- Substrate may be affected by a short-term reduction due to increased compaction and sedimentation.
- Floodplain connectivity may have a short-term decrease due to increased compaction and riparian disturbance.
- Forage may have a short-term decrease due to riparian and channel disturbance, loss of benthos from shading and long-term maintenance due to replaced riparian function from mitigation.
- Natural cover may have a short-term decrease due to riparian and channel disturbance.
- Short-term reduction in salmon food sources as a result of herbicide treatments to control invasive plant species.

3.3 Essential Fish Habitat Conservation Recommendations

NMFS expects that full implementation of this EFH conservation recommendation would protect EFH, by avoiding or minimizing the adverse effects described in Section 3.2 above.

1. The BPA should follow their proposed design criteria 1 to 6 as guidance for administration of the HIP III program.
2. The BPA should ensure that their proposed design criteria 7 through 9 (except 8(1) that is for fish capture and removal from in-water work area isolation sites), and proposed categorical design criteria described in sections 1.3.5 through 1.3.12, are included, as applicable, as enforceable conditions for any project funded through HIP III.
3. The BPA should ensure that the additional conservation measures provided in terms and conditions 2.a. through 2.g., from section 2.8.3 of the biological opinion, are are included, as applicable, as enforceable conditions for any project funded through HIP III.

3.4 Statutory Response Requirement

As required by section 305(b)(4)(B) of the MSA, the Federal action agency must provide a detailed response in writing to NMFS within 30 days after receiving an EFH conservation recommendation from NMFS. Such a response must be provided at least 10 days prior to final approval of the action if the response is inconsistent with any of NMFS' EFH conservation recommendations, unless NMFS and the Federal action agency have agreed to use alternative time frames for the Federal action agency response. 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 NMFS' conservation recommendations, the Federal action agency must explain its reasons for not following the recommendations, including the scientific justification for any disagreements with NMFS over the anticipated effects of the action and the measures needed to avoid, minimize, mitigate, or offset such effects, 50 CFR 600.920(k)(1).

In response to increased oversight of overall EFH program effectiveness by the Office of Management and Budget, NMFS established a quarterly reporting requirement to determine how many conservation recommendations are provided as part of each EFH response and how many are adopted by the action agency. Therefore, we ask that in your statutory reply to the EFH portion of this consultation, you clearly identify the number of conservation recommendations accepted.

3.5 Supplemental Consultation

The (Federal action agency) must reinitiate EFH consultation with NMFS if the proposed action is substantially revised in a way that may adversely affect EFH, or if new information becomes available that affects the basis for NMFS' EFH conservation recommendations, 50 CFR 600.920(l).

4. DATA QUALITY ACT DOCUMENTATION AND PRE-DISSEMINATION REVIEW

Section 515 of the Treasury and General Government Appropriations Act of 2001 (Public Law 106-554) (Data Quality Act) specifies three components contributing to the quality of a document. They are utility, integrity, and objectivity. This section of the opinion addresses these Data Quality Act (DQA) components, documents compliance with the DQA, and certifies that this opinion has undergone pre-dissemination review.

4.1 Utility: Utility principally refers to ensuring that the information contained in this consultation is helpful, serviceable, and beneficial to the intended users. The intended users are BPA and applicants receiving BPA funding.

A copy was provided to BPA with directions to provide a copy applicants receiving BPA funding. This consultation will be posted on the NMFS Northwest Region website (http://www.nwr.noaa.gov). The format and naming adheres to conventional standards for style.

4.2 Integrity: This consultation was completed on a computer system managed by NMFS in accordance with relevant information technology security policies and standards set out in Appendix III, 'Security of Automated Information Resources,' Office of Management and Budget Circular A-130; the Computer Security Act; and the Government Information Security Reform Act.

4.3 Objectivity:

Information Product Category: Natural Resource Plan.

Standards: This consultation and supporting documents are clear, concise, complete, and unbiased; and were developed using commonly accepted scientific research methods. They adhere to published standards including the NMFS ESA Consultation Handbook, ESA Regulations, 50 CFR 402.01, *et seq*., and the MSA implementing regulations regarding EFH, 50 CFR 600.920(j).

Best Available Information: This consultation and supporting documents use the best available information, as referenced in the Literature Cited section. The analyses in this opinion/EFH response contain more background on information sources and quality.

Referencing: All supporting materials, information, data and analyses are properly referenced, consistent with standard scientific referencing style.

Review Process: This consultation was drafted by NMFS staff with training in ESA and MSA implementation, and reviewed in accordance with Northwest Region ESA quality control and assurance processes.

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