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.:
NWR-2013-9717

March 19, 2013

Shawn H. Zinszer, Chief
Regulatory Branch
U.S. Army Corps of Engineers, Portland District
P.O. Box 2946
Portland, Oregon 97208-2946

Joyce Casey, Chief
Environmental Resources Branch
Planning, Programs and Project Management Division
U.S. Army Corps of Engineers, Portland District
P.O. Box 2946
Portland, Oregon 97208-2946

Re: Endangered Species Act Section 7 Programmatic Conference and Biological Opinion and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Consultation for Revisions to Standard Local Operating Procedures for Endangered Species to Administer Stream Restoration and Fish Passage Improvement Actions Authorized or Carried Out by the U.S. Army Corps of Engineers in Oregon (SLOPES V Restoration).

Dear Mr. Zinszer and Ms. Casey:

The enclosed document contains a programmatic conference and biological opinion (opinion) prepared by the National Marine Fisheries Service (NMFS) pursuant to section 7(a)(2) of the Endangered Species Act (ESA) on the effects of implementing a proposed revision to the standard local operating procedures used by the U.S. Army Corps of Engineers, Portland District (Corps), to authorize or carry out stream restoration activities and fish passage improvement actions in Oregon (SLOPES V Restoration). This action is in accordance with the Corps' regulatory and civil works authorities under section 10 of the Rivers and Harbors Act of 1899, section 404 of the Clean Water Act of 1972, and sections 1135, 206, and 536 of the Water Resources Development Acts of 1986, 1996, and 2000, respectively. Actions covered in this opinion and conference report are modified from those analyzed in the biological opinion issued on February 25, 2008, as summarized in the consultation history section of the opinion.

During this consultation, NMFS concluded that the proposed action is not likely to adversely affect southern DPS green sturgeon *(Acipenser medirostris)*, Steller sea lion *(Eumetopias jubatus)*, and southern resident killer whales *(Orcinus orca)* and their designated critical habitat. Steller sea lions and southern resident killer whales do not have critical habitat designated in the program action area. NMFS also concluded that the proposed program is not likely to jeopardize the continued existence of the following 16 species, or result in the destruction or adverse modification of their proposed or designated critical habitats.

1. Lower Columbia River (LCR) Chinook salmon (*Oncorhynchus tshawytscha*)
2. Upper Willamette River (UWR) Chinook salmon
3. Upper Columbia River (UCR) spring-run Chinook salmon
4. Snake River (SR) spring/summer run Chinook salmon
5. SR fall-run Chinook salmon
6. Columbia River (CR) chum salmon (*O. keta*)
7. LCR coho salmon (*O. kisutch*)
8. Oregon Coast (OC) coho salmon
9. Southern Oregon/Northern California Coasts (SONCC) coho salmon
10. SR sockeye salmon (*O. nerka*)
11. LCR steelhead (*O. mykiss*)
12. UWR steelhead
13. MCR steelhead
14. UCR steelhead
15. Snake River Basin (SRB) steelhead
16. Southern distinct population segment eulachon (*Thaleichthys pacificus*)

As required by section 7 of the ESA, NMFS is providing an incidental take statement (ITS) with the opinion. The ITS describes reasonable and prudent measures NMFS considers necessary or appropriate to minimize the impact of incidental take associated with this program. The ITS also 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 the listed species considered in this opinion, except eulachon because NMFS has not yet promulgated an ESA section 4(d) rule prohibiting take of threatened eulachon. However, anticipating that such a rule may be issued in the future, we have included terms and conditions to minimize take of eulachon. These terms and conditions are identical to the terms and conditions required to minimize take of listed salmon and steelhead. Therefore, we expect the Corps would follow these terms and conditions regardless of whether take of eulachon is prohibited. The take exemption for eulachon will take effect on the effective date of any future 4(d) rule prohibiting take of eulachon.

This document also includes the results of our analysis of the program'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 four conservation recommendations to avoid, minimize, or otherwise offset potential adverse effects on EFH. These conservation recommendations are a subset of the ESA take statement's terms and conditions. Section 305(b)(4)(B) of the MSA 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 recommendations, the Corps must explain why the recommendations will not be followed, including the scientific justification for any disagreements over the effects of the program 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 consultation 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.

If you have any questions regarding this consultation, please contact Marc Liverman at 503-231-2336 or Ben Meyer at 503-230-5425, of my staff in the Oregon State Habitat Office.

Sincerely,

William W. Stelle, Jr.
Regional Administrator

cc: Natural Resources Conservation Service
Oregon Department of Fish and Wildlife
Oregon Department of Parks and Recreation
Oregon Department of State Lands
Oregon Watershed Enhancement Board

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

for

Revisions to Standard Local Operating Procedures for Endangered Species to Administer Stream Restoration and Fish Passage Improvement Activities Authorized or Carried Out by the U.S. Army Corps of Engineers in the Oregon (SLOPES V Restoration)

NMFS Consultation No.: NWR-2013-9717

Action Agency: U.S. Army Corps of Engineers,
Portland District, Operations and Regulatory Branches

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
Southern Oregon/Northern California coasts 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	No	No
Eulachon	T	Yes	No	No
Southern resident killer whale	T	No	No	N/A
Steller sea lion	T	No	No	N/A

*Critical habitat has been proposed for LCR coho salmon.

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 Issued: March 19, 2013

TABLE OF CONTENTS

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 National Marine Fisheries Service (NMFS) prepared the conference and biological opinion (opinion) and incidental take statement portions of this document 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.

We also completed an essential fish habitat (EFH) consultation, 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, incidental take statement, and EFH conservation recommendations are each in compliance with Data Quality Act (44 U.S.C. 3504(d)(1) *et seq.*) and they underwent pre-dissemination review.

The U.S. Army Corps of Engineers, Portland District (Corps), propose to revise the Standard Local Operating Procedures for Endangered Species (SLOPES). “SLOPES” refers to the process and criteria that the Corps uses to guide the administration of activities regulated under section 10 of the Rivers and Harbors Act of 1899 (RHA) and section 404 of the Clean Water Act of 1972 (CWA), or carried out by the Corps as part of civil works programs authorized by sections 1135, 206, and 536 of the Water Resources Development Acts of 1986, 1996, and 2000, respectively (WRDA), in areas occupied by ESA-listed salmon and steelhead or their designated critical habitats.

Section 10 of the RHA requires authorization from the Secretary of the Army for the creation of any structure, excavation, or fill within the limits defined for navigable waters of the U.S, if the structure or work will affect the course, location, or condition of the waterbody. The law applies to any dredging or disposal of dredged material, excavation, filling, channelization, or any other modification of a navigable water of the U.S., and applies to all structures, from the smallest floating dock to the largest commercial undertaking. It further includes, without limitation, any wharf, dolphin, weir, boom, breakwater, jetty, groin, bank stabilization, mooring structures (such as pilings), aerial or subaqueous power transmission lines, intake or outfall pipes, permanently moored floating vessel, tunnel, artificial canal, boat ramp, aids to navigation, and any other permanent or semi-permanent obstacle or obstruction.

Section 404 of the CWA requires authorization from the Secretary of the Army, acting through the Corps, for the discharge of dredged or fill material into all waters of the U.S., including adjacent wetlands. Discharges of fill material generally include, without limitation, any placement of fill that is necessary for construction of any type of structure, development, property protection, reclamation, or other work involving the discharge of fill or dredged material. A Corps permit is required whether the work is permanent or temporary. Examples of temporary discharges included dewatering of dredged material before final disposal, and temporary fills for access roadways, cofferdams, storage, and work areas.

Section 1135 of WRDA authorizes the Corps to modify the structure or operation of a Corps project to restore or improve environmental quality and ecosystem functions impaired by that project, provided that the modification does not conflict with the authorized project purposes. Section 206 of WRDA expands this authority to cover construction of projects for the restoration and protection of aquatic ecosystems unrelated to an existing Corps facility. Section 536 of WRDA authorizes studies and ecosystem restoration actions in the Lower Columbia River and Tillamook Bay. The Corps has environmental restoration programs in place, in Oregon, that are authorized by these authorities and are intended to restore habitat for ESA-listed salmon and steelhead.

Nearly all anadromous fish-bearing streams within the Corps' jurisdiction are occupied by ESA-listed salmon and steelhead and designated as EFH for Chinook salmon and coho salmon. Individual ESA and EFH consultation for permits within these streams results in a substantial workload for both the Corps and NMFS, often with little additional benefit to the species. Many of these activities are minor and repetitive in nature, and consultation on them has resulted in the imposition of similar conditions for regulatory approval.

1.2 Consultation History

Since March 21, 2001, the Portland District has used SLOPES, as described in a series of programmatic biological opinions[1,2,3,4] to guide its review of individual permit requests under section 10 of the RHA and section 404 of the CWA, including requests for authorization of activities under the Corp's nationwide permit 27 (NWP-27 "Aquatic Habitat Restoration,

[1] Programmatic Biological Opinion - 15 Categories of Activities Requiring Department of the Army Permits. (refer to:OSB2001-0016) (March 21, 2001); Programmatic Biological Opinion and Magnuson-Stevens Act Essential Fish Habitat Consultation for Standard Local Operating Procedures for Endangered Species (SLOPES) for Certain Activities Requiring Department of Army Permits in Oregon and the North Shore of the Columbia River (refer to OHB2001-0016-PEC) (June 14, 2002); Letter from D. Robert Lohn, NOAA Fisheries, to Lawrence Evans and Thomas Mueller, U.S. Army Corps of Engineers (August 14, 2002) (Amending Terms and Conditions for SLOPES, issued June 14, 2002).

[2] Programmatic Biological Opinion and Magnuson-Stevens Act Essential Fish Habitat Consultation for Standard Local Operating Procedures for Endangered Species (SLOPES II) for Certain Regulatory and Operations Activities Carried Out by the Department of Army Permits in Oregon and the North Shore of the Columbia River (refer to: 2003/00850) (July 8, 2003).

[3] Programmatic Biological Opinion and Conference Opinion and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Consultation for Revised Standard Local Operating Procedures for Endangered Species (SLOPES III) to Administer Certain Activities Authorized or Carried Out by the Department of the Army in the State of Oregon and on the North Shore of the Columbia River (refer to: 2004/01043) (November 30, 2004).

[4] Endangered Species Act Section 7 Formal and Informal Programmatic Opinion and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Consultation for Revisions to Standard Local Operating Procedures for Endangered Species to Administer Stream Restoration and Fish Passage Improvement Actions Authorized or Carried Out by the U.S. Army Corps of Engineers in Oregon (SLOPES IV Restoration) (refer to NMFS No.: 2007/07790.) (February 25, 2008).

Establishment, and Enhancement"). "Habitat restoration activity" is defined by NMFS to mean an activity that has the sole objective of restoring natural aquatic or riparian conditions or processes (50 CFR 222.102). In 2003, the use of SLOPES was expanded to include the Portland District's restoration actions under WRDA. The Corps uses SLOPES to evaluate applications for stream and wetland restoration actions that are within the range of ESA-listed salmon and steelhead. Applications for actions that the Corps finds to be within the range of effects considered in the most recent SLOPES biological opinion are issued a permit with corresponding conditions; applications that are not found to be within this range of effects are submitted to NMFS for additional, site-specific ESA and EFH consultation.

Under SLOPES, the Corps is required to provide an annual monitoring report. The report is intended to be a summary of action data and a description of program participation, the quality of supporting analyses, monitoring information, compensatory mitigation provided by applicants, and recommendations to improve the effectiveness of the program. Between 2002 and 2012, the number of time the Corps used SLOPES to issue permits for stream and wetland restoration has steadily increased. The high numbers of projects in 2008-2009 reflect spending under the American Recovery and Reinvestment Act of 2009. The bulk of the projects are in the Willamette/Lower Columbia and Oregon Coast recovery domains (Table 1).

Table 1. Number of stream and wetland restoration permits issued by the Corps using SLOPES-Restoration, by geographic area and year (n=398).

Recovery Domain	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Willamette/Lower Columbia (n=165)	6	12	17	11	13	1	26	25	24	9	21
Interior Columbia (n=43)	1	0	6	1	2	2	5	6	4	9	7
Oregon Coast (n=100)	1	6	6	2	7	0	17	21	15	10	15
Southern Oregon/Northern California Coasts (n=90)	0	5	12	4	6	3	29	8	7	5	11
TOTAL	8	23	41	18	28	6	77	60	50	33	54

By design, SLOPES provides a focus for discussion between NMFS, the Corps, and applicants regarding ways to reduce or remove the adverse effects of regulated actions on ESA-listed salmon and steelhead, designated critical habitat, and EFH. The delivery of technical assistance for administration of individual actions under SLOPES, interagency training in the use of SLOPES, the SLOPES annual review process, and many individual consultations which are beyond the range of actions authorized by SLOPES, have all been informed by previous SLOPES opinions, and thus helped to ensure that SLOPES will continue to be adaptive, accountable, and credible as a conservation and regulatory tool.

In this way, NMFS and the Corps have examined the shared characteristics of many regulatory actions with similar effects and identified those types of actions for which short-term environmental effects are likely to be low intensity, repetitive, and predictable, and for which long-term effects are likely to contribute to the recovery of listed species. These individual actions also have similar requirements for regulatory approval and, beyond confirmation that each action meets applicable constraints on design and the use of conservation practices, would not reward additional analysis or deliberation with further conservation benefits. NMFS and the Corps have used this information in SLOPES to set clear expectations and achieve consistent outcomes that, with other important regulatory initiatives, have significantly reduced conflict over listed species and regulatory actions, thus improving public relations and creating new opportunities for further advances in listed species conservation.

Accordingly, on February 7, 2013, the Corps Operations and Regulatory branches requested reinitiation of SLOPES for actions related to stream and wetland restoration. The Corps determined that the proposed program and projects funded under that program "may affect, but are not likely to adversely affect" the eastern DPS Steller sea lions (*Eumetopias jubatus)* or southern resident killer whales (*Orcinus orca*). The Corps also concluded that the proposed program and funded projects "may affect, and are likely to adversely affect" 17 ESA-listed species and their designated critical habitats. Critical habitat has been proposed for LCR coho salmon; therefore, we will conference on this critical habitat.

NMFS concurred with the Corps' finding in Section 2.11 of the opinion that follows. However, we found that the proposed action is not likely to adversely affect southern DPS green sturgeon, Steller sea lions and southern resident killer. These species do not have critical habitat designated in the program action area. Also, the proposed action "would adversely affect" areas designated by the Pacific Fisheries Management Council as EFH for Pacific salmon (PFMC 1999), groundfish (PFMC 2005), and coastal pelagic species (PFMC 1998), including estuarine areas designated as Habitat Areas of Particular Concern. Detailed information on the status and trends of these listed resources, and their biology and ecology, are in the listing regulations and critical habitat designations published in the Federal Register (Table 2).

Table 2. Listing status, status of critical habitat designations and protective regulations, and relevant Federal Register (FR) decision notices for ESA-listed species considered in this opinion. Listing status: 'T' means listed as threatened under the ESA; 'E' means listed as endangered; 'P' means proposed for listing or designation.

Species	Listing Status	Critical Habitat	Protective Regulations
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 spring-run	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 6/20/11; 76 FR 35755	2/11/08; 73 FR 7816	2/11/08; 73 FR 7816
Southern Oregon/Northern California Coasts	T 6/28/05; 70 FR 37160	5/5/99; 64 FR 24049	6/28/05; 70 FR 37160
Sockeye salmon *(O. nerka)*			
Snake River	E 8/15/11; 70 FR 37160	12/28/93; 58 FR 68543	ESA section 9 applies
Steelhead (*O. mykiss*)			
Lower Columbia River	T 1/5/06; 71 FR 834	9/02/05; 70 FR 52630	6/28/05; 70 FR 37160
Upper Willamette River	T 1/5/06; 71 FR 834	9/02/05; 70 FR 52630	6/28/05; 70 FR 37160
Middle Columbia River	T 1/5/06; 71 FR 834	9/02/05; 70 FR 52630	6/28/05; 70 FR 37160
Upper Columbia River	T 1/5/06; 71 FR 834	9/02/05; 70 FR 52630	2/1/06; 71 FR 5178
Snake River Basin	T 1/5/06; 71 FR 834	9/02/05; 70 FR 52630	6/28/05; 70 FR 37160
Eulachon *(Thaleichthys pacificus)*			
Southern DPS	T 3/18/10; 75 FR 13012	10/20/11; 76 FR 65324	Not applicable

1.3 Proposed Action

For this consultation, the proposed action is a revision of SLOPES that the Corps uses to guide the permitting of stream restoration and fish passage activities regulated under section 10 of the Rivers and Harbors Act of 1899 and section 404 of the Clean Water Act, including NWP27, or that are carried out by the Corps as part of civil works programs authorized by sections 206, 536, and 1135 of the Water Resources Development Act. Use of the revised SLOPES will ensure that the Corp's regulatory oversight of these aquatic habitat restoration actions will continue to meet requirements of the ESA and MSA with procedures that are simpler to use, more efficient, and more accountable for all parties.

The Corps is proposing to use SLOPES V Restoration to authorize ten categories of action related to aquatic habitat restoration, including wetland restoration, a new category. Those categories are:

1. **Boulder Placement** to increase habitat diversity and complexity, improve flow heterogeneity, provide substrate for aquatic vertebrates, moderate flow disturbances, and provide refuge for fish during high flows by placing large boulders in stream beds where similar natural rock has been removed.
2. **Fish Passage Restoration** to improve fish passage by installing or improving step structures, fish ladders, or lamprey ramps at an existing facility, or replacing or improving culverts.
3. **Large Wood Restoration** to increase coarse sediment storage, 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 refuge for fish during high flows by placing large wood in areas where natural wood accumulations have been removed.
4. **Off- and Side-Channel Habitat Restoration** to reconnect stream channels with floodplains, increase habitat diversity and complexity, improve flow heterogeneity, provide long-term nutrient storage and substrate for aquatic macroinvertebrates, moderate flow disturbances, increase retention of leaf litter, and provide refuge for fish during high flows by restoring or modifying hydrologic and other essential habitat features of historical river floodplain swales, abandoned side channels, and floodplain channels.
5. **Pile Removal** to improve water quality by eliminating chronic sources of toxic contamination.
6. **Set-Back Existing Berms, Dikes and Levees** to reconnect stream channels with floodplains, increase habitat diversity and complexity, moderate flow disturbances, and provide refuge for fish during high flows by increasing the distance that existing berms, dikes or levees are set back from active streams or wetlands.
7. **Spawning Gravel Restoration** to improve spawning substrate by compensating for an identified loss of a natural gravel supply.
8. **Streambank Restoration** to restore eroding streambanks by (a) bank shaping and installation of coir logs or other soil reinforcements as necessary to support riparian vegetation; (b) planting or installing large wood, trees, shrubs, and herbaceous cover and controlling invasive and non-native plant species as necessary to restore ecological function in riparian and floodplain habitats; or (c) a combination of the above methods.
9. **Water Control Structure Removal** to reconnect stream corridors, reestablish wetlands, improve fish passage, and restore more natural channel and flow conditions by removing earthen embankments, subsurface drainage features, spillway systems, tide gates, outfalls, pipes, instream flow redirection structures (*e.g.*, drop structure, gabion, groin), or similar devices used to control, discharge, or maintain water levels.
10. **Wetland Restoration** to restore degraded wetlands by excavation and removal of fill materials.

1.3.1 Proposed Design Criteria

The Corps proposed to apply the following design criteria, in relevant part, to every action authorized under this opinion. Measures described under “Administration” apply to the Corps as it manages the SLOPES V Restoration program. Measures described under “General

Construction" apply, in relevant part, to each action that involves a construction component. Measures described under "Types of Action" apply, in relevant part, to each specific type of actions as described. The Corps will ensure that all other measures apply to each party that is given authorization for, or carries out, an action under SLOPES V Restoration.

Program Administration

1. **Initial rollout.** The Corps will cooperate with NMFS to provide an initial rollout of this opinion for Corps staff to ensure that these conditions are considered at the onset of each project, incorporated into all phases of project design, and that any constraints, such as the need for fish passage or hydrologic engineering, are resolved early on and not under-designed as add-on features.
2. **Failure to report may trigger reinitiation.** NMFS may recommend reinitiation of this consultation if the Corps fails to provide full reports or attend the annual coordination meeting.
3. **Full implementation required.** Failure to comply with all applicable conditions for a specific project may invalidate protective coverage of ESA section 7(o)(2) regarding "take" of listed species, and may lead NMFS to a different conclusion regarding the effects of that project.
4. **Review and approval.** The Corps will review each project to be covered under this opinion to ensure that:
   a. The project is:
      i. Within the present or historic range of an ESA-listed salmon, steelhead, or eulachon, or designated critical habitat.
      ii. May affect one of the 17 endangered or threatened species considered in this opinion, or their designated critical habitat.
      iii. The effects are likely to be within the range of effects considered in this opinion.
      iv. Any applicant receiving Corps authorization will comply with all of the following conditions, including obtaining NMFS review and approval, as appropriate.
   b. NMFS will review and approve any project with any of the following elements:
      i. Modification or variance of any requirement
      ii. Fish passage restoration, including any culvert replacement or retrofit
      iii. Fishway intended to attract, collect, exclude, guide, transport, or release an ESA-listed fish under NMFSs' jurisdiction including, but not limited to, a culvert retrofit, a pool-riffle structure, or a roughened chute
      iv. Off- and side-channel habitat restoration
      v. Set-back or removal of an existing berm, dike, or levee
      vi. Water control structure removal
      vii. Wetland restoration
   c. Any project covered under SLOPES V Restoration will <u>not</u>:
      i. Make the program exceed the amount or extent of take described in the incidental take statement issued with this opinion
      ii. Use pesticide-treated wood
      iii. Install, replace, or repair a tide gate

iv. Be of a scope and scale that it requires an environmental impact statement; thereby requiring an individual project analysis under the ESA
v. Require in-water work in the Willamette River downstream of Willamette Falls between Dec 1 and Jan 31
vi. Require any earthwork at an EPA-designated Superfund Site, a state-designated clean-up area, or in the likely impact zone of a significant contaminant source, as identified by historical information or the Corps' best professional judgment.

5. **Permit conditions.** The Corps will include each of the relevant project design criteria as an enforceable condition of every action authorized under this opinion. The Corps will also include each applicable design criterion as a final action specification of every WRDA civil works action carried out under this opinion.

6. **Site access.** The Corps will retain the right of reasonable access to each project site to monitor the use and effectiveness of these conditions.

7. **Monitoring and reporting.** The Corps will ensure that the following notifications and reports (Appendix A) are submitted to NMFS for each project to be completed under this opinion. All project notifications and reports are to be submitted electronically to NMFS at slopes.nwr@noaa.gov, including:
   a. Project notification within 60-days before start of construction (Part 1).
   b. Project completion within 60-days of end of construction (Part 1 with Part 2 completed).
   c. Fish salvage within 60-days of work area isolation with fish capture (Part 1 with Part 3 completed).

8. **Annual program report.** The Corps' Regulatory and Civil Works Branches will each submit a monitoring report to NMFS by February 15 each year that describes the Corps' efforts to carry out this opinion. The report will include an assessment of overall program activity, a map showing the location and type of each action authorized and carried out under this opinion, and any other data or analyses the Corps deems necessary or helpful to assess habitat trends as a result of actions authorized under this opinion. The Corps will submit reports to NMFS by email at this address: slopes.nwr@noaa.gov.

9. **Annual coordination meeting.** The Corps' Regulatory and Civil Works branches will attend an annual coordination meeting with NMFS by March 31 each year to discuss the annual report and any actions that can improve conservation under this opinion, or make the program more efficient or accountable.

Project Design Criteria - General Construction Measures

10. **Project Design.**
    a. Use the best available scientific information regarding the likely effects of climate change on resources in the project area, including projections of local stream flow and water temperature, to ensure that the project will be adaptable to those changes.
    b. Obtain all applicable regulatory permits and official project authorizations before beginning construction.
    c. Minimize the extent and duration of earthwork, *e.g.*, compacting, dredging, drilling, excavation, and filling.

    i. Avoid use of heavy equipment, vehicles or power tools below bankfull elevation unless project specialists determine such work is necessary, or would result in less risk of sedimentation or other ecological damage than work above that elevation.
    ii. Complete earthwork in wetlands, riparian areas, and stream channels as quickly as possible.
  d. Cease project operations when high flows may inundate the project area, except for efforts to avoid or minimize resource damage.

11. Site contamination assessment.

  a. The level of detail and resources committed to such an assessment will be commensurate with the level and type of past or current development at the site. An applicant's assessment may include the following:
    i. Review available records, such as former site use and records of any prior contamination events.
    ii. If the project site was used for industrial processes (*i.e.*, mining or manufacturing with chemicals), inspect to determine the environmental condition of the property.
    iii. Interview people who are knowledgeable about the site, *e.g.*, site owners, operators, and occupants, neighbors, or local government officials.
  b. Consult with NMFS if ground disturbance to accomplish the proposed project would potentially release contaminants to aquatic habitat that supports listed fish species.

12. Site layout and flagging.

  a. Before any significant ground disturbance or entry of mechanized equipment or vehicles into the construction area, clearly flag that area to identify:
    i. Sensitive areas, *e.g.*, wetlands, water bodies, ordinary high water, spawning areas.
    ii. Equipment entry and exit points.
    iii. Road and stream crossing alignments.
    iv. Staging, storage, and stockpile areas.
  b. Before use of herbicides, clearly flag all buffer areas, including any no-application zones.

13. Staging, storage, and stockpile areas.

  a. Designate and use staging areas to store hazardous materials, or to store, fuel, or service heavy equipment, vehicles and other power equipment with tanks larger than 5 gallons, that are at least 150 feet from any natural water body or wetland, or on an established paved area, such that sediment and other contaminants from the staging area cannot be deposited in the floodplain or stream.
  b. Natural materials that are displaced by construction and reserved for restoration, *e.g.*, large wood, gravel, and boulders, may be stockpiled within the 100-year floodplain.
  c. Dispose of any material not used in restoration and not native to the floodplain outside of the functional floodplain.

d. After construction is complete, obliterate all staging, storage, or stockpile areas, stabilize the soil, and revegetate the area.[5]

14. Erosion control.

a. Use site planning and site erosion control measures commensurate with the scope of the project to prevent erosion and sediment discharge from the project site.
b. Before significant earthwork begins, install appropriate, temporary erosion controls downslope to prevent sediment deposition in the riparian area, wetlands, or water body.
c. During construction, if eroded sediment appears likely to be deposited in the stream during construction, install additional sediment barriers as necessary.
d. Temporary erosion control measures may include fiber wattles, silt fences, jute matting, wood fiber mulch and soil binder, or geotextiles and geosynthetic fabric.
e. Soil stabilization using wood fiber mulch and tackifier (hydro-applied) may be used to reduce erosion of bare soil, if the materials are free of noxious weeds and nontoxic to aquatic and terrestrial animals, soil microorganisms, and vegetation.
f. Remove sediment from erosion controls if it reaches 1/3 of the exposed height of the control.
g. Whenever surface water is present, maintain a supply of sediment control materials and an oil-absorbing floating boom at the project site.
h. Remove temporary erosion controls after construction is complete and the site is fully stabilized.

15. Hazardous material spill prevention and control.

a. At the project site:
   i. Post written procedures for notifying environmental response agencies, including an inventory and description of all hazardous materials present, and the storage and handling procedures for their use.
   ii. Maintain a spill containment kit, with supplies and instructions for cleanup and disposal, adequate for the types and quantity of hazardous materials present.
   iii. Train workers in spill containment procedures, including the location and use of the spill containment kits.
b. Temporarily contain any waste liquids generated under an impervious cover, such as a tarpaulin, in the staging area until the wastes can be properly transported to, and disposed of, at an approved receiving facility.

16. Equipment, vehicles, and power tools.

a. Select, operate and maintain all heavy equipment, vehicles, and power tools to minimize adverse effects on the environment, *e.g.*, low pressure tires, minimal hard-turn paths for track vehicles, use of temporary mats or plates to protect wet soils.
b. Before entering wetlands or within 150 feet of a waterbody, replace all petroleum-based hydraulic fluids with biodegradable products.[6]

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[5] 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.

[6] For additional information and suppliers of biodegradable hydraulic fluids, motor oil, lubricant, or grease. See,

c. Invasive species prevention and control.
    i. Before entering the project site, power wash all heavy equipment, vehicles and power tools, allow them to fully dry, and inspect them to make certain no plants, soil, or other organic material adhering to the surface.
    ii. Before entering the water, inspect any watercraft, waders, boots, or other gear to be used in or near water and remove any plants, soil, or other organic material adhering to the surface.

d. Inspect all equipment, vehicles, and power tools for fluid leaks before they leave the staging area.

e. Before operation within 150 feet of any waterbody , and as often as necessary during operation, thoroughly clean all equipment, vehicles, and power tools to keep them free of external fluids and grease and to prevent leaks and spills from entering the water.

f. Generators, cranes or other stationary heavy equipment operated within 150 feet of any waterbody must be maintained and protected as necessary to prevent leaks and spills from entering the water.

17. Temporary access roads and paths.

a. Whenever reasonable, use existing access roads and paths preferentially.

b. Minimize the number and length of temporary access roads and paths through riparian areas and floodplains.

c. Minimize removal of riparian vegetation.

d. When it is necessary to remove vegetation, cut at ground level (no grubbing).

e. Do not build temporary access roads or paths where grade, soil, or other features suggest slope instability.

f. Any road on a slope steeper than 30% must be designed by a civil engineer with experience in steep road design.

g. After construction is complete, obliterate all temporary access roads and paths, stabilize the soil, and revegetate the area.

h. Temporary roads and paths in wet areas or areas prone to flooding must be obliterated by the end of the in-water work window. Decompact road surfaces and drainage areas, pull fill material onto the running surface, and reshape to match the original contours.

18. Dust abatement.

a. Employ dust abatement measures commensurate with soil type, equipment use, wind conditions, and the effects of other erosion control measures.

b. Sequence and schedule work to reduce the exposure of bare soil to wind erosion.

c. Maintain spill containment supplies on-site whenever dust abatement chemicals are applied.

d. Do not use petroleum-based products.

Environmentally Acceptable Lubricants by the U.S. EPA (2011); *e.g.*, mineral oil, polyglycol, vegetable oil, synthetic ester; Mobil® biodegradable hydraulic oils, Total® hydraulic fluid, Terresolve Technologies Ltd.® bio-based biodegradable lubricants, Cougar Lubrication® 2XT Bio engine oil, Series 4300 Synthetic Bio-degradable Hydraulic Oil, 8060-2 Synthetic Bio-Degradable Grease No. 2, *etc*. The use of trade, firm, or corporation names in this opinion is for the information and convenience of the action agency and applicants and does not constitute an official endorsement or approval by the U.S. Department of Commerce or NMFS of any product or service to the exclusion of others that may be suitable.

e. Do not apply dust-abatement chemicals, *e.g.*, magnesium chloride, calcium chloride salts, ligninsulfonate, within 25 feet of water or a stream channel.
f. Do not apply ligninsulfonate at rates exceeding 0.5 gallons per square yard of road surface, assuming a 50:50 solution of ligninsulfonate to water.
g. Do not apply dust abatement chemicals at stream crossings, within 25 feet of a water body, or in other areas where they may runoff directly into a wetland or water body.

19. Temporary stream crossings.

a. No stream crossing may occur at active spawning sites, when holding adult listed fish are present, or when eggs or alevins are in the gravel.
b. Do not place temporary crossings in areas that may increase the risk of channel re-routing or avulsion, or in potential spawning habitat, *e.g.*, pools and pool tailouts.
c. Minimize the number of temporary stream crossings; use existing stream crossings whenever reasonable.
d. Install temporary bridges and culverts to allow for equipment and vehicle crossing over perennial streams during construction.
e. Wherever possible, vehicles and machinery must cross streams at right angles to the main channel.
f. Equipment and vehicles may cross the stream in the wet only where the streambed is bedrock, or where mats or off-site logs are placed in the stream and used as a crossing.
g. Obliterate all temporary stream crossings as soon as they are no longer needed, and restore any damage to affected stream banks or channel.

20. Surface water withdrawal and construction discharge water.

a. Surface water may be diverted to meet construction needs, but only if developed sources are unavailable or inadequate.
b. Diversions may not exceed 10% of the available flow and must have a juvenile fish exclusion device that is consistent with NMFS's criteria (NMFS 2011e).[7]
c. Treat all construction discharge water using the best management practices applicable to site conditions to remove debris, sediment, petroleum products, and any other pollutants likely to be present, (*e.g.*, green concrete, contaminated water, silt, welding slag, sandblasting abrasive, grout cured less than 24 hours, drilling fluids) to ensure that no pollutants are discharged from the construction site.

21. Fish passage.

a. Provide fish passage for any adult or juvenile ESA-listed 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.
b. After construction, provide fish passage for any adult or juvenile ESA-listed fish that meets NMFS's fish passage criteria (NMFS 2011) for the life of the action.

22. In-water work timing.

a. Complete all work within the wetted channel during dates listed in the most recent version of Oregon Guidelines for Timing of In-water Work to Protect Fish

[7] National Marine Fisheries Service. 2011. Anadromous salmonid passage facility design. Northwest Region.

and Wildlife Resources (ODFW 2008), except that the winter work window (December 1 – January 31) is not approved for actions in the Willamette River below Willamette Falls.

b. Hydraulic and topographic measurements and placement of large wood or gravel may be completed anytime, provided the affected area is not occupied by adult fish congregating for spawning, or in an area where redds are occupied by eggs or pre-emergent alevins.

23. Work area isolation

a. Isolate any work area within the wetted channel 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 known spawning habitats.

b. Engineering design plans for work area isolation must include all isolation elements and fish release areas.

c. Dewater the shortest linear extent of work area practicable, unless wetted in-stream work is deemed to be minimally harmful to fish, and is beneficial to other aquatic species.[8]

   i. Use a coffer dam and a by-pass culvert or pipe, or a lined, non-erodible diversion ditch to divert flow around the dewatered area. Dissipate flow energy to prevent damage to riparian vegetation or stream channel and provide safe downstream reentry of fish, preferably into pool habitat with cover.

   ii. Where gravity feed is not possible, pump water from the work site to avoid rewatering. Maintain a fish screen on the pump intake to avoid juvenile fish entrainment.

   iii. Pump seepage water to a temporary storage and treatment site, or into upland areas, to allow water to percolate through soil or to filter through vegetation before reentering the stream channel with a treatment system comprised of either a hay bale basin or other sediment control device.

   iv. Monitor below the construction site to prevent stranding of aquatic organisms.

   v. When construction is complete, re-water the construction site slowly to prevent loss of surface flow downstream, and to prevent a sudden increase in stream turbidity.

d. Whenever a pump is used to dewater the isolation area and ESA-listed fish may be present, a fish screen must be used that meets the most current version of NMFS's fish screen criteria (NMFS 2011e). NMFS approval is required for pumping that exceeds 3 cfs.

24. Fish capture.

a. If practicable, allow listed fish species to migrate out of the work area or remove fish before dewatering; otherwise remove fish from an exclusion area as it is slowly dewatered with methods such as hand or dip-nets, seining, and trapping with minnow traps (or gee-minnow traps).

b. Fish capture must be supervised by a qualified fisheries biologist, with experience in work area isolation and competent to ensure the safe handling of all fish.

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[8] For instructions on how to dewater areas occupied by lamprey, see USFWS (2010).

c. Conduct fish capture activities during periods of the day with the coolest air and water temperatures possible, normally early in the morning to minimize stress and injury of species present.
d. Monitor the nets need to isolate a site frequently enough to ensure they stay secured to the banks and free of organic accumulation.
e. Electrofishing may only be used only after other means of fish capture are determined to be not feasible or ineffective during the coolest time of day.
   i. Do not electrofish when the water appears turbid, *e.g.*, when objects are not visible at depth of 12 inches.
   ii. Do not intentionally contact fish with the anode.
   iii. Follow NMFS (2000) electrofishing guidelines, including use of only direct current (DC) or pulsed direct current within the following ranges:[9]
      1. If conductivity is less than 100 µs, use 900 to 1100 volts.
      2. If conductivity is between 100 to 300 µs, use 500 to 800 volts.
      3. If conductivity greater than 300 µs, use less than 400 volts.
   iv. Begin electrofishing with a minimum pulse width and recommended voltage, then gradually increase to the point where fish are immobilized.
   v. Immediately discontinue electrofishing if fish are killed or injured, *i.e.*, dark bands visible on the body, spinal deformations, significant de-scaling, torpid or inability to maintain upright attitude after sufficient recovery time. Recheck machine settings, water temperature and conductivity, and adjust or postpone procedures as necessary to reduce injuries.
f. If buckets are used to transport fish:
   i. Minimize the time fish are in a transport bucket.
   ii. Keep buckets in shaded areas or, if no shade is available, covered by a canopy.
   iii. Limit the number of fish within a bucket; fish will be of relatively comparable size to minimize predation.
   iv. Use aerators or replace the water in the buckets at least every 15 minutes with cold clear water.
   v. Release fish in an area upstream with adequate cover and flow refuge; downstream is acceptable provided the release site is below the influence of construction.
   vi. Be careful to avoid mortality counting errors.
g. Monitor and record fish presence, handling, and injury during all phases of fish capture and submit a fish salvage report to the Corps and NMFS within 10 days.

25. Site restoration.

a. Restore any significant disturbance of riparian vegetation, soils, stream banks or stream channel.
b. Remove all project related waste; *e.g.*, pick up trash, sweep roadways in the project area to avoid runoff-containing sediment, *etc.*
c. Obliterate all temporary access roads, crossings, and staging areas.

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[9] National Marine Fisheries Service. 2000. Guidelines for electrofishing waters containing salmonids listed under the Endangered Species Act. Portland, Oregon and Santa Rosa, California.

d. Loosen compacted areas of soil when necessary for revegetation or infiltration.
e. Although no single criterion is sufficient to measure restoration success, the intent is that the following features should be present in the upland parts of the project area, within reasonable limits of natural and management variation:
    i. Human and livestock disturbance, if any, are confined to small areas necessary for access or other special management situations.
    ii. Areas with signs of significant past erosion are completely stabilized and healed, bare soil spaces are small and well-dispersed.
    iii. Soil movement, such as active rills and soil deposition around plants or in small basins, is absent or slight and local.
    iv. Native woody and herbaceous vegetation, and germination microsites, are present and well distributed across the site; invasive plants are absent.
    v. Plants have normal, vigorous growth form, and a high probability of remaining vigorous, healthy and dominant over undesired competing vegetation.
    vi. Plant litter is well distributed and effective in protecting the soil with little or no litter accumulated against vegetation as a result of active sheet erosion ("litter dams").
    vii. A continuous corridor of shrubs and trees appropriate to the site are present to provide shade and other habitat functions for the entire streambank.

26. Revegetation.

a. Plant and seed disturbed areas before or at the beginning of the first growing season after construction.
b. Use species that will achieve shade and erosion control objectives, including forb, grass, shrub, or tree species that are appropriate for the site and native to the project area or region.
c. Short-term stabilization measures may include use of non-native sterile seed mix if native seeds are not available, weed-free certified straw, jute matting, and similar methods.
d. When feasible, use vegetation salvaged from local areas scheduled for clearing due to development.
e. Do not apply surface fertilizer within 50 feet of any wetland of water body.
f. Install fencing as necessary to prevent access to revegetated sites by livestock or unauthorized persons.
g. Do not use invasive or non-native species for site restoration.
h. Remove or control invasive plants until native plant species are well-established.

27. Invasive and non-native plant control.

a. ***Non-herbicide methods.*** Limit vegetation removal and soil disturbance within the riparian zone by limiting the number of workers there to the minimum necessary to complete manual and mechanical plant control (*e.g.*, hand pulling, clipping, stabbing, digging, brush-cutting, mulching or heating with radiant heat, pressurized hot water, or heated foam).
b. ***Herbicide Label.*** Herbicide applicators must comply with all label instructions.

c. ***Power equipment.*** Refuel gas-powered equipment with tanks larger than 5 gallons in a vehicle staging area placed 150 feet or more from any natural waterbody, or in an isolated hazard zone such as a paved parking lot.
d. ***Maximum herbicide treatment area.*** For the total area treated with herbicides within riparian areas, do not exceed 10-acres above bankfull elevation and 2 acres below bankfull elevation, per 1.6-mile reach of a stream, per year.
e. ***Herbicide applicator qualifications.*** Herbicides may only be applied only by an appropriately licensed applicator using an herbicide specifically targeted for a particular plant species that will cause the least impact. The applicator will be responsible for preparing and carrying out and the herbicide transportation and safely plan, as follows.
f. ***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.
g. ***Herbicides.*** The only herbicides proposed for use under this opinion are (some common trade names are shown in parentheses):[10]
    i. aquatic imazapyr (*e.g.*, Habitat)
    ii. aquatic glyphosate (*e.g.*, AquaMaster, AquaPro, Rodeo)
    iii. aquatic triclopyr-TEA (*e.g.*, Renovate 3)
    iv. chlorsulfuron (*e.g.*, Telar, Glean, Corsair)
    v. clopyralid (*e.g.*, Transline)
    vi. imazapic (*e.g.*, Plateau)
    vii. imazapyr (*e.g.*, Arsenal, Chopper)
    viii. metsulfuron-methyl (*e.g.*, Escort)
    ix. picloram (*e.g.*, Tordon)
    x. sethoxydim (*e.g.*, Poast, Vantage)
    xi. sulfometuron-methyl (*e.g.*, Oust, Oust XP)
h. ***Herbicide adjuvants.*** The only adjuvants proposed for use under this opinion are as follows, with mixing rates described in label instructions (Table 3). Polyethoxylated tallow amine (POEA) surfactant and herbicides that contain POEA (*e.g.*, Roundup) will not be used.

[10] The use of trade, firm, or corporation names in this opinion is for the information and convenience of the action agency and applicants and does not constitute an official endorsement or approval by the U.S. Department of Commerce or NMFS of any product or service to the exclusion of others that may be suitable.

Table 3. Herbicide adjuvants, trade names, and application areas.

Adjuvant Type	Trade Name	Application Areas
Surfactants	Agri-Dex	Riparian
	LI 700	Riparian
Drift Retardants	41-A	Riparian
	Vale	Upland

i. ***Herbicide carriers.*** Herbicide carriers (solvents) are limited to water or specifically labeled vegetable oil. Use of diesel oil as an herbicide carrier is prohibited.

j. ***Herbicide mixing.*** Mix herbicides more than 150 feet from any natural waterbody to minimize the risk of an accidental discharge.

k. ***Dyes.*** Use a non-hazardous indicator dye (*e.g.*, Hi-Light or Dynamark™) with herbicides within 100 feet of live water. The presence of dye makes it easier to see where the herbicide has been applied and where or whether it has dripped, spilled, or leaked. Dye also makes it easier to detect missed spots, avoid spraying a plant or area more than once, and minimize over-spraying (SERA 1997).

l. ***Spill Cleanup Kit.*** Provide a spill cleanup kit whenever herbicides are used, transported, or stored. At a minimum, cleanup kits will include, Material Safety Data Sheets, the herbicide label, emergency phone numbers, and absorbent material such as cat litter to contain spills.

m. ***Herbicide application rates.*** Apply herbicides will be applied at the lowest effective label rates.

n. ***Herbicide application methods.*** Apply liquid or granular forms of herbicides as follows:
   i. Broadcast spraying – hand held nozzles attached to back pack tanks or vehicles, or by using vehicle mounted booms.
   ii. 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.
   iii. Hand/selective – wicking and wiping, basal bark, fill (“hack and squirt”), stem injection, cut-stump.
   iv. Triclopyr – will not be applied by broadcast spraying.
   v. Keep the spray nozzle within 4 feet of the ground; 6 feet for spot or patch spraying more than 15 feet of the high water mark (HWM) if needed to treat tall vegetation.
   vi. Apply spray in swaths parallel towards the project area, away from the creek and desirable vegetation, *i.e.*, the person applying the spray will generally have their back to the creek or other sensitive resource.
   vii. Avoid unnecessary run off during cut surface, basal bark, and hack-squirt/injection applications.

o. ***Washing spray tanks.*** Wash spray tanks 300 feet or more away from any surface water.

p. ***Minimization of herbicide drift and leaching.*** Minimize herbicide drift and leaching will as follows:

   i. Do not spray when wind speeds exceed 10 miles per hour, or are less than 2 miles per hour.
   ii. Be aware of wind directions and potential for herbicides to affect aquatic habitat area downwind.
   iii. Keep boom or spray as low as possible to reduce wind effects.
   iv. 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.
   v. Do not apply herbicides during temperature inversions, or when ground temperatures exceed 80 degrees Fahrenheit.
   vi. Wind and other weather data will be monitored and reported for all broadcast applications.

q. ***Rain.*** Do not apply herbicides when the soil is saturated or when a precipitation event likely to produce direct runoff to salmon bearing waters from the treated area is forecasted by the NOAA National Weather Service or other similar forecasting service within 48 hours following application. Soil-activated herbicides may follow label instructions. Do not conduct hack-squirt/injection applications during periods of heavy rainfall.

r. ***Herbicide buffer distances.*** Observe the following no-application buffers, measured in feet and are based on herbicide formula, stream type, and application method, during herbicide applications (Table 4). Use the most conservative buffer for any herbicide included in a combination of approved herbicides. Buffer widths are in feet, measured as map distance perpendicular to the bankfull elevation for streams, the upland boundary for wetlands, or the upper bank for roadside ditches. Before herbicide application begins, flag or mark the upland boundary of each applicable herbicide buffer to ensure that all buffers are in place and functional during treatment.

Table 4. Herbicide buffer distances by herbicide formula, stream type, and application method.

Herbicide	**No Application Buffer Width (feet)**					
	Streams and Roadside Ditches with flowing or standing water present and Wetlands			Dry Streams, Roadside Ditches, and Wetlands		
	Broadcast Spraying	Spot Spraying	Hand Selective	Broadcast Spraying	Spot Spraying	Hand Selective
Labeled for Aquatic Use						
Aquatic Glyphosate	100	waterline	waterline	50	None	none
Aquatic Imazapyr	100	15	waterline	50	None	none
Aquatic Triclopyr-TEA	**Not Allowed**	15	waterline	**Not Allowed**	None	none
Low Risk to Aquatic Organisms						
Imazapic	100	15	bankfull elevation	50	None	none
Clopyralid	100	15	bankfull elevation	50	None	none
Metsulfuron-methyl	100	15	bankfull elevation	50	None	none
Moderate Risk to Aquatic Organisms						
Imazapyr	100	50	bankfull elevation	50	15	bankfull elevation
Sulfometuron-methyl	100	50	5	50	15	bankfull elevation
Chlorsulfuron	100	50	bankfull elevation	50	15	bankfull elevation
High Risk to Aquatic Organisms						
Picloram	100	50	50	100	50	50
Sethoxydim	100	50	50	100	50	50

Project Design Criteria - Types of Restoration Actions

28. Boulder placement.[11]

a. Boulder placement is 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.

b. Install boulders as follows:

   i. The cross-sectional area of boulders 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.

   ii. Boulders will be machine-placed (no end dumping allowed).

   iii. Permanent anchoring, including rebar and cables, may not be used.

[11] For additional information on design and methods for boulder placement, see "boulder clusters" in Cramer (2012).

29. Fish passage restoration: Step structures, fish ladder, and culvert replacement.

a. Step structures for engineered riffles (3-5% slope) and cascades (>5% slope):

   i. Construct log or rock structures in a 'V' or 'U' shape, oriented with the apex upstream, and lower in the center to direct flows to the middle of channel.

   ii. Key structures into the stream bed to minimize structure undermining due to scour, preferably at least 2.5x their exposure height. The structures should also be keyed into both banks—if feasible greater than 8 feet.

   iii. If several structures will be used in series, space them at the appropriate distances to promote fish passage of all life stages of native fish. Incorporate fish passage criteria (jump height, pool depth, *etc*.) in the design of log or rock step structures. Recommended spacing should be no closer than the net drop divided by the channel slope (for example, a one-foot high step in a stream with a two-percent gradient will have a minimum spacing of 50 feet).

   iv. All rock structures shall be comprised of a well graded mix between D50 and Dmax material, and contain no less than 15% fine material. For boulder weir designs, the placement of large weir stones only, tends to create porous flow through the weir, instead of surface flow over the weir sill. For this reason the use of bands is recommended over weirs. Both designs should ensure the rock mix is properly sealed by washing sufficient fines into the structure until pooled water is static for several minutes without visible seepage. This will reduce the risk of subsurface flow and ensure fish passage immediately following construction if natural flows are present. If a project involves the removal of multiple barriers on one stream or in one watershed over the course of a work season, remove the most upstream barrier first if possible. This way, work at the upstream sites can be completed without listed fish in the project area.

   v. This consultation does not include structures that use gabion baskets, sheet pile, concrete, articulated concrete block, cable anchors, or structures perpendicular to the channel, which disperse flows and can cause channel widening and thus structure "flanking" (erosion around the ends of the structure).

b. When a permanent stream crossing is replaced to provide fish passage, the new crossing must provide for a fully functional floodplain as follows:

   i. Maintain a clear unobstructed opening above the general scour prism; streambank and channel stabilization may be applied below the general scour elevation.

   ii. For a single span structure, including culverts, the necessary opening is presumed to be 1.5 times the active channel width[12], or wider.

[12] 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.

iii. Entrenched Streams: If a stream is entrenched (entrenchment ratio of less than 1.4), the culvert must be greater in width than the bankfull channel width, allow sufficient vertical clearance to allow ease of construction and maintenance activities, provide adequate room for the construction of natural channel banks, and be reviewed by NMFS for consistency with (NMFS 2011e).

iv. For a multiple span structure, the necessary opening is presumed to be 2.2 times the active channel width, or wider, except for piers or interior bents.

v. Install relief conduits, as necessary, within existing road fill at potential flood flow pathways based on analysis of flow patterns or floodplain topography.

vi. Remove all other artificial constrictions within the functional floodplain that are not otherwise a component of the final design:

1. Remove vacant bridge supports below total scour depth, unless the vacant support is part of the rehabilitated or replacement stream crossing.
2. Remove existing roadway fill, embankment fill, approach fill, or other fill.

c. Reshape exposed floodplains and streambanks to match upstream and downstream conditions.

d. The Corps will not issue a permit to install or improve a step structure or fish ladder, or to replace or improve a culvert, until the action has been reviewed and approved by NMFS for consistency with NMFS fish passage criteria (NMFS 2011e). Fish passage actions that would not require prior approval must still complete a post-action report.

30. Large wood placement.[13]

a. Place large wood in areas where it would naturally occur and in a manner that closely mimic natural accumulations for that particular stream type.

b. 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.

c. Use of decayed or fragmented wood found lying on the ground or partially sunken in the ground is not acceptable.

d. Anchoring alternatives may be used in preferential order: 1) use of adequate sized wood sufficient for stability; 2) orient and place wood in such a way that movement is limited; 3) ballast (gravel and/or rock) to increase the mass of the structure to resist movement; 4) use large boulders as anchor points for the large wood.

[13] For additional information on selection of large wood for restoration actions, see stream slope and width dimensions and minimum large wood piece diameters described in Figure 1 in the most recent version of ODF and ODFW (1995), and for anchoring and placement, see Cramer *et al.* (2003).

31. Off- or side-channel habitat restoration.[14]

a. 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, and excavation within historical channels that does not exceed the thalweg depth in the main channel. The purpose of the additional sediment removal is to provide unimpeded flow through the side-channel to minimize fish entrapment.
b. 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.
c. Data requirements and analysis that must be submitted to NMFS with a request for approval of off- and side-channel habitat restoration include evidence of historical channel location, such as land use surveys, historical photographs, topographic maps, and remote sensing information.
d. The Corps will not issue a permit for off- or side channel habitat restoration until the action has been reviewed and approved by NMFS.

32. Pile removal.

a. Use the following steps to minimize creosote release, sediment disturbance, and total suspended solids:
   i. Install a floating surface boom to capture floating surface debris.
   ii. Keep 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.
   iii. Dislodge the piling with a vibratory hammer, whenever feasible--never intentionally break a pile by twisting or bending.
   iv. Slowly lift the pile from the sediment and through the water column.
   v. Place 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).
   vi. Fill the holes left by each piling with clean, native sediments.
   vii. Dispose of all removed piles, floating surface debris, any sediment spilled on work surfaces, and all containment supplies at a permitted upland disposal site.
b. If a pile breaks above the surface of uncontaminated sediment, or less than 2 feet below the surface, make every attempt short of excavation 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.
c. 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.

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[14] For additional information on methods and design considerations for off- and side-channel habitat restoration, see "side channel/off-channel habitat restoration" in Cramer (2012).

d. 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.

33. Set-back existing berm, dike, or levee. [15]

a. To the greatest degree possible, non-native fill material, originating from outside the floodplain of the action area will be removed from the floodplain to an upland site.

b. 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.

   i. Breaches shall be equal to or greater than the active channel width.

   ii. 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.

   iii. When necessary, loosen compacted soils once overburden material is removed.

c. 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.

d. The Corps will not issue a permit for set-back of existing berms, dikes or levees until the action has been reviewed and approved by NMFS.

34. Spawning gravel restoration.[16]

a. Gravel augmentation is limited to areas where the natural supply has been eliminated or significantly reduced through anthropogenic means.

b. Gravel to be placed in streams must be obtained from an upland source outside of the channel and riparian area (gravel from any instream source is prohibited), sized such that 50% of the gradation becomes mobile at the dominant discharge event, rounded and uncrushed (less than 25% fractured face), and washed before instream placement.

35. Streambank restoration.[17]

a. Without changing the location of the bank toe, restore damaged streambanks to a natural slope, pattern, and profile suitable for establishment of permanent woody vegetation.

b. Complete all soil reinforcement earthwork and excavation in the dry. Use soil layers or lifts that are strengthened with biodegradable fabrics and penetrable by plant roots.

c. Include large wood in each streambank restoration action to the maximum extent feasible. Large wood must be intact, hard, and undecayed to partly decaying, and

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[15] For additional information on methods and design considerations for levee removal and modification, see "levee removal and modification" in Cramer (2012).

[16] For additional information on gravel restoration methods and design, see "salmonid spawning gravel cleaning and placement" in Cramer (2012).

[17] For additional information on methods and design for bank shaping; installation of coir logs and soil reinforcements; anchoring and placement of large wood; woody plantings; and herbaceous cover, see Cramer *et al.* (2003), and "riparian restoration and management" in Cramer (2012).

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. Wood that is already within the stream or suspended over the stream may be repositioned to allow for greater interaction with the stream.

d. Rock may not be used for streambank restoration, except as ballast to stabilize large wood.
e. Use 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.
f. Do not apply surface fertilizer within 50 feet of any stream channel.
g. Install fencing as necessary to prevent access to revegetated sites by livestock or unauthorized persons.

36. Water control structure removal.

a. This includes removal of small dams that are less than 10 meters (16.4 feet) high, do not impound contaminated sediments, and are not likely to initiate head-cutting; channel-spanning structures; subsurface drainage features; tide gates; or instream flow redirection structures.
    i. Data requirements and analysis for structure removal include:
        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.
    ii. A survey of any downstream spawning areas that may be affected by sediment released by removal of the water control structure. 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.

b. The Corps will not issue a permit for removal of any water control structure (including an earthen embankment, subsurface drainage feature, spillway system, tide gate, and an instream flow redirection structure, such as a drop structure, gabion, or groin) that is used to control, discharge, or maintain water levels, until the action has been reviewed and approved by NMFS.

37. Wetland restoration.

a. The Corps will include applicable general construction measures and PDC for specific types of actions as applicable (*e.g.*, general construction measures; off- and side-channel restoration; set-back of existing berms, dikes, and levees; and removal of water control structures) to ensure that all adverse effects to fish and their designated critical habitats are within the range of effects considered in this opinion.

The NMFS relied on the foregoing description of the proposed action, including all proposed design criteria, to complete this consultation. However, unforeseen occurrences or changed circumstances encountered while carrying out the proposed action may require a significant change in the proposed design, construction methods, or other on-the-ground practices. These changes may, in turn, result in effects of the action which exceed the amount or extent of taking specified in the incidental take statement or otherwise affect listed species or designated critical habitat in ways not previously considered.

1.4 Action Area

"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). For this consultation, the overall program action area consists of the combined action areas for each action to be authorized or carried out under this opinion within the range of ESA-listed salmon or steelhead, designated critical habitat, or designated EFH in Oregon. This includes all upland, riparian and aquatic areas affected by site preparation, construction, and site restoration design criteria at each action site. This includes streams, rivers and estuaries in 12 of the 18 river basins that occur in Oregon: North Coast, Mid Coast, Umpqua, South Coast, Rogue, Willamette, Sandy, Hood, Deschutes, John Day, Umatilla (including part of the Walla Walla River), and Grande Ronde. Five river basins in Oregon are not included because those basins have natural or artificial barriers that preclude anadromous migration, thus making them inaccessible to species considered in this opinion: Goose and Summer Lakes, Harney, Owyhee, Malheur, and Powder. The waters that form the Klamath River system do not fall within the geographic jurisdiction of the U.S. Army Corps of Engineers Portland District and thus no SLOPES projects will be authorized within that basin (nor will SLOPES projects authorized in other areas have effects in that basin).

Each individual project authorized under SLOPES V will have a project-level action area that exists within the program action area. Individual project-level action areas include riparian areas, banks, and the stream channel in area extending no more than 300 feet upstream, although the beneficial effects of the action can extend much further upstream if fish passage is restored, and 300 feet downstream from the action footprint, where aquatic habitat conditions will be temporarily degraded until site restoration is complete. All actions authorized by this opinion will occur within the jurisdiction of the Corps Portland District in Oregon.

2. ENDANGERED SPECIES ACT

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 U.S. Fish and Wildlife Service, 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 specifying the impact of any incidental taking, and including reasonable and prudent measures to minimize such impacts.

2.1 Approach to the Analysis

Section 7(a)(2) of the ESA requires Federal agencies to consult with NMFS 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. 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.

"To jeopardize the continued existence of a listed species" means to engage in an action that 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 (50 CFR 402.02).

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.[18]

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.
- Describe the environmental baseline in the action area.
- Analyze the effects of the proposed action on both species and their habitat.
- Describe any cumulative effects in the action area.
- Integrate and synthesize the above factors to assess the risk that the proposed action poses to species and critical habitat.
- Reach jeopardy and adverse modification conclusions.
- If necessary, define a reasonable and prudent alternative to the proposed action.

2.2 Rangewide Status of the Species and Critical Habitat

This opinion examines the status of each species that would be affected by the proposed action. The status is the level of risk that the listed species face, based on parameters considered in documents such as recovery plans, status reviews, and listing decisions. The species status section helps to inform the description of the species' current "reproduction, numbers, or distribution" as described in 50 CFR 402.02. The opinion also examines the condition of critical

[18] Memorandum from William T. Hogarth to Regional Administrators, Office of Protected Resources, NMFS (Application of the "Destruction or Adverse Modification" Standard Under Section 7(a)(2) of the Endangered Species Act) (November 7, 2005).

habitat throughout the designated area, evaluates the conservation value of the various watersheds and coastal and marine environments that make up the designated area, and discusses the current function of the essential physical and biological features that help to form that conservation value.
One factor affecting the status of ESA-listed species considered in this opinion, and aquatic habitat at large is climate change.

2.2.1 Status of Listed Species

For Pacific salmon, steelhead, and other relevant species NMFS commonly uses four parameters to assess the viability of the populations that, together, constitute the species: spatial structure, diversity, abundance, and productivity (McElhany *et al*. 2000). These "viable salmonid population" (VSP) criteria therefore encompass the species' "reproduction, numbers, or distribution" as described in 50 CFR 402.02. When these parameters are collectively at appropriate levels, they maintain a population's capacity to adapt to various environmental conditions and allow it to sustain itself in the natural environment. These attributes are influenced by survival, behavior, and experiences throughout a species' entire life cycle, and these characteristics, in turn, are influenced by habitat and other environmental conditions.

"Spatial structure" refers both to the spatial distributions of individuals in the population and the processes that generate that distribution. A population's spatial structure depends fundamentally on habitat quality and spatial configuration and the dynamics and dispersal characteristics of individuals in the population.

"Diversity" refers to the distribution of traits within and among populations. These range in scale from DNA sequence variation at single genes to complex life history traits (McElhany *et al.* 2000).

"Abundance" generally refers to the number of naturally-produced adults (*i.e.*, the progeny of naturally-spawning parents) in the natural environment (*e.g.*, on spawning grounds).

"Productivity," as applied to viability factors, refers to the entire life cycle; *i.e.*, the number of naturally-spawning adults produced per parent. When progeny replace or exceed the number of parents, a population is stable or increasing. When progeny fail to replace the number of parents, the population is declining. McElhany *et al*. (2000) use the terms "population growth rate" and "productivity" interchangeably when referring to production over the entire life cycle. They also refer to "trend in abundance," which is the manifestation of long-term population growth rate.

For species with multiple populations, once the biological status of a species' populations has been determined, NMFS assesses the status of the entire species using criteria for groups of populations, as described in recovery plans and guidance documents from technical recovery teams. Considerations for species viability include having multiple populations that are viable, ensuring that populations with unique life histories and phenotypes are viable, and that some viable populations are both widespread to avoid concurrent extinctions from mass catastrophes and spatially close to allow functioning as metapopulations (McElhany *et al.* 2000).

The summaries that follow describe the status of the ESA-listed species, and their designated critical habitats, that occur within the geographic area of this proposed action and are considered in this opinion.
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 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. Warming is likely to continue during the next century as average temperatures increase another 3 to 10°F. 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. 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. 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 interannual 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; USGCRP 2009; Zabel *et al.* 2006). Ocean conditions adverse to salmon and steelhead may be more likely under a warming climate (Zabel *et al.* 2006).
The status of species and critical habitat sections below are organized under four recovery domains (Table 5) to better integrate recovery planning information that NMFS is developing on the conservation status of the species and critical habitats considered in this consultation.

Table 5. Recovery planning domains identified by NMFS and their ESA-listed salmon and steelhead species.

Recovery Domain	Species
Willamette-Lower Columbia (WLC)	LCR Chinook salmon UWR Chinook salmon CR chum salmon LCR coho salmon LCR steelhead UWR steelhead
Interior Columbia (IC)	UCR spring-run Chinook salmon SR spring/summer-run Chinook salmon SR fall-run Chinook salmon SR sockeye salmon MCR steelhead UCR steelhead SRB steelhead
Oregon Coast (OC)	OC coho salmon
Southern Oregon/Northern California Coasts (SONCC)	SONCC 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 evolutionarily significant units (ESU) that, if met, would indicate that an ESU will have a negligible risk of extinction over a 100-year time frame.[19]

Although the TRTs operated from the 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).
The abundance and productivity (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

[19] For Pacific salmon, NMFS uses its 1991 ESU policy, that states that a population or group of populations will be considered a Distinct Population Segment if it is an Evolutionarily Significant Unit. An ESU represents a distinct population segment of Pacific salmon under the Endangered Species Act that: (1) is substantially reproductively isolated from conspecific populations; and (2) represents an important component of the evolutionary legacy of the species. The species *O. mykiss* is under the joint jurisdiction of NMFS and the Fish and Wildlife Service, so in making its listing January, 2006 determinations NMFS elected to use the 1996 joint FWS-NMFS DPS policy for this species.

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 spatial structure and diversity (SS/D) risk combines risk for likely, future environmental conditions, and diversity (Ford 2011; McElhany *et al.* 2007; McElhany *et al.* 2000). 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 is at a 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 are 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.

Overall viability risk scores (high to low) and population persistence scores are based on combined ratings for the A&P and SS/D[20] metrics (Table 6) (McElhany *et al.* 2006). Persistence probabilities, which are provided here for Lower Columbia River salmon and steelhead, are the complement of a population's extinction risk (*i.e.*, persistence probability = 1 – extinction risk) (NMFS 2012c). The IC-TRT has provided viability criteria that are based on McElhany (2000) and McElhany (2006), as well as the results of previous applications in other TRTs and a review of specific information available relative to listed IC ESU populations (Ford 2011; IC-TRT 2007).

[20] 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 6. Population persistence categories from McElhany *et al.* (2006). A low or negligible risk of extinction is considered "viable" (Ford 2011). 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 2011).

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 were 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 TRTs have divided the 15 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).

The size and distribution of the populations considered in this opinion generally have declined over the last few decades due to natural phenomena and human activity, including climate change (as described in Section 2.2), the operation of hydropower systems, over-harvest, effects of hatcheries, and habitat degradation. Enlarged populations of terns, seals, California sea lions, and other aquatic predators in the Pacific Northwest may be limiting the productivity of some Pacific salmon and steelhead populations (Ford 2011).

Viability status or probability or population persistence is described below for each of the populations considered in this opinion. Although southern distinct population segment (DPS) eulachon are part of more than one recovery domain structure, they are presented below for convenience as part of the WLC recovery domain.

Willamette-Lower Columbia Recovery Domain. Species in the WLC recovery domain we considered include LCR Chinook salmon, UWR Chinook salmon, CR chum salmon, LCR coho salmon, LCR steelhead, UWR steelhead, and southern DPS eulachon. The WLC-TRT has identified 107 demographically independent populations of Pacific salmon and steelhead (Table

7). 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.

Table 7. Populations in the WLC recovery domain. Combined extinction risks for salmon and steelhead based on an analysis of Oregon populations.

Species	Populations
LCR Chinook salmon	32
UWR Chinook salmon	7
CR chum salmon	17
LCR coho salmon	24
LCR steelhead	23
UWR steelhead	4

Status of 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.[21] 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 8). 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 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 2012c).

[21] 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 2011b).

Table 8. 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 2012c). 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	H
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 2012c). Low abundance of natural-origin spawners (100 fish or fewer) has increased genetic and demographic risks. Other LCR Chinook 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 2012c; 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

Status of UWR Chinook Salmon

Spatial Structure and Diversity. 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 9). The McKenzie River population currently characterized as at a “low” risk of extinction and the Clackamas population has a “moderate” risk. (Ford 2011). 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. Clackamas River Chinook salmon have a “low” risk rating for spatial structure (Ford 2011).

Table 9. 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

Abundance and Productivity. The Clackamas and McKenzie river populations currently have the best risk ratings for A&P, spatial structure, and diversity. Data collected since the BRT status update in 2005 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 include (NOAA Fisheries 2011; ODFW and NMFS 2011):

- 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%

Status of 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 10). CR chum salmon spawning aggregations identified in the mainstem Columbia River were included in the population associated with the nearest river basin.

Table 10. 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 2012c). 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.

The very low persistence probabilities or possible extirpations of most chum salmon populations are due to low abundance, productivity, spatial structure, and diversity. Although, hatchery production of chum salmon has been limited and hatchery effects on diversity are thought to have been relatively small, diversity has been greatly reduced at the ESU level because of presumed extirpations and the low abundance in the remaining populations (fewer than 100 spawners per year for most populations)(Lower Columbia Fish Recovery Board 2010; NMFS 2012c). The Lower Gorge population meets abundance and productivity criteria for very high levels of viability, but the distribution of spawning habitat (*i.e.*, spatial structure) for the population has been significantly reduced (Lower Columbia Fish Recovery Board 2010); spatial structure may need to be improved, at least in part, through better performance from the Oregon portion of the population (NMFS 2012c).

Abundance and Productivity. Of the 17 populations that historically made up this ESU, 15 of them (six in Oregon and nine in Washington) are so depleted that either their baseline probability of persistence is very low or they are extirpated or nearly so (Ford 2011; Lower Columbia Fish Recovery Board 2010; NMFS 2012c; ODFW 2010). All three strata in the ESU fall significantly short of the WLC-TRT criteria for viability. Currently almost all natural production occurs in just two populations: the Grays/Chinook and the Lower Gorge. The Grays/Chinook population has a moderate persistence probability, and the Lower Gorge population has a high probability of persistence (Lower Columbia Fish Recovery Board 2010; NMFS 2012c).

Limiting Factors include (NMFS 2012c; 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, in particular of floodplain connectivity and function, channel structure and complexity, stream substrate, and riparian areas and large wood recruitment as a result of cumulative impacts of agriculture, forestry, and development
- Degraded stream flow as a result of hydropower and water supply operations
- Loss of access and loss of some habitat types as a result of passage barriers such as roads and railroads
- Reduced water quality
- Current or potential predation from hatchery-origin salmonids, including coho 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

Status of 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 White Salmon and Hood rivers; in the Willamette River to Willamette Falls, Oregon; and progeny of 25 artificial propagation programs.[22] 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 2012c). Out of the 24 populations that make up this ESU (Table 11), 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 2012c; ODFW 2010).

[22] 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 2011b).

Table 11. 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 2012c). 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 2012c). 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 2011b; NMFS 2012c).

Limiting Factors include (NMFS 2012c; 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

Status of 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 12).[23] The DPS also includes the progeny of ten artificial propagation programs.[24] 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.

[23] 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 2009).

[24] 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 2011b).

Table 12. 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 2012c). Persistence probability 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 2012c; ODFW 2010). All four strata in the DPS fall short of the WLC-TRT criteria for viability (NMFS 2012c).

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 2012c; 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 12) (Lower Columbia Fish Recovery Board 2010; NMFS 2012c; 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 2012c). 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 2012c).

Limiting Factors include (NMFS 2012c; 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

Status of UWR Steelhead

Spatial Structure and Diversity. 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. One stratum and four extant populations of UWR steelhead occur within the DPS (Table 13). Historical observations, hatchery records, and genetics suggest that the presence of UWR steelhead in many tributaries on the west side of the upper basin is the result of recent introductions. Nevertheless, the WLC-TRT recognized that although west side UWR steelhead does not represent a historical population, those tributaries may provide juvenile rearing habitat or may be temporarily (for one or more generations) colonized during periods of high abundance. Hatchery summer-run steelhead that are released in the subbasins are from an out-of-basin stock, not part of the DPS. Additionally, stocked summer steelhead that have become established in the McKenzie River were not considered in the identification of historical populations (ODFW and NMFS 2011).

Table 13. 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

Abundance and Productivity. 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 include (NOAA Fisheries 2011; ODFW and NMFS 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.

Status of Southern DPS Eulachon

Spatial Structure and Diversity. The southern DPS of eulachon occur in four salmon recovery domains: Puget Sound, the Willamette and Lower Columbia, Oregon Coast, and Southern Oregon/Northern California Coasts. 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.

Abundance and Productivity. 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 (Joint Columbia River Management Staff 2009), and since 2005, the fishery has operated at the most conservative level allowed in the management plan (Joint Columbia River Management Staff 2009). 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).

Limiting Factors include (Gustafson *et al.* 2011; Gustafson *et al.* 2010; NOAA Fisheries 2011):

- Changes in ocean conditions due to climate change, 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.
- 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)
- Bycatch of eulachon in commercial fisheries
- Adverse effects related to dams and water diversions
- Artificial fish passage barriers
- Increased water temperatures, insufficient streamflow
- Altered sediment balances
- Water pollution
- Over-harvest
- Predation

Interior Columbia Recovery Domain. Species in the Interior Columbia (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 14). 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.

Table 14. Populations of ESA-listed salmon and steelhead in the IC recovery domain.

Species	Populations
UCR spring-run Chinook salmon	3
SR spring/summer-run Chinook salmon	28
SR fall-run Chinook salmon	1
SR sockeye salmon	1
MCR steelhead	17
UCR steelhead	4
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; NRC 1995).

Status of UCR Spring-Run Chinook Salmon

Spatial Structure and Diversity. 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 (excluding the Okanogan River), the Columbia River upstream to Chief Joseph Dam, 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 (Ford 2011; IC-TRT 2003)(Table 15).

Table 15. Scores for the key elements (A/P, diversity, and SS/D) used to determine current overall viability risk for spring-run UCR Chinook salmon (Ford 2011). Risk ratings range from very low (VL), low (L), moderate (M), high (H), to very high (VH), and extirpated.

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				E

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 Upper Columbia Spring 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).

Abundance and Productivity. UCR spring-run Chinook salmon 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 (Table 15). 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.

Limiting Factors include (NOAA Fisheries 2011; Upper Columbia Salmon Recovery Board 2007):

- 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

Status of SR Spring/Summer-Run Chinook Salmon

Spatial Structure and Diversity**.** 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 currently believes there are 27 extant and 4 extirpated populations of SR spring/summer-run Chinook salmon, and aggregated these into major population groups (Ford 2011; IC-TRT 2007). Each of these populations faces a "high" risk of extinction (Ford 2011) (Table 16).

Table 16. 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.

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 (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).

Abundance and Productivity. 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 (Table 16). 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.

Limiting Factors include (NOAA Fisheries 2011):

- 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

Status of SR Fall-Run Chinook Salmon

Spatial Structure and Diversity. 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 (Ford 2011; IC-TRT 2003). 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).

Abundance and Productivity. 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." 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."[25]

Limiting Factors include (NOAA Fisheries 2011):

[25] "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.

- 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.
- Harvest-related effects
- Loss of access to historic habitat above Hells Canyon and other Snake River dams
- Mainstem Columbia River and Snake River hydropower impacts
- Hatchery-related effects
- Degraded estuarine and nearshore habitat

Status of SR Sockeye Salmon

Spatial Structure and Diversity. 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).

Abundance and Productivity. 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 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).

Limiting Factors. 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 likely reduce the survival of adult sockeye returning to the Stanley 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 (Reed *et al.* 2003) (*e.g.*, > 50% mortality in one year) 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).

Status of MCR Steelhead

Spatial Structure and Diversity. 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 17) (Ford 2011; NMFS 2009).

Table 17. 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 (Ford 2011; NMFS 2009). Risk ratings range from very low (VL), low (L), moderate (M), high (H), to very high (VH), and extirpated (E). 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				E*
	Crooked River				E*
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).

Straying frequencies into at least the Lower John Day River population are high. Out-of-basin hatchery stray proportions, although reduced, remain very high in the Deschutes River basin.

Abundance and Productivity. 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. 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 (2005) remain as concerns or key uncertainties. Natural origin spawning estimates of populations have been highly variable with respect to meeting minimum abundance thresholds. Overall, the new information considered does not indicate a change in the biological risk category since the last status review (Ford 2011).

Limiting Factors include (NMFS 2009; NOAA Fisheries 2011):

- 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

Status of UCR Steelhead

Spatial Structure and Diversity. 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 UC spring-run Chinook salmon (*i.e.*, Wenatchee, Entiat, Methow, and Okanogan; Table 18) and, similarly, no major population groupings were identified due to the relatively small geographic area involved (Ford 2011; IC-TRT 2003). All extant populations are considered to be at high risk of extinction (Table 18)(Ford 2011). With the exception of the Okanogan population, the Upper Columbia 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. The proportions of hatchery origin returns in natural spawning areas remain extremely high across the DPS, especially in the Methow and Okanogan River populations. Overall, the new information considered does not indicate a change in the biological risk category since the last status review (Ford 2011).

Table 18. 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

Abundance and Productivity. Upper Columbia steelhead populations have increased in natural origin abundance in recent years, but productivity levels remain low. 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.

Limiting Factors include (NOAA Fisheries 2011; Upper Columbia Salmon Recovery Board 2007):

- 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

Status of SRB Steelhead

Spatial Structure and Diversity. 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 19) (Ford 2011; IC-TRT 2011). The IC-TRT has not assessed the viability of this species. 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 19. 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; NMFS 2011c). 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	*	M	M	H
	Asotin Creek	*	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	*	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	MT
	South Fork Salmon	*	L	L	H
	Secesh River	*	L	L	H
	Chamberlain Creek	*	L	L	H
	Lower MF Salmon	*	L	L	H
	Upper MF Salmon	*	L	L	H
	Panther Creek	*	M	H	H
	North Fork Salmon	*	M	M	MT
	Lemhi River	*	M	M	MT
	Pahsimeroi River	*	M	M	MT
	East Fork Salmon	*	M	M	MT
	Upper Main Salmon	*	M	M	MT
Imnaha	Imnaha River	M		M	MT

* These ratings are uncertain due to a lack of population-specific data.

Abundance and Productivity. 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.

Limiting Factors include (IC-TRT 2011; NMFS 2011c):

- 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 Recovery Domain. Species we considered in the OC recovery domain include OC coho salmon, and southern DPS eulachon, in 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.

Status of OC Coho Salmon

Spatial Structure and Diversity. This species includes populations of coho salmon in Oregon coastal streams south of the Columbia River and north of Cape Blanco. The Cow Creek stock (South Umpqua population) is included as part of the ESU because the original brood stock was founded from the local, natural origin population and natural origin coho salmon have been incorporated into the brood stock on a regular basis.

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 5 biogeographic strata (Table 20)(Lawson *et al.* 2007).

Table 20. 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) (Lawson *et al.* 2007; McElhany *et al.* 2000).

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

A 2010 BRT noted significant improvements in hatchery and harvest practices have been made (Stout *et al.* 2011). However, harvest and hatchery reductions have changed the population dynamics of the ESU. Current concerns for spatial structure focus on the Umpqua River. Of the four populations in the Umpqua stratum, 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.

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.

Abundance and Productivity. 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. Wainwright (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.

Limiting Factors include (NOAA Fisheries 2011; Stout *et al.* 2011):

- 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

Southern Oregon and Northern California Coasts Recovery Domain. Species we considered in the SONCC recovery domain include coho salmon, and southern DPS eulachon. The SONCC recovery domain extends from Cape Blanco, Oregon, to Punta Gorda, California. This area includes many small-to-moderate-sized coastal basins, where high quality habitat occurs in the lower reaches of each basin, and three large basins (Rogue, Klamath and Eel) where high quality habitat is in the lower reaches, little habitat is provided by the middle reaches, and the largest amount of habitat is in the upper reaches of the subbasins.

Status of SONCC Coho Salmon

Spatial Structure and Diversity. This species includes all naturally-spawned populations of coho salmon in coastal streams from the Elk River near Cape Blanco, Oregon, through and including the Mattole River near Punta Gorda, California, and progeny of three artificial propagation programs (NMFS 2012d). Williams *et al.* (2006) designated 45 populations of coho salmon in the SONCC coho salmon ESU. These populations were further grouped into seven diversity strata based on the geographical arrangement of the populations and basin-scale genetic, environmental, and ecological characteristics (Table 21).

Table 21. SONCC coho salmon populations in Oregon. Williams (2006) classified populations as dependent or independent based on their historic population size. 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). Core population types are independent populations judged most likely to become viable most quickly. Non-core 1 population types are independent populations judged to have lesser potential for rapid recovery than the core 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. Two ephemeral populations (E) are defined as populations both small enough and isolated enough that they are only intermittently present (McElhany *et al.* 2000; NMFS 2012d; Williams *et al.* 2006).

Stratum	Population	Population Type
Northern Coastal	Elk River	FI Core
	Hubbard Creek	E
	Brush Creek	D
	Mussel Creek	D
	Euchre Creek	E
	Lower Rogue River	PI Non-Core 1
	Hunter Creek	D
	Pistol River	D
	Chetco River	FI Core
	Winchuck River*	PI Non-Core 1
Interior Rogue	Upper Rogue River	FI Core
	Middle Rogue/Applegate*	FI Non-Core 1
	Illinois River*	FI Core
Interior Klamath	Upper Klamath River*	FI Core
Central Coastal	Smith River*	FI Core

* Populations that also occur partly in California.

NMFS considered the role each population is expected to play in a recovered ESU to determine population abundance and juvenile occupancy targets for all the populations in the SONCC coho salmon ESU. Independent populations are evaluated using a modified Bradbury (1995) framework. This model uses three groupings of criteria for ranking watersheds for Pacific salmon restoration prioritization: (1) biological and ecological resources (Biological Importance); (2) watershed integrity and salmonid extinction risk (Integrity and Risk); and (3) potential for restoration (Optimism and Potential). Scores for Biological Importance are based on the concept of VSPs (McElhany *et al.* 2000), and are used to describe the current status of the population – population size, productivity, spatial structure, and diversity. "Core" populations were designated based on current condition, geographic location in the ESU, low risk threshold compared to the number of spawners needed for the entire stratum, and other factors. "Non-core 1" populations are in the moderate risk threshold, which is the depensation threshold[26] multiplied by four. NMFS chooses this target if the population is likely to ultimately produce considerably more than the depensation threshold, but less than the low risk threshold.

The draft recovery plan establishes the following criteria at the ESU, diversity strata, and population scales to measure whether the recovery objectives are met (NMFS 2012d).

VSP Parameter	Population Type	Recovery Objective	Recovery Criteria
Abundance	Core	Low risk of extinction.	The geometric mean of wild spawners over 12 years at least meets the "low risk threshold" of spawners for each core population
	Non-Core 1	Moderate or low risk of extinction.	The annual number of wild spawners meets or exceeds the moderate risk threshold for each non-core population
Productivity	Core and Non-Core 1	Population growth rate is not negative.	Slope of regression of the geometric mean of wild spawners over the time series ≥ zero
Spatial Structure	Core and Non-Core 1	Ensure populations are widely distributed.	Annual within-population distribution ≥ 80% of habitat (outside of a temperature mask)
	Non-Core 2 and Dependent	Achieve inter- and intra-stratum connectivity.	20% of accessible habitat is occupied in years following spawning of cohorts that experienced good marine survival
Diversity	Core and Non-Core 1	Achieve low or moderate hatchery impacts on wild fish.	Proportion of hatchery-origin spawners (pHOS) ≤ 0.10
	Core and Non-Core 1	Achieve life history diversity.	Variation is present in migration timing, age structure, size and behavior. Variation in these parameters is retained.

Abundance and Productivity. Although long-term data on abundance of SONCC coho salmon are scarce, available evidence from shorter-term research and monitoring efforts indicate that conditions have worsened for populations since the last formal status review was published (Good *et al.* 2005; NMFS 2012d). Because the extinction risk of an ESU depends upon the extinction risk of its constituent independent populations and the population abundance of most independent populations are below their depensation threshold, the SONCC coho salmon ESU is at high risk of extinction and is not viable (NMFS 2012d; Williams *et al.* 2008).

Limiting Factors. Threats from natural or man-made factors have worsened in the past 5 years, primarily due to four factors: small population dynamics, climate change, multi-year drought, and poor ocean survival conditions (NMFS 2012d; NOAA Fisheries 2011). Limiting factors include:

- Lack of floodplain and channel structure
- Impaired water quality
- Altered hydrologic function (timing of volume of water flow)
- Impaired estuary/mainstem function
- Degraded riparian forest conditions
- Altered sediment supply

[26] Williams (2008) defines the depensation threshold as one spawner per km of stream with estimated rearing potential or Intrinsic Potential.

- Increased disease/predation/competition
- Barriers to migration
- Adverse fishery-related effects
- Adverse hatchery-related effects

2.2.2 Status of the Critical Habitats

This section examines the status of designated critical habitat affected by the proposed action by examining the condition and trends of essential physical and biological features throughout the designated areas. These features are essential to the conservation of the listed species because they support one or more of the species' life stages (*e.g.*, sites with conditions that support spawning, rearing, migration and foraging).

For salmon and steelhead, NMFS ranked watersheds within designated critical habitat at the scale of the fifth-field hydrologic unit code (HUC_5) in terms of the conservation value they provide to each listed species they support.[27] The conservation rankings are high, medium, or low. To determine the conservation value of each watershed to species viability, NMFS' critical habitat analytical review teams (CHARTs) evaluated the quantity and quality of habitat features (for example, spawning gravels, wood and water condition, side channels), the relationship of the area compared to other areas within the species' range, and the significance to the species of the population occupying that area (NOAA Fisheries 2005). Thus, even a location that has poor quality of habitat could be ranked with a high conservation value if it were essential due to factors such as limited availability (*e.g.*, one of a very few spawning areas), a unique contribution of the population it served (*e.g.*, a population at the extreme end of geographic distribution), or the fact that it serves another important role (*e.g.*, obligate area for migration to upstream spawning areas).

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 (Table 22-23). 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 yolk sac depletion, 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 22. Primary constituent elements (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, SR sockeye salmon, and SONCC coho salmon), and corresponding species life history events.

[27] The conservation value of a site depends upon "(1) the importance of the populations associated with a site to the ESU [or DPS] conservation, and (2) the contribution of that site to the conservation of the population through demonstrated or potential productivity of the area" (NOAA Fisheries 2005).

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 23. PCEs of critical habitats designated for SR spring/summer-run Chinook salmon, SR fall-run Chinook salmon, SR sockeye salmon, SONCC coho 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

<u>CHART Salmon and Steelhead Critical Habitat Assessments</u>. The CHART for each recovery domain 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 are also essential for conservation. The CHARTs assigned a 0 to 3 point score for the PCEs in each HUC_5 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

HUC_5 watershed; and Factor 3 (quality – potential condition), which considers the likelihood of achieving PCE potential in the HUC_5 watershed, either naturally or through active conservation/restoration, given known limiting factors, likely biophysical responses, and feasibility.

Southern DPS Eulachon. Critical habitat for eulachon includes portions of 16 rivers and streams in California, Oregon, and Washington (USDC 2011). 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. Table 24 delineates the designated physical or biological features for eulachon.

Table 24. Physical or biological features of critical habitats designated for eulachon and corresponding species life history events.

Physical or biological features		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

The range of eulachon in the Pacific Northwest completely overlaps with the range of several ESA-listed stocks of salmon and steelhead. Although the habitat requirements of these fishes differ somewhat from eulachon, efforts to protect habitat generally focus on the maintenance of watershed processes that would be expected to benefit eulachon. The BRT identified dams and water diversions as moderate threats to eulachon in the Columbia and Klamath rivers where hydropower generation and flood control are major activities. Degraded water quality is common in some areas occupied by southern DPS eulachon. In the Columbia and Klamath systems, large-scale impoundment of water has increased winter water temperatures, potentially altering the water temperature during eulachon spawning periods (Gustafson *et al.* 2010). Numerous chemical contaminants are also present in spawning rivers, but the exact effect these compounds have on spawning and egg development is unknown (Gustafson *et al.* 2010). The BRT identified dredging as a low to moderate threat to eulachon in the Columbia River. Dredging during eulachon spawning would be particularly detrimental because eggs could be destroyed by mechanical disturbance or smothered by in-water disposal of dredged materials. The lower Columbia River mainstem provides spawning and incubation sites, and a large migratory corridor to spawning areas in the tributaries. Prior to the construction of Bonneville Dam, eulachon ascended the Columbia River as far as Hood River, Oregon. Major tributaries that support spawning runs include the Grays, Skamokawa, Elochoman, Kalama, Lewis and Sandy rivers.

The number of eulachon returning to the Umpqua River seems to have declined in the 1980s, and does not appear to have rebounded to previous levels. Additionally, eulachon are regularly caught in salmonid smolt traps operated in the lower reaches of Tenmile Creek by the Oregon Department of Fish and Wildlife (ODFW).

Willamette-Lower Columbia 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. 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 (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 (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 ACOE. 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.* 2002b).

Riparian forests have diminished considerably in the lower reaches of the Willamette River (Gregory *et al.* 2002c). 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.* (2002c) 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 (Fernald *et al.* 2001; Wentz *et al.* 1998). 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 2011d; NMFS 2012c). 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 2011d; NMFS 2012c). 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 ACOE. 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, 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 2011d; NMFS 2012c). 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 (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 2011d; NMFS 2012c). Diking and filling activities have reduced the tidal prism and eliminate emergent and forested wetlands and floodplain habitats. These changes have likely 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 aquatic resources (Lower Columbia River Estuary Partnership 2007). Contaminants of concern include dioxins and furans, heavy metals, polychlorinated biphenyls (PCBs) and organochlorine pesticides such as DDT (dichloro-diphenyl-trichloroethane). 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 have likely 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 most HUC_5 watersheds with PCEs for salmon or steelhead are in fair-to-poor or fair-to-good condition. However, most of these watersheds have some or a high potential for improvement. Only watersheds in the upper McKenzie River and its tributaries are in good to excellent condition with no potential for improvement (Table 25).

Table 25. **Willamette-Lower Columbia Recovery Domain:** Current and potential quality of HUC_5 watersheds identified as supporting historically independent populations of ESA-listed Chinook salmon (CK), chum salmon (CM), and steelhead (ST) (NOAA Fisheries 2005).[28] Watersheds are ranked primarily by "current quality" and secondly by their "potential for restoration."

Current PCE Condition	Potential PCE Condition
3 = good to excellent	3 = highly functioning, at historical potential
2 = fair to good	2 = high potential for improvement
1 = fair to poor	1 = some potential for improvement
0 = poor	0 = little or no potential for improvement

Watershed Name(s) and HUC_5 Code(s)	Listed Species	Current quality	Restoration Potential
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 and 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

[28] On January 14, 2013, NMFS published a proposed rule for the designation of critical habitat for LCR coho salmon and Puget Sound steelhead (USDC 2013). A draft biological report, which includes a CHART assessment for LCR coho salmon, was also completed (NMFS 2012a). Habitat quality assessments for LCR coho salmon are out for review; therefore, they are not included on this table.

Current PCE Condition	Potential PCE Condition
3 = good to excellent	3 = highly functioning, at historical potential
2 = fair to good	2 = high potential for improvement
1 = fair to poor	1 = some potential for improvement
0 = poor	0 = little or no potential for improvement

Watershed Name(s) and HUC$_5$ Code(s)	Listed Species	Current quality	Restoration Potential
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"		
Willamette River #1709000xxx			
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
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)	CK/ST	2/2	3/2

Current PCE Condition	Potential PCE Condition
3 = good to excellent	3 = highly functioning, at historical potential
2 = fair to good	2 = high potential for improvement
1 = fair to poor	1 = some potential for improvement
0 = poor	0 = little or no potential for improvement

Watershed Name(s) and HUC$_5$ Code(s)	**Listed Species**	**Current quality**	**Restoration Potential**
Clackamas rivers			
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

Interior Columbia 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 (NMFS 2009; Wissmar *et al.* 1994). 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 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. 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 recovery domain 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 with PCEs for Chinook salmon or steelhead are in good to excellent condition with no potential for improvement. Overall, most IC recovery domain watersheds are in fair-to-poor or fair-to-good condition. However, most of these watersheds have some or high potential for improvement. In Washington, the Upper Methow, Lost, White, and Chiwawa watersheds are in good-to-excellent condition with no potential for improvement. In Oregon, only the Lower Deschutes, Minam, Wenaha, and Upper and Lower Imnaha Rivers HUC_5 watersheds are in good-to-excellent condition with no potential for improvement. In Idaho, a number of watersheds with PCEs for steelhead (Upper Middle Salmon, Upper Salmon/Pahsimeroi, Middle Fork Salmon, Little Salmon, Selway, and Lochsa rivers) are in good-to-excellent condition with no potential for improvement. Additionally, several Lower Snake River HUC_5 watersheds in the Hells Canyon area, straddling Oregon and Idaho, are in good-to-excellent condition with no potential for improvement (Table 26).

Table 26. **Interior Columbia Recovery Domain:** Current and potential quality of HUC_5 watersheds identified as supporting historically independent populations of ESA-listed Chinook salmon (CK) and steelhead (ST) (NOAA Fisheries 2005). Watersheds are ranked primarily by "current quality" and secondly by their

"potential for restoration."

Current PCE Condition	Potential PCE Condition
3 = good to excellent	3 = highly functioning, at historical potential
2 = fair to good	2 = high potential for improvement
1 = fair to poor	1 = some potential for improvement
0 = poor	0 = little or no potential for improvement

Watershed Name and HUC$_5$ Code(s)	Listed Species	Current Quality	Restoration Potential
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	ST	2	2

Current PCE Condition	Potential PCE Condition
3 = good to excellent	3 = highly functioning, at historical potential
2 = fair to good	2 = high potential for improvement
1 = fair to poor	1 = some potential for improvement
0 = poor	0 = little or no potential for improvement

Watershed Name and HUC$_5$ Code(s)	Listed Species	Current Quality	Restoration Potential
(605) creeks			
Ladd Creek (406); Phillips/Willow Creek (408); Upper (501) & Middle (503) Wallowa rivers; & Lower Grande Ronde River/Menatche Creek (607)	ST	1	3
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 and 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 and 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

Current PCE Condition	Potential PCE Condition
3 = good to excellent	3 = highly functioning, at historical potential
2 = fair to good	2 = high potential for improvement
1 = fair to poor	1 = some potential for improvement
0 = poor	0 = little or no potential for improvement

Watershed Name and HUC_5 Code(s)	Listed Species	Current Quality	Restoration Potential
Agency Creek (404)	ST	1	1
Panther Creek/Spring Creek (320) & Clear Creek (323)	ST	0	3
Big Deer Creek (321)	ST	0	1
Mid-Salmon-Chamberlain, South Fork, Lower, and Middle Fork Salmon #1706020xxx			
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 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)	ST	3	3
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 and 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	ST	3	3

Current PCE Condition	Potential PCE Condition
3 = good to excellent	3 = highly functioning, at historical potential
2 = fair to good	2 = high potential for improvement
1 = fair to poor	1 = some potential for improvement
0 = poor	0 = little or no potential for improvement

Watershed Name and HUC_5 Code(s)	Listed Species	Current Quality	Restoration Potential
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			
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 River/Pine Creek (606); & Upper Potlatch River (607); Lower (615), Middle (616) & Upper (618) Lolo creeks	ST	2	2
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

Current PCE Condition	Potential PCE Condition
3 = good to excellent	3 = highly functioning, at historical potential
2 = fair to good	2 = high potential for improvement
1 = fair to poor	1 = some potential for improvement
0 = poor	0 = little or no potential for improvement

Watershed Name and HUC$_5$ Code(s)	Listed Species	Current Quality	Restoration Potential
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
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"		

Oregon Coast 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.

Oregon's assessment of OC coho salmon (Nicholas *et al.* 2005) mapped how streams with high intrinsic potential for 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, had the lowest number of improving sites.

Southern Oregon/Northern California Coasts Recovery Domain. In this recovery domain critical habitat has been designated for SONCC coho salmon. Many large and small rivers supporting significant populations of coho salmon flow through this area, including the Elk, Rogue, Chetco, Smith and Klamath. The following summary of critical habitat information in the Elk, Rogue, and Chetco rivers is also applicable to habitat characteristics and limiting factors in other basins in this area.

The Elk River flows through Curry County, and drains approximately 92 square miles (or 58,678 acres) (Maguire 2001). Historical logging, mining, and road building have degraded stream and riparian habitats in the Elk River basin. Limiting factors identified for salmon and steelhead production in this basin include sparse riparian cover, especially in the lower reaches, excessive fine sediment, high water temperatures, and noxious weed invasions (Maguire 2001).

The Rogue River drains approximately 5,160 square miles within Curry, Jackson and Josephine counties in southwest Oregon. The mainstem is about 200 miles long and traverses the coastal mountain range into the Cascades. The Rogue River estuary has been modified from its historical condition. Jetties were built by the ACOE in 1960, which stabilized and deepened the mouth of the river. A dike that extends from the south shore near Highway 101 to the south jetty was completed in 1973. This dike created a backwater for the large shallow area that existed here, which has been developed into a boat basin and marina, eliminating most of the tidal marsh.

The quantity of estuary habitat is naturally limited in the Rogue River. The Rogue River has a drainage area of 5,160 square miles, but the estuary at 1,880 acres is one of the smallest in Oregon. Between 1960 and 1972, approximately 13 acres of intertidal and 14 acres of subtidal land were filled in to build the boat basin dike, the marina, north shore riprap and the other north shore developments (Hicks 2005). Jetties constructed in 1960 to stabilize the mouth of the river and prevent shoaling have altered the Rogue River, which historically formed a sill during summer months (Hicks 2005).

The Lower Rogue Watershed Council's watershed analysis (Hicks 2005) lists factors limiting fish production in tributaries to Lower Rogue River watershed. The list includes water temperatures, low stream flows, riparian forest conditions, fish passage and over-wintering habitat. Limiting factors identified for the Upper Rogue River basin include fish passage barriers, high water temperatures, insufficient water quantity, lack of large wood, low habitat complexity, and excessive fine sediment (Rogue Basin Coordinating Council 2006).

The Chetco River estuary has been significantly modified from its historical condition. Jetties were erected by the ACOE in 1957, which stabilized and deepened the mouth of the river. These jetties have greatly altered the mouth of the Chetco River and how the estuary functions as habitat for salmon migrating to the ocean. A boat basin and marina were built in the late 1950s and eliminated most of the functional tidal marsh. The structures eliminated shallow water habitats and vegetation in favor of banks stabilized with riprap. Since then, nearly all remaining bank habitat in the estuary has been stabilized with riprap. The factors limiting fish production in the Chetco River appear to be high water temperature caused by lack of shade, especially in tributaries, high rates of sedimentation due to roads, poor over-wintering habitat due to a lack of large wood in tributaries and the mainstem, and poor quality estuary habitat (Maguire 2001).

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).

As described above in the Status of the Species and Critical Habitat sections, factors that limit the recovery of species considered in this opinion vary with the overall condition of aquatic habitats on private, state, and Federal lands. Within the program-level action area, many stream and riparian areas have been degraded by the effects of land and water use, including road construction, forest management, agriculture, mining, transportation, urbanization, and water development. Each of these economic activities has contributed to a myriad of interrelated factors for the decline of species considered in this opinion. 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. 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.

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 species considered in this opinion, 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 woody debris 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) (Ferguson *et al.* 2005; Williams *et al.* 2005).

Marine fish considered in this opinion 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, steelhead, and eulachon. The primary resident fish predators of salmonids in many areas of the State of Oregon inhabited by anadromous salmon 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 piscivorous predators, predation by birds has and continues to decrease population abundance and productivity.

The existing highway system contributes to a poor environmental baseline condition in several significant ways. Many miles of highway that parallel streams have degraded stream bank conditions by armoring the banks with rip rap, degraded floodplain connectivity by adding fill to floodplains, and discharge untreated or marginally treated highway runoff to streams. Culvert and bridge stream crossings have similar effects, and create additional problems for fish when they act as physical or hydraulic barriers that prevent fish access to spawning or rearing habitat, or contribute to adverse stream morphological changes upstream and downstream of the crossing itself.

The environmental baseline includes the anticipated impacts of all Federal actions in the action area that have already undergone formal consultation. For example, from 2007 through 2012, the Corps authorized 280 restoration actions in Oregon under the SLOPES programmatic consultation and another 397 actions for construction, minor discharge, over- and in-water structures, transportation, streambank stabilization, surveys, and utility lines in habitat affecting ESA-listed fish species (NMFS 2008b; NMFS 2008d). The Corps, Bonneville Power Administration (BPA), and Bureau of Reclamation have consulted on large water management actions, such as operation of the Federal Columbia River Power System, the Umatilla Basin Project, and the Deschutes Project. The U.S. Bureau of Indian Affairs (BIA), U.S. Bureau of Land Management (BLM), and the U.S. Forest Service (USFS) have consulted on Federal land management throughout Oregon, including restoration actions, forest management, livestock grazing, and special use permits. The BPA, NOAA Restoration Center, and USFWS have also consulted on large restoration programs that consist of actions designed to address species limiting factors or make contributions that would aid in species recovery. 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.

The precise project-level action area for each restoration project is not yet known, so the current condition of fish or critical habitats in each project area, the factors responsible for that condition, and the conservation value of each site can only be partially described. Therefore, to complete the jeopardy and destruction or adverse modification of critical habitat analyses in this consultation, NMFS made the following assumptions regarding the environmental baseline in each area that will eventually be chosen to support an action:

1. The purpose of the proposed program is to implement habitat restoration and fish passage improvements for the benefit of populations of ESA-listed species.
2. Each individual action area will be occupied by one or more populations of ESA-listed species.
3. Restoration projects will occur as sites where the biological requirements of individual fish of ESA-listed species are not being fully met due, in part, to the presence of impaired fish passage, floodplain fill, streambank degradation, or degraded channel or riparian conditions.
4. Restoration projects will occur at sites where the biological requirements of individual fish of ESA-listed species are not being due to one or more impaired aquatic habitat functions related to any of the habitat factors limiting the recovery of the species in that area.

The action area for some previously consulted on actions is likely to overlap with the project-level action area for transportation and restoration projects that will be authorized or conducted by the Corps. Impacts to the environmental baseline from these previous actions include a wide range of short and long-term effects that maybe adverse or beneficial.

2.4 Effects of the Action on Species and Designated Critical Habitat

“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 (50 CFR 402.02). Indirect effects are those that are caused by the proposed action and are later in time, but still are reasonably certain to occur.

This analysis begins with an overview of the scope of the SLOPES Restoration program, deconstructs the program and individual types of actions, then examines the general environmental impacts of each of those elements in detail before analyzing their combined impact on species and designated critical habitats. Under the administrative portion of this action, the Corps will evaluate each individual action to ensure that the following conditions are true: (a) The requirements of this opinion are only applied where ESA-listed salmon or steelhead, their designated critical habitats, or both, are present; (b) the anticipated range of effects is within the range considered in this opinion; (c) the action is carried out consistent with the proposed design criteria; and (d) action and program level monitoring and reporting requirements are met. Although that process will not, by itself, affect a listed species or critical habitat, it determines which factors must be considered to analyze the effects of each individual action that will be authorized or completed under this opinion.

A central part of the SLOPES program includes processes for program administration to ensure that individual projects covered by this analysis remain within the scope of effects considered here, and to ensure that the aggregate or program-level effects of those individual projects are also accounted for.

Construction of each action will begin after the Corps' approval. The discussion of the direct physical and chemical effects of this part of the action on the environment will vary depending on the type of restoration or fish passage action being performed, but will all be based on a common set of effects related to construction. Actions involving fish passage restoration, off- or side channel reconstruction, set-back of an existing berm, dike or levee, or removal of a water control structure are likely to have all of the following effects; actions that only involve placement of boulders, gravel or wood will only have a subset of those effects, or will express those effects to a lesser degree.

Construction will have direct physical and chemical effects on the environment that commonly begin with pre-construction activity, such as surveying, minor vegetation clearing, placement of stakes and flagging guides. This requires movement of personnel and sometimes machines over the action area. The next stage, site preparation, may require development of access roads, construction staging areas, and materials storage areas that affect more of the action area. If additional earthwork is necessary to clear, excavate, fill, or shape the site, more vegetation and topsoil may be removed, deeper soil layers exposed, and operations extended into the active channel. The final stage of construction is site restoration. This stage consists of any action necessary to undo disturbance caused by the action, may include replacement of large wood, native vegetation, topsoil, and native channel material displaced by construction, and otherwise restoring ecosystem processes that form and maintain productive fish habitats.

The physical, chemical, and biotic effects of each individual project the Corps authorizes under SLOPES V will vary according to the number and type of elements present, although each element will share, in relevant part, a common set of effects related to pre-construction and construction (Darnell 1976; Spence *et al.* 1996), site restoration (Cramer *et al.* 2003; Cramer 2012), and operation and maintenance. NMFS assumes that every individual project will share some the effects described here in proportion to the project's complexity and footprint proximity to species and critical habitat, but that no action will have effects that are greater than the full range of effects described here, because every action is based on the same set of underlying construction activities or elements, and each element is limited by the same design criteria. The duration of construction required to complete most projects will normally be less than one year, although significant fish passage projects may require additional in-water work or upland work to complete. Projects requiring an environmental impact statement pursuant to the National Environmental Policy Act would be ineligible for coverage under this consultation.

Program administration. The Corps will provide initial design criteria for likely users of this opinion to ensure they are incorporated into all phases of design for each authorized project, and that any unique project or site constraint related to site suitability, right-of-way, special maintenance needs, compensatory mitigation, or cost is resolved early on. Then, the Corps will review each proposed project to ensure that the opinion is being used as intended. The Corps will also obtain an additional approval from NMFS for involves projects that involve (a) fish passage restoration; (b) off- and side-channel habitat restoration; (c) set-back of a berm, dike or levee; or (d) removal of a water control structure any project that will have a substantial effect on fish passage or stream geometry, or has other characteristics that require NMFS's special expertise to determine whether the proposal is consistent with the incidental take statement for this opinion and therefore sufficient to fulfill the Corps' ESA duties. The Corps will also retain the right of reasonable access to each project site so that the use of effectiveness of these design criteria can be monitored if necessary. Further, the Corps will notify NMFS before each project begins construction. Shortly (within 60 days) after inwater work for a project is completed, the Corps or the applicant will submit the completion report portion of the implementation form, along with any pertinent information needed, to ensure that a completed project matches its proposed design.

As an additional program-level check on the continuing effects of the action, the Corps and NMFS will meet at least annually to review implementation of this opinion and opportunities to improve conservation, or make the program overall more effective or efficient. Application of consistent design criteria and engineering improvements to the maximum extent feasible in each recovery domain is likely to gradually reduce the total adverse impacts, improve ecosystem resilience, and contribute to management actions necessary for the recovery of ESA-listed species and critical habitats in Oregon.

Preconstruction. Some restoration projects have little or even no construction footprint in the riparian zone, riparian area, or in the active channel. For example, piling removal and invasive or nonnative plant control have little ground disturbance. Other project footprints extend far into the active channel, such as fish passage restoration and water control structure removal, and may require activities like work area isolation, fish capture, and relocation.

Each construction footprint that extends into a riparian or instream area is likely to have short-term adverse effects due to the physical and chemical consequences of altering those environments, and to have long-term adverse effects due to the impact of maintaining the built environment's encroachment on aquatic habitats. Conversely, under the action as proposed, each project is also likely to have long-term positive effects through application of design criteria that reduce pre-existing impacts by, for example, improving floodplain connectivity, streambank function, water quality, or fish passage.

Preconstruction activities for restoration projects typically include surveying, mapping, placement of stakes and flagging guides, exploratory drilling, minor vegetation clearing, opening access roads, and establishing vehicle and material staging areas.

Surveying, mapping, and the placement of stakes and flagging entail minor movements of machines and personnel over the action area with minimal direct effects but important indirect effects by establishing geographic boundaries that will limit the environmental impact of subsequent activities. The Corps will ensure that work area limits are marked to preserve vegetation and reduce soil disturbance as a fundamental and effective management practice that will to avoid and reduce the impact of all subsequent construction actions.

The Corps will ensure that a suite of erosion and pollution control measures will be applied to any project that involves soil disturbance. Those measures will constrain the use and disposal of all hazardous products, the disposal of construction debris, secure the site against erosion and inundation during high flow events, and ensure that no earthwork will occur at an EPA-designated Superfund Site, a state-designated clean-up area, or in the likely impact zone of a significant contaminant source, as identified by historical information or the Corps' best professional judgment. Any action involving off- and side-channel habitat restoration or set-back of an existing berm, dike or levee must include the results of a site assessment to identify the type, quantity, and extent of any potential contamination.

Establishing access roads and staging areas requires disturbance of vegetation and soils that support floodplain and riparian function, such as delivery of large wood and particulate organic matter, shade, development of root strength for slope and bank stability, and sediment filtering and nutrient absorption from runoff (Darnell 1976; Spence *et al.* 1996). Although the size of areas likely to be adversely affected by actions proposed to be authorized or carried out under this opinion are small, and those effects are likely to be short-term (weeks or months), even small denuded areas will lose organic matter and dissolved minerals, such as nitrates and phosphates. The microclimate at each action site where vegetation is removed is likely to become drier and warmer, with a corresponding increase in wind speed, and soil and water temperature. Water tables and spring flow in the immediate area may be temporarily reduced. Loose soil will temporarily accumulate in the construction area. In dry weather, part of this soil is dispersed as dust and in wet weather loose soil; part is transported to streams by erosion and runoff, particularly in steep areas. Erosion and runoff increase the supply of sediment to lowland drainage areas and eventually to aquatic habitats, where they increase total suspended solids and sedimentation.

Whenever possible, temporary access roads will not be built on steep slopes, where grade, soil, or other features suggest a likelihood of excessive erosion or failure; will use existing ways whenever possible; and will minimize soil disturbance and compaction within 150 feet of a stream, waterbody, or wetland. All temporary access roads will be obliterated when the action is completed, the soil will be stabilized and the site will be revegetated. Temporary roads in wet or flooded areas will be restored by the end of the applicable in-water work period.

During and after wet weather, increased runoff resulting from soil and vegetation disturbance at a construction site both during preconstruction and construction phases is likely to suspend and transport more sediment to receiving waters as long as construction continues so that multiyear projects are likely to cause more sedimentation. This increases total suspended solids and, in some cases, stream fertility. Increased runoff also increases the frequency and duration of high stream flows and wetland inundation in construction areas. Higher stream flow increases stream energy that scours stream bottoms and transports greater sediment loads farther downstream that would otherwise occur. Sediments in the water column reduce light penetration, increase water temperature, and modify water chemistry. Redeposited sediments partly or completely fill pools, reduce the width to depth ration of streams, and change the distribution of pools, riffles, and glides. Increased fine sediments in substrate also reduce survival of eggs and fry, reducing spawning success of salmon and steelhead.

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 reduce soil quality and site fertility in upland and riparian areas. Concurrent in-water work compacts or dislodges channel sediments, thus increasing total suspended solids and allowing currents to transport sediment downstream where it is eventually re-deposited. Continued operations when the construction site is inundated significantly increase the likelihood of severe erosion and contamination. However, the Corps proposes to cease work when high flows may inundate the project area, except for efforts to avoid or minimize resource damage, so significant erosion and contamination are unlikely.

Construction. Use of heavy equipment for vegetation removal and earthwork compact the soil, thus reducing permeability and infiltration. Use of heavy equipment, including stationary equipment like generators and cranes, also creates a risk that accidental spills of fuel, lubricants, hydraulic fluid, coolants, and other contaminants may occur. Petroleum-based contaminants, such as fuel, oil, and some hydraulic fluids, contain PAHs, which are acutely toxic to salmon, steelhead, and other fish and aquatic organisms at high levels of exposure and cause sublethal adverse effects on aquatic organisms at lower concentrations (Heintz *et al.* 2000; Heintz *et al.* 1999; Incardona *et al.* 2005; Incardona *et al.* 2004; Incardona *et al.* 2006). It is likely that petroleum-based contaminants have similar effects on eulachon.

The Corps will require that heavy-duty equipment and vehicles for each project be selected with care and attention to features that minimize adverse environmental effects (*e.g.*, minimal size, temporary mats or plates within wet areas or sensitive soils), use of staging areas at least 150 feet from surface waters, and regular inspection and cleaning before operation to ensure that vehicles remain free of external oil, grease, mud, and other visible contaminants. Also, as noted above, to reduce the likelihood that sediment or pollutants will be carried away from project construction sites, the Corps will ensure that clearing areas are limited and that a suite of erosion and pollution control measures will be applied to any project that involves the likelihood of soil and vegetation disturbance that can increase runoff and erosion, including securing the site against erosion, inundation, or contamination by hazardous or toxic materials.

Work involving the presence of equipment or vehicles in the active channel when ESA-listed fish is likely to result in injury or death of some individuals. The Corps avoid or reduce that risk by limiting the timing of that work to avoid vulnerable life stages of ESA-listed fish, including migration, spawning and rearing. Further, when work in the active channel involves substantial excavation, backfilling, embankment construction, or similar work below OHW where adult or juvenile fish are reasonably certain to be present, or 300 feet or less upstream from spawning habitats, the Corps will require that the work area be effectively isolated from the active channel to reduce the likelihood of direct, mechanical interactions with fish, or indirect interactions through environmental effects. Regardless of whether a work area is isolated or not, and with few exceptions, the Corps will require that passage for adult and juvenile fish that meets NMFS's (2011e) criteria, or most recent version, will be provided around the project area during and after construction.

If any juvenile fish are likely to be present in the work isolation area, the Corps will require that they be captured and released. However, it is unlikely that any adult fish, including salmon, steelhead, or eulachon will be affected by this procedure because it will occur when adults are unlikely to be present and, if any are present, their size allows them to easily escape from the containment area. Capturing and handling fish causes them stress though they typically recover fairly rapidly from the process and therefore the overall effects of the procedure are generally short-lived (NMFS 2002).

The primary contributing factors to stress and death from handling are differences in water temperature between the river where the fish are captured and wherever the fish are held, dissolved oxygen conditions, the amount of time that fish are held out of the water, and physical trauma. Stress on fish increases rapidly from handling if the water temperature exceeds 64°F or dissolved oxygen is below saturation. The Corps' conservation measures regarding fish capture and release, use of pump screens during the de-watering phase, and fish passage around the isolation area are based on standard NMFS guidance to reduce the adverse effects of these activities (NMFS 2011e). Moreover, the Corps will notify each project manager that injured, sick, or dead ESA-listed fish must be delivered to NMFS so that the cause of death for any dead specimen can be analyzed. If it is determined that carrying out the project had any unanticipated role in the death of an ESA-listed fish, that information will be reviewed by the Corps and NMFS to decide whether it is necessary to modify the project or the program to further reduce impacts.

Direct habitat loss refers to displacement of native streambed material and diversity by the installation of rock or other hard structures within the functional floodplain. The habitat features of concern include water velocity, depth, substrate size, gradient, accessibility and space that are suitable for salmon and steelhead rearing. In spawning areas, rock and other hard structures are often used to replace spawning gravels, realign channels to eliminate natural meanders, bends, spawning riffles and other habitat elements. Riffles and gravel bars downstream are scoured when flow velocity is increased. For eulachon, the important habitat features are flow, water quality and substrate conditions, primarily in lower Columbia River tributaries.

In this SLOPES programmatic opinion, rock may not be used for streambank restoration, except as ballast to stabilize large wood. Damaged streambanks must be restored to a natural slope, pattern, and profile suitable for establishment of permanent woody vegetation, without changing the location of the bank toe. Rock and other hard structures within the functional floodplain reduce water quality by reducing or eliminating riparian vegetation that regulates the quantity and quality of runoff and, together with channel complexity, help to maintain and reduce stream temperatures. The benefits of using rock or other hard structures for this purpose are often speculative or minimal, at best, particularly in contrast to the multiple habitat benefits provided by other erosion control methods that do not require hardening of the stream bank or bed (Cramer *et al.* 2003; Cramer 2012).

Treated wood as a construction material is not allowed for bridge projects under this consultation. Copper and other toxic chemicals, such as zinc, arsenic, chromium, and PAHs, that leach from pesticide-treated wood used to construct a road, culvert or bridge are likely to adversely affect salmon, steelhead, and eulachon that spawn, rear, or migrate by those structures, and when they ingest contaminated prey (Poston 2001). These effects are unpredictable, with the intensity of effect depending on numerous factors. Effects from the use of treated wood are best addressed in an individual consultation. Copper has been shown to impair the olfactory nervous system and olfactory-mediated behaviors in salmon and steelhead (Baldwin *et al.* 2003; Baldwin and Scholz 2005; Hecht *et al.* 2007; Linbo *et al.* 2006; McIntyre *et al.* 2008). Similarly, PAHs, which leach from wood treated with creosote, may cause cancer, reproductive anomalies, immune dysfunction, growth and development impairment, and other impairments to exposed fish (Carls *et al.* 2008; Collier *et al.* 2002; Incardona *et al.* 2005; Incardona *et al.* 2004; Incardona *et al.* 2006; Johnson 2000; Johnson *et al.* 2002; Johnson *et al.* 1999; Stehr *et al.* 2009). Alternatives to treated wood, such as silica-based wood preservation, improved recycled plastic technology, and environmentally safe wood sealer and stains are allowed.[29]

Any temporary water withdrawal will have a fish screen installed, operated, and maintained as described in NMFS (2011e). Conversely, the Corps will require that all discharge water created by concrete washout, pumping for work area isolation, vehicle wash water, drilling fluids, or other construction work must be treated using the BMPs applicable to site conditions for removal of debris, heat, nutrients, sediment, petroleum products, metals and any other pollutants likely to be present, (*e.g.*, green concrete, contaminated water, silt, welding slag, sandblasting abrasive, grout cured less than 24 hours) to ensure that no pollutants are discharged from the construction site.

Some of these adverse effects will abate almost immediately, such as increased total suspended solids caused by boulder or large wood restoration. Others will be long-term conditions that may decline quickly but persist at some level for weeks, months, or years, until riparian and floodplain vegetation are fully reestablished. Failure to complete site restoration, or to prevent disturbance of newly restored areas by livestock or unauthorized persons will delay or prevent recovery of processes that form and maintain productive fish habitats.

All of the activities are designed to have long term beneficial effects to critical habitat. However, as noted above, the long-term effectiveness of habitat restoration actions, in general, have not been well documented. In part, this is because they often concentrate on instream habitat without addressing the processes that led to the loss of the habitat (Cederholm *et al.* 1997; Doyle and Shields 2012; Fox 1992; Roper *et al.* 1997; Simenstad and Thom 1996; Zedler 1996). Nevertheless, the proposed actions are reasonably certain to lead to some degree of ecological recovery within each action area, including the establishment or restoration of environmental conditions associated with functional habitat and high conservation value. Fish passage improvement actions, in particular, are likely to have long-term beneficial effects at the watershed or designation-wide scale (Roni *et al.* 2002).

As with large wood, addition of boulders and properly designed rock structures can help restore natural stream processes and provide cover for rearing salmonids. Boulders can accomplish the

[29] See, *e.g.*, American Plastic Lumber (Shingle Springs, California) and Resco Plastics (Coos Bay, Oregon) for structural lumber from recycled plastic; Plastic Pilings, Inc. (Rialto, California) for structurally reinforced plastic marine products; Timbersil (Springfield, Virginia) for structural lumber from wood treated with a silica-based fusion technology; and Timber Pro Coatings (Portland, Oregon) for non-petroleum based wood sealer and stains. The use of trade, firm, or corporation names in this Opinion is for the information and convenience of the action agency and applicants and does not constitute an official endorsement or approval by the U.S. Department of Commerce or NMFS of any product or service to the exclusion of others that may be suitable.

retention of gravel by physically intercepting the bed load or slowing the water, increase the interaction with the floodplain habitat by increasing the bed elevation and providing pool habitat. Boulders are most effective in high velocity or bedrock dominated streams. Roni *et al.* (2006b) found that placement of boulder structures in highly disturbed streams of Western Oregon led to increased pool area and increased abundance of trout and coho salmon. The addition of gravel in areas where it is lacking, such as below impoundments, will provide substrate for food organisms, fill voids in wood and boulder habitat structures to slow water and create pool habitat and provide spawning substrate for fish. Although little research has been conducted on the effectiveness of gravel augmentation in improving salmonid spawning, Merz and Chan (2005) found that gravel augmentation can result in increased macroinvertebrate densities and biomass, thus leading to more food for juvenile salmonids.

Off- and side-channel habitat restoration to reconnect stream channels with historical river floodplain swales, abandoned side channels, and floodplain channels, setting back existing berms, dikes and levees, and water control structure removal are likely to have similar but significantly greater positive indirect effects on habitat diversity and complexity by affecting a larger habitat area (Cramer 2012).

Fish passage restoration using a step structure is likely to result in development of a backwater upstream of the structure, with reduced velocities and greater depths at a variety of flows, accelerated flow through the structure, and deposition of sediment immediately downstream of the structure ("tailouts") (Cramer *et al.* 2003). Adding a fish ladder to an existing facility, or improving a culvert for fish passage, is likely to decrease stream gradient in at least a portion of the reach, which will reduce stream energy and may cause aggradation due to sedimentation and provide access to previously blocked habitat (Cramer *et al.* 2003). The indirect effects of piling removal are likely to include reduction of resting and areas for piscivorous birds, and of hiding habitat for aquatic predators such as smallmouth bass.

In addition to construction effects discussed above, the effects of fish passage restoration as proposed by the Corps by constructing step structures are likely to include development of a backwater upstream of the structure, with reduced velocities and greater depths at a variety of flows, accelerated flow through the structure, and deposition of sediment immediately downstream of the structure ("tailouts") (Cramer *et al.* 2003). Adding a fish ladder to an existing facility, or improving a culvert for fish passage, is likely to decrease stream gradient in at least a portion of the reach, which will reduce stream energy and may cause aggradation due to sedimentation and provide access to previously blocked habitat (Cramer *et al.* 2003).

Invasive and non-native plant control actions, including manual, mechanical, and herbicidal treatment, are commonly employed as part of streambank restoration, set-back existing berms, dikes and levees, and stream crossing replacement projects. Manual and mechanical treatments are likely to produce at least minor damage to riparian soil and vegetation over a defined area. 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 changes are only likely to occur with of invasive plant treatments of monocultures on small stream channels. The effects would vary depending on site aspect, elevation, and amount of topographic shading, but are likely to decrease over time as shade from native vegetation is reestablished.

Although the Corps will limit the use of herbicides to specific formulas chosen for having ingredients that pose low direct risks to fish, those substances are still likely to have at least short-term sublethal effects when they enter aquatic habitats where they can alter fish behavior in ways that are likely to impact survival, and through adverse impacts on aquatic habitats, such as reduction in cover and the abundance of food organisms (NMFS 2005). Herbicides can also pose risks when they combine with other pesticides and contaminants already in the water in ways that make them more toxic to fish.

Surface water contamination with herbicides occurs 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.

Spray and vapor drift are additional, important pathways for herbicide entry into aquatic habitats. Many 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 herbicides volatilize. The formulation and volatility of a compound will determine its vapor drift potential. The potential for vapor drift is greatest under high air temperatures and with ester formulations. For example, ester formulations such as triclopyr are very susceptible to vapor drift, particularly at temperatures above 80°F.

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. The Corps will avoid or minimize drift impacts 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-based equipment reduces the risk of drift, and hand equipment nearly eliminates it.

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. 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 program, some formulas of herbicide may 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.

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. The Corps will minimize these impacts 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. The Corps will minimize these impacts by restricting the formulas used, and the time, place and manner of their application to minimize offsite movement.

In summary, the Corps will limit the use of herbicide formulas, application methods, and the time and place of application to greatly reduce the likelihood that 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. The indirect effects or beneficial 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.

Restoration of off and side-channel habitat as proposed by the Corps includes removal of fill material to passively reconnect existing stream channels to historical off- and side-channels. The proposed action does not include meander reconstruction or the creation of new off- and side-channel habitats. The effects on the environment of reconnecting stream channels with historical river floodplain swales, abandoned side channels, and floodplain channels are likely to include relatively intense construction effects, as discussed above. The indirect effects are likely to include equally intense beneficial effects to habitat diversity and complexity (Cramer 2012), including increased overbank flow and greater potential for groundwater recharge in the floodplain; attenuation of sediment transport downstream due to increased sediment storage; greater channel complexity and/or increased shoreline length; increased floodplain functionality reduction of chronic bank erosion and channel instability due to sediment deposition; and increased width of riparian corridors. Increased riparian functions are likely to include increased shade and hence moderated water temperatures and microclimate; increased abundance and retention of wood; increased organic material supply; water quality improvement; filtering of sediment and nutrient inputs; more efficient nutrient cycling; and restoration of flood-flow refuge for ESA-listed fish (Cramer 2012).

The effects of setting back existing berms, dikes, and levees are similar to off- and side-channel habitat restoration discussed above, although the effects of this type of action may also include short-term or chronic instability of affected streams and rivers as channels adjust to the new hydrologic conditions. Moreover, this type of action is likely to affect larger areas overall because the area isolated by a berm, dike or levee is likely to be larger than that included in an off- or side-channel feature.

The effects of stream bank restoration are likely to include construction effects discussed above, and reestablishment of native riparian forests or other appropriate native riparian plant communities, provide increased cover (large wood, boulders, vegetation, and bank protection structures) and a long-term source of all sizes of instream wood, reduce fine sediment supply, increase shade, moderate microclimate effects, and provide more normative channel migration over time.

Removal of water control structures, such as a small dam, earthen embankment, subsurface drainage features, tide gate, or gabion, as proposed by the Corps is likely to have significant local and landscape-level effects to processes related to sediment transport, energy flow, stream flow, temperature, and biotic fragmentation (Poff and Hart 2002). The diversity of water control structures distributed on the landscape combined with the relative scarcity of knowledge about the environmental response to their removal makes it difficult to generalize about the ecological harm or benefits of their removal. However, many small water control structures are nearing the end of their useful life due to sediment accumulation and general deterioration, and are likely to be either intentionally removed by parties concerned about liability that may arise from failure, or fail due to lack of maintenance. Thus, it is likely that in some cases, the best outcome of a restoration action based on removal of a water control structure will be a minimization of adverse effects that may have followed an unplanned failure, such as reducing the size of a contaminated sediment release, or preventing an unplanned sediment pulse, controlling undesirable species, or ensuring fish passage around any remnant of the structure.

When a water control structure is specifically targeted for restoration, it may have less significant adverse effects and more beneficial effects than a structure that is removed primarily for safety or economic reasons, but neither action is likely to entirely restore pristine conditions. The legacy of flow control includes altered riparian soils and vegetation, channel morphology, and plant and animal species composition that frequently take many years or decades to fully respond to restoration of a more natural flow regime. The indirect effects or long-term consequences of water control structure removal will depend on the long-term progression of climatic factors and the success of follow-up management actions to manage sediments, exclude undesirable species, revegetate restored, and ensure that continuing water and land use impacts do not impair ecological recovery.

Removal of tide gates or tidal levees is likely to result in restoration of estuarine functions related to regulation of temperature, tidal currents, and salinity; increased habitat abundance from distributary channels, that increase in size after tidal flows are allowed to inundate and scour on a twice daily basis; reduction of fine sediment in-channel and downstream; reduced estuary filling due to increased availability of low-energy, overbank storage areas for fine sediment; restoration of fish access into tributaries, off- and side-channel pond and wetlands;

restoration of saline-dependent plant species; increased primary productivity; increased estuarine food production; and restoration of an estuarine transition zone for fish and other species migrating through the tidal zone (Cramer 2012; Giannico and Souder 2004; Giannico and Souder 2005).

Wetland restoration projects as proposed by the Corps are likely to have effects on the environment similar to those of construction; off-and side channel restoration; set-back of existing berms, dikes, and levees; and removal of water control structures, as described above. Benefits of wetland restorations include increased storage capacity of flood flows, filtration of pollutants from runoff, and reduction of scour erosion. Wetlands, floodplain hydrological connections, and native plant communities, provide fish habitat and enhance subsurface flow into streams during the summer.

Site restoration. After each project is complete, the Corps will require any significant disturbance of riparian vegetation, soils, streambanks, or stream channel that was caused by the construction to be cleaned up and restored to reestablish those features within reasonable limits of natural and management variation. Thus, each restoration project will typically include replacement of natural materials or other geomorphic characteristics that were previously altered or degraded there in some way, so that ecosystem processes that form and maintain productive fish habitats are replaced and can function at those sites. The project footprint of any restoration project more complicated than simple site stabilization and revegetation will almost always occur in the riparian area or zone, or inside the active channel.

For actions that include a construction phase, the direct physical and chemical effects of site clean-up after construction is complete are essentially the reverse of the construction activities that go before it. Bare earth will be protected by various methods, including seeding, planting woody shrubs and trees, and mulching. This will immediately dissipate erosive energy associated with precipitation and increase soil infiltration. It also will accelerate vegetative succession necessary to restore the delivery of large wood to the riparian area and aquatic system, 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. Whether recovery occurs over weeks or years, the disturbance frequency, considered as the number of actions funded per year within a given recovery domain is likely to be extremely low, as is the intensity of the disturbance, considered as a function of the total number of miles of critical habitat present within each watershed.

Restoration of aquatic habitats is fundamentally about allowing stream systems to express their capacities, *i.e.*, the relief of human influences that have suppressed the development of desired habitat mosaics (Ebersole *et al.* 2001). Thus, the time necessary for recovery of functional habitat attributes sufficient to support species recovery following any disturbance, including construction necessary to complete a restoration action, will vary by the potential capacity of each habitat attribute. Recovery mechanisms such as soil stability, sediment filtering and nutrient absorption, and vegetation succession may recover quickly (*i.e.*, months to years) after completion of the project. Recovery of functions related to wood recruitment and microclimate may require decades or longer. Functions related to shading of the riparian area and stream, root strength for bank stabilization, and organic matter input may require intermediate lengths of time.

The time necessary for recovery of functional habitat attributes following disturbance will vary by attribute. Recovery mechanisms such as soil stability, sediment filtering and nutrient absorption, and vegetation succession may recover quickly (months to years) after completion of the proposed action. Recovery of functions related to large wood and microclimate may require decades or longer. Functions related to shading of the riparian area and stream, root strength for bank stabilization, and organic matter input may require intermediate lengths of time. The rate and extent of functional recovery is also controlled in part by watershed context. Proposed actions will occur in areas where productive habitat functions and recovery mechanisms were absent or degraded.

The indirect effects, or effectiveness, of habitat restoration actions, in general, have not been well documented, in part because they often concentrate on instream habitat without addressing the processes that led to the loss of the habitat (Cederholm *et al.* 1997; Fox 1992; Simenstad and Thom 1996; Zedler 1996). Nonetheless, the careful, interagency process used by the Corps to develop the proposed program ensures that it is reasonably certain to lead to some degree of ecological recovery within each action area, including the establishment or restoration of environmental conditions associated with functional habitat and high conservation value.

2.4.1 Effects of the Action on Species

As noted above, each individual project will be completed as proposed with full application of design criteria for construction. Each action is likely to have the following effects on individual fish at the site and reach scale. The nature of these effects will be similar between projects because each project is based on a similar set of underlying construction activities that are limited by the same design criteria and the individual salmon and steelhead ESUs or DPSs have relatively similar life history requirements and behaviors regardless of species.

The intensity of the effects, in terms of changes in the condition of individual fish and the number of individuals affected, and severity of these effects will also vary somewhat between projects because of differences at each site in the scope of work area isolation and construction, the particular life history stages present, the baseline condition of each fish present, and factors responsible for those conditions. However, no project will have effects on fish that are beyond the full range of effects described here. The effects of the proposed actions are also reasonably certain to result in some degree of ecological recovery at each project site.

The proximity of spawning adults, eggs, and fry of most salmon and steelhead species to any construction-related effects of projects completed under the proposed program that could injure or kill them will be limited by the proposed design criteria that require work within the active channel to be isolated from that channel and completed in accordance with the Oregon guidelines for timing of in-water work to protect fish and wildlife resources. The Oregon guidelines for timing of in-water work are primarily based on the average run timing of salmon and steelhead populations, although the actual timing of each run varies from year to year according to environmental conditions. Moreover, because populations of salmon and steelhead have evolved different run timings, work timing becomes less effective as a measure to reduce adverse effects on species when two or more populations occur in a particular area. It is unlikely that spawning adults, eggs, or fry of endangered UCR spring-run Chinook salmon, SR sockeye salmon, and UCR steelhead will ever occur in proximity to construction-related effects of the projects completed under the proposed program because those species do not spawn in Oregon. Nonetheless, adult and juvenile individuals of these species pass through the Columbia River mainstem and estuary and so are likely to encounter effects of the action during those life history periods. It is unknown whether the Oregon guidelines for timing of in-water work are also protective of eulachon because their migration and rearing times are less well known and were not considered when the guidelines were prepared.

In general, direct effects are ephemeral (instantaneous to hours) or short-term (days to months), and indirect effects are long-term (years to decades, or the life of the project). Effects are described by life history stage in outline form below. Projects with a more significant construction aspect are likely to adversely affect more fish, and to take a longer time to recover, than projects with less construction. This will contribute to more normal freshwater habitat conditions that produce fry, parr, or smolts that are larger or healthier when they enter the estuary than they would otherwise, and therefore more likely to survive to adulthood, and to improve access and other spawning conditions for adults.

Except for fish that are captured during work area isolation, or injured or killed during boulder and large wood placement, individual fish whose condition or behavior is impaired by the effects of a project authorized or completed under this opinion are likely to suffer primarily from ephemeral or short-term sublethal effects during construction, including diminished rearing and migration as described below. Projects that will require two or more years to complete are also likely to adversely affect more fish because their duration will be longer, but those effects are also likely to be less intense during each subsequent year as a result of work area isolation that will only be completed once per work area.

Any construction impacts to stream margins are likely to be most important to fish because those areas often provide shallow, low-flow conditions, may have a slow mixing rate with mainstem waters, and may also be 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 (Bottom *et al.* 2005; Fresh *et al.* 2005). 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.

The peak number of projects that were reviewed under the SLOPES-IV programmatic opinion was 77 in 2008, likely as a result of the American Recovery and Reinvestment Act of 2009. Over the period 2010-2012, the average number of projects per year authorized by the Corps has been about 46 projects, with no more than 24 in any recovery domain. Therefore, we expect that no more than 80 total restoration projects, with no more than 33 in a single recovery domain, in a single year under this opinion. Based on past experience, in most domains far fewer projects will likely be implemented (Table 1). Measured as miles of streambank disturbance, the average physical impact of these projects combined is small compared to the total number of miles of critical habitat available in each recovery domain. The likelihood of additive effects on species at the program level due to projects occurring in close proximity within the same watershed, or even within sequential watersheds, is very remote, whether those effects are adverse or beneficial.

Based on our previous experience with restoration projects, it is unlikely at the program level, although not impossible, that the action area for two or more projects will occur in proximity to each other in the same watershed, during the same year. Moreover, the total streamside footprint that will be physically disturbed by the full program each year, which corresponds to the area where almost all direct construction impacts will occur, is extremely small compared to the total number of watersheds or critical habitat miles in each recovery domain.

Of the ESA-listed species considered in this opinion, only juvenile salmon and steelhead are likely to be captured during work area isolation. Restrictions on timing and location of projects would not overlap with juvenile eulachon, making their capture extremely unlikely. Adult salmon, steelhead, and eulachon that may be present when the in-water work area is isolated are likely to leave by their own volition, or can otherwise be easily excluded without capture or direct contact before the isolation is complete.

Most direct, lethal effects of authorizing and carrying out the proposed actions are likely be caused by the isolation of in-water work area, even though lethal and sublethal effects would be greater without isolation. Any individual fish present in the work isolation area will be captured and released. 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. Stress and death from handling occur because of differences in water temperature and dissolved oxygen between the river and transfer buckets, as well as physical trauma and the amount of time that fish are held out of the water. Stress on salmon and steelhead increases rapidly from handling if the water temperature exceeds 64ºF, or if dissolved oxygen is below saturation. Debris buildup and predation within minnow traps can also kill or injure listed fish if they are not monitored and cleared on a regular basis. Design criteria related to the capture and release of fish during work area isolation will avoid most of these consequences, and ensure that most of the resulting stress is short-lived (NMFS 2002).

An estimate of the maximum effect that capture and release operations for projects authorized or completed under this opinion will have on the abundance of adult salmon and steelhead in each recovery domain was obtained as follows: A = n(pct), where:

A = number of adult equivalents "killed" each year
n = number of projects likely to occur in a recovery domain each year
p = 31, *i.e.*, number of juveniles to be captured per project[30]

[30] In 2007, ODOT completed 36 work area isolation operations involving capture and release using nets and electrofishing; 12 of those operations resulted in capture of 0 Chinook salmon, 345 coho salmon, and 22 steelhead; with an average mortality of 5% Cannon (2008). Cannon (2012) reported a mortality rate of 4.4% for 455 listed salmon and steelhead captures during 30 fish salvage operations in 2012. No sturgeon or eulachon have been captured as a result of ODOT Salvage operations.

c = .05, *i.e.*, rate of juvenile injury or death caused by electrofishing during capture and release, primarily steelhead and coho salmon. Consistent with observations by Cannon (2008; 2012) and data reported in McMichael *et al*. (1998).

t = .02, *i.e.*, an estimated average smolt to adult survival ratio, see Smoker *et al*. (2004) and Scheuerell and Williams (2005). This is very conservative because many juveniles are likely to be captured as fry or parr, life history stages that have a survival rate to adulthood that is exponentially smaller than for smolts.

Thus, the effects of work area isolation on the abundance of juvenile or adult salmon or steelhead in any population is likely to be small, no more than one adult-equivalent per year in any recovery domain (Table 27).

Table 27. Number of salmon and steelhead affected, per year, by recovery domain.

Recovery Domain	Estimated Maximum Number of Projects (per year)	Estimated Maximum Number of Juveniles Captured (per year)	Estimated Maximum Number of Juveniles Injured or Killed (per year)	Estimated Maximum Number of Adult Equivalents "Killed" (per year)
WLC	33	1023	51	1.0
IC	9	279	14	0.3
OC	20	620	31	0.6
SONC	18	558	28	0.6
Total	80	2480	124	2.5

Rapid changes and extremes in environmental conditions caused by construction are likely to cause a physiological stress response that will change the behavior of salmon and steelhead (Moberg 2000; Shreck 2000). For example, reduced input of particulate organic matter to streams, the addition of fine sediment to channels, and mechanical disturbance of shallow-water habitats are likely to lead to under use of stream habitats, displacement from or avoidance of preferred rearing areas, or abandonment of preferred spawning grounds, which may increase losses to competition, disease, predation, or, for juvenile fish, reduce the ability to obtain food necessary for growth and maintenance (Moberg 2000; Newcombe and Jensen 1996; Sprague and Drury 1969).

The ultimate effect of these changes in behavior, and on the distribution and productivity of salmon and steelhead, will vary with life stage, the duration and severity of the stressor, the frequency of stressful situations, the number and temporal separation between exposures, and the number of contemporaneous stressors experienced (Newcombe and Jensen 1996; Shreck 2000). Restoration actions that affect stream channel widths are also likely to impair local movements of juvenile fish for hours or days, and downstream migration maybe similarly impaired. Moreover, smaller fry are likely to be injured or killed due to in-water interactions with construction activities, including work area isolation, and due to the adverse consequences that displacement and impaired local movement will have on rearing activities, at each restoration site subject to those activities.

Fish may compensate for, and adapt to, some of these perturbing situations so that they continue to perform necessary physiological and behavioral functions, although in a diminished capacity. However, fish that are subject to prolonged, combined, or repeated stress by the effects of the action combined with poor environmental baseline conditions will likely suffer a metabolic cost that will be sufficient to impair their rearing, migrating, feeding, and sheltering behaviors and thereby increase the likelihood of injury or death.

In addition to the general effects of construction on listed species described above, each type of action will also have the following effects on individual fish. Restoration of boulders, gravel, and large wood, as well as restoration of specific off-channel, floodplain and wetland habitats will all provide habitat conditions that are likely to increase the productivity of rearing salmon and steelhead (Cramer 2012; Roni *et al.* 2006b; Roni *et al.* 2006a). Fish passage restoration will increase the quantity of spawning and rearing habitat accessible to affected species. Removal of pilings is likely to decrease predation on juvenile salmon and steelhead by reducing resting areas for piscivorous birds and cover for aquatic predators, and reducing long-term exposure to toxics. Although it is not possible to estimate those effects as a number of fish because they will arise due to multiple stressors for which no data are available that are comparable to those obtained from past salvage operations, they are expected to be small, commensurate with the intensity and severity of environmental effects described above.

Population level responses to habitat alterations can be thought of as 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).

At the species level, direct biological effects are synonymous with those at the population level or, more likely, are the integrated demographic response of one or more subpopulations (McElhany *et al.* 2000). Because the likely effects of any action authorized or completed under this opinion will be too minor, localized and brief to affect the VSP characteristics of any salmon or steelhead population, they also will not have any effects at the species level.

Given the small reduction in the growth and survival of fish that will be directly affected by individual projects, primarily at the fry, parr, and smolts life stages, the relatively low intensity and severity of the that reduction at the population level, and their low frequency in a given population, any adverse effects to fish growth and survival are likely to be inconsequential. Moreover, projects completed under the proposed program are also reasonably certain to lead to some degree of species recovery within each action area, including more normal growth and development, improved survival, and improved spawning success. Projects that improve fish passage through culverts or better longitudinal connectivity (up and downstream), habitat complexity, and ecological connectivity between streams and floodplains will likely have long-term beneficial effects on population structure.

Summary of the effects of the action by fish life history stages:

1. <u>Freshwater spawning</u>
    a. Salmon and steelhead
        i. Adult. *Direct* – Chemical contaminants from machinery impair reproductive behavior. No holding or spawning are likely to occur in the immediate restoration area due to in-water timing and work restrictions. However, pre-spawning mortality and less spawning success will occur downstream of long-term restoration sites due to higher bioenergetic cost, more sublethal effects of contaminants, less adaptive behavior and movement, and an increased likelihood of competition, predation, and disease. The occurrence of these effects is likely to be infrequent and spread over a very large area. Better spawning success would likely occur

after spawning gravel supplementation. Long term positive effects on population abundance or productivity are expected. *Indirect* – Better pre-spawning survival and spawning success after the completion of projects due to improved migration conditions and fewer adult fish passage barriers.

ii. Egg. *Direct* – Chemical contaminants and sediment in runoff during restoration activities reduce egg survival. Improved incubation success after spawning gravel restoration. *Indirect* – No effect if spawning areas are upstream of restoration areas. Survival of eggs may be reduced for some years in some limited areas that are downstream of restoration sites if sufficient fine sediment is deposited to reduce the availability of interstitial space and impeding delivery of sufficient oxygen to incubating embryos until natural scouring effects restore the preferred sediment distribution size. Where fine sediments is not deposited, or after it is scoured, more normal egg development is likely to occur due to improved water quality.

iii. Alevin. *Direct* – Temporary increase in chemical contaminants and sediment during restoration reduce alevin survival. No direct effects due to in-water timing and work restrictions. *Indirect* – More normal growth and development after site restoration due to improved water quality and cover, and less disease and predator induced mortality, and improved conditions for local movements.

b. Eulachon. Assumed to be similar to salmon and steelhead, although impacts of contaminants on adult eulachon reproductive behavior are undocumented, and eulachon eggs and larvae are carried downstream and widely dispersed by estuarine and ocean currents.

2. <u>Freshwater rearing</u>

a. Salmon and steelhead

i. Fry. *Direct* – Temporary increase in chemical contaminants and sediment during restoration activities reduce forage and impair behavior. Capture, with some injury and death, during in-water work isolation and construction of restoration projects, reduced growth and development due to higher bioenergetic cost, more sublethal effects of contaminants, less adaptive behavior and movement, an increased likelihood of competition, predation, and disease, and a degraded biological community. These effects may be stronger when projects take place beside or in small tributaries where aquatic habitat areas are correspondingly small and easily modified. Conversely, fewer individuals are likely to occur in those habitats. In larger tributaries and main stem rivers, aquatic habitat areas are larger and less likely to be modified by restoration activities, although more individual fish may be affected. Large wood and off- and side-channel habitat restoration projects would increase fry rearing habitat quantity and quality. Piling removal projects would improve water quality by eliminating chronic sources of toxic contamination. *Indirect* – More normal growth and development after site restoration due to better forage, less disease and predator induced mortality, more effective migration and distribution due to improved water quality and cover, better forage, more functional floodplain conditions, and fewer juvenile passage barriers.

    ii. Parr. Same as for fry, although probably fewer individuals directly affected due to greater swimming ability.

b. Eulachon. Assumed to be similar to salmon and steelhead, although freshwater rearing is largely absent in eulachon.

3. <u>Freshwater migration</u>

  a. Salmon and steelhead

    i. Adult. *Direct* – Temporary increase in chemical contaminants and sediment during restoration activities impair orientation and migratory behavior. Delayed upstream migration and increased pre-spawning mortality during instream restoration activities due to higher bioenergetic cost, more sublethal effects of contaminants, less adaptive behavior and movement, and an increased likelihood of competition, predation, and disease. These effects are likely to occur at a very limited number of sites in any given year. *Indirect* – More normal upstream migration and pre-spawning mortality after site restoration due to less disease induced morality, improved migration conditions, and fewer adult fish passage barriers.

    ii. Kelt (steelhead). *Direct* – Same as for adults, plus delayed seaward migration and increased post-spawning mortality during instream restoration activities due to higher bioenergetic cost, more sublethal effects of contaminants, less adaptive behavior and movement, and an increased likelihood of competition, predation, and disease. *Indirect* – More normal seaward migration and post-spawning mortality after site restoration due to less disease induced mortality, improved migration conditions, and fewer adult fish passage barriers.

    iii. Fry. *Direct* – Same as for freshwater rearing, plus capture (with some injury and death) during in-water work isolation, delayed seaward migration and reduced growth and development during instream restoration activities due to higher bioenergetic cost, more sublethal effects of contaminants, less adaptive behavior and movement, and an increased likelihood of competition, predation, and disease. *Indirect* – More normal seaward migration, growth and development after site restoration due to improved water quality and cover, better forage, more functional floodplain conditions, and fewer juvenile passage barriers.

    iv. Parr. Same as for fry, although probably fewer individuals affected due to greater swimming ability.

  b. Eulachon. Assumed to be similar to salmon and steelhead, although freshwater migration by juvenile eulachon is assumed to passive and accomplished largely by currents.

4. <u>Estuary rearing and smoltification</u>

  a. Salmon and steelhead

    i. Fry. *Direct* – Same as for freshwater rearing and migration.

    ii. Parr. Same as for fry.

iii. Smolt. Same as for fry and parr, although probably fewer individuals affected due to greater swimming ability.

b. Eulachon. Assumed to be similar to salmon and steelhead, although estuary movement by juvenile eulachon is assumed to be passive and accomplished largely by currents.

5. Nearshore marine growth and migration – These life history stages to not occur in the action area.
6. Offshore marine growth and migration – These life history stages do not occur in the action area.

2.4.2 Effects of the Action on Designated Critical Habitat

Each individual project, completed as proposed, including full application of the design criteria for restoration, is likely to have the following effects on critical habitat PCEs. These effects will vary somewhat in degree between actions because of differences in the scope of construction at each, and in the current condition of PCEs and the factors responsible for those conditions. This assumption is based on the fact that all of the actions are based on the same set of underlying restoration actions, and the PCEs and conservation needs identified for each species are also essentially the same. In general, ephemeral effects are likely to last for hours or days, short-term effects are likely to last for weeks, and long-term effects are likely to last for months, years or decades. The intensity of each effect, in terms of change in the PCE from baseline condition, and severity of each effect, measured as recovery time, will vary somewhat between projects because of differences in the scope of the work. However, no individual restoration project is likely to have any effect on PCEs that is greater than the full range of effects summarized here.

No more than 29 restoration actions in a single recovery domain have been completed using this opinion in a single year (2008, 29 in SONCC recovery domain). As noted above, we anticipate no more than 25 restoration projects will be completed in a single recovery domain, in a single year, using this opinion and most domains will have many fewer (Table 27). This number of projects is already small compared to the total number of watersheds in each recovery domain, but the intensity of those project effects appears far smaller when considered as a function of their average streamside footprint. The streamside footprint that will be temporarily disturbed by the full program each year corresponds to the area where almost all direct construction impacts will occur.

Because the area affected for individual projects is small, the intensity and severity of the effects described is relatively low, and their frequency in a given watershed is very low, any adverse effects to PCE conditions and conservation value of critical habitat at the site level or reach level are likely to quickly return to, and improve beyond, critical habitat conditions that existed before the action. Moreover, projects completed under the proposed program are also reasonably certain to lead to some degree of ecological recovery within each action area, including the establishment or restoration of environmental conditions associated with functional aquatic habitat and high conservation value. This is because each action is likely to partially or fully correct improper or inadequate engineering designs in ways that will help to restore lost habitat, improve water quality, reduce upstream and downstream channel impacts, improve floodplain connectivity, and reduce the risk of structural failure. Improved fish passage through culverts and more functional floodplain connectivity, in particular, may have long-term beneficial effects.

As noted above, the indirect effects, or effectiveness, of habitat restoration actions, in general, have not been well documented, in part because they often concentrate on instream habitat without addressing the processes that led to the loss of the habitat (Cederholm *et al.* 1997; Fox 1992; Simenstad and Thom 1996; Zedler 1996). Nonetheless, the careful, interagency process used by the Corps to develop the proposed program ensures that it is reasonably certain to lead to some degree of ecological recovery within each project area, including the establishment or restoration of environmental conditions associated with functional habitat and high conservation value.

Summary of the effects of the action by critical habitat PCE:

1. <u>Freshwater spawning sites</u>
    a. Water quantity – Brief reduction in flow due to short-term construction needs, reduced riparian permeability, increased riparian runoff, and reduced late season flows; slight longer-term increase based on improved riparian function and floodplain connectivity.
    b. Water quality – Short-term increase in total suspended solids, dissolved oxygen demand, and temperature due to riparian and channel disturbance; longer-term improvement due to improved riparian function and floodplain connectivity.
    c. Substrate – Short-term reduction in quality due to increased compaction and sedimentation; long-term increase in quality due to gravel placement, and increased sediment storage from boulders and large wood.
2. <u>Freshwater rearing sites</u>
    a. Water quantity – as above.
    b. Floodplain connectivity – Short-term decrease due to increased compaction and riparian disturbance; long-term improvement due to off- and side channel habitat restoration, set-back of existing berms, dikes, and levees, and removal of water control structures.
    c. Water quality – as above.
    d. Forage – Short-term decrease due to riparian and channel disturbance, and water quality impairments; long-term improvement due to improved habitat diversity and complexity, and improved riparian function and floodplain connectivity, and increased litter retention.
    e. Natural cover – Short-term decrease due to riparian and channel disturbance; long-term increase due to improved habitat diversity and complexity, improved riparian function and floodplain connectivity, and off- and side channel habitat restoration.
3. <u>Freshwater migration corridors</u>
    a. Free passage – Short-term decrease due to decreased water quality and in-water work isolation; long-term increase due to improved water quantity and quality, habitat diversity and complexity, forage to support juvenile migration, and natural cover.
    b. Water quantity – as above.

c. Water quality – as above.
d. Natural cover – as above.

4. Estuarine areas
   a. Free passage – as above.
   b. Water quality – as above.
   c. Water quantity – as above.
   d. Salinity – no effect.
   e. Natural cover – as above.
   f. Forage – as above.
5. Nearshore marine areas – These PCEs do not occur in the action area.
6. Offshore marine areas – These PCEs do not occur in the action area.

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. 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 (Metro 2010; Metro 2011). 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 2000 and 2010, the population of Oregon grew from approximately 3.4 to 3.8 million, primarily due to migration from other states (U.S. Census Bureau 2011). Most of that growth occurred before the economic slowdown that began in 2007. Half of the population increase occurred in Oregon's three most populated counties around the City of Portland area. Other large counties in the Willamette Valley also gained population although the largest increase statewide, 37%, was in Deschutes County in central Oregon. Only 12% of Oregon's population lives east of the Cascade Mountains, a primarily rural area with an economic base dominated by agriculture and Federal lands. Eight eastern counties lost population during the last decade. The State population is expected to continue to grow in the future, although the rate of growth has slowed and is unlikely to change soon.

The adverse effects of non-Federal actions stimulated by general resource demands are likely to continue in the future driven by changes in human population density and standards of living. These effects are likely to continue to a similar or reduced extent in the rural areas of the Willamette Valley, eastern Oregon, and along the Oregon Coast where counties are maintaining or losing population. Counties that are gaining population around the City of Portland, parts of the Willamette Valley, and part of central Oregon are likely to experience greater resource demands, and therefore more adverse environmental effects. Oregon's land use laws and progressive policies related to long-range planning will help to limit those impacts by ensuring that concern for a healthy economy that generates jobs and business opportunities is balanced by concern for protection of farms, forests, rivers, streams and natural areas (Metro 2000; Metro 2008; Metro 2011). In addition to careful land use planning to minimize adverse environmental impacts, larger population centers may also partly offset the adverse effects of their growing resource demands with more river restoration projects designed to provides ecosystem-based cultural amenities, although the geographic distribution of those actions, and therefore any benefits to ESA-listed species or critical habitats, may occur far from the centers of human populations.

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; NMFS 2011a; NWPCC 2012; OWEB 2011). 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.

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 population of Oregon is 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 program. 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 opinion as to whether the proposed program 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).

As described in Section 2.2, individuals of many ESA-listed salmon and steelhead species and eulachon use the program action area to fully complete the migration, spawning and rearing parts of their life cycle; some salmon, steelhead, and eulachon migrate and rear in the program action area; and some species only migrate through, once as out-migrating juveniles and then again as adult fish on upstream spawning migration. The viability of the various populations that comprise the 15 salmon and steelhead species considered in this opinion ranges from extirpated or nearly so to populations that are a low risk for extinction. The southern eulachon population abundance has declined significantly since the early 1990s and there is no evidence to date of their returning to former population levels.

Adult upstream migrating ESA-listed salmonids are present primarily from early spring through autumn but upstream migrating fish may be found year-around. The adult fish are generally migrating in the upper 25 feet of the water column but may be found to depths of 50 feet. Shallow water habitats are an important rearing habitat for juvenile salmon and steelhead, especially for species that spend an extended amount of time in freshwater. The highest densities of juvenile salmon and steelhead occur in the spring when individuals of all the species may be present, with the lowest densities occurring in the summer and fall. The juvenile fish tend to inhabit shallow waters near the shoreline but have been observed at depths of 20 feet. Some individuals spend little time in shallow water or in the estuary during juvenile migration, although food produced in the shallow waters and estuaries may still be important to the migrating fish.

Southern eulachon typically enter the Columbia River, and probably the Umpqua River, from mid-December to May with peak entry and spawning during February and March. The eulachon spawn in the mainstem Columbia River, Cowlitz River, Grays River, Skamokawa Creek, Elochoman River, Kalama River Lewis River and Sandy River. Eulachon eggs are believed to hatch in 30-40 days. Young eulachon are feeble swimmers, usually near the bottom as they are transported downstream but they may be found throughout the water column.

The action area is also designated as critical habitat for ESA-listed salmon, steelhead, and eulachon. The physical and biological features of salmon and steelhead critical habitat in the action area are freshwater spawning, freshwater rearing, adult and juvenile migration corridors, and estuarine habitat. The features of eulachon critical habitat that are likely to be affected by projects completed under the proposed program are freshwater spawning and incubation habitat, and freshwater migration. Climate change and human development have and continue to adversely impact critical habitat creating limiting factors and threats to the recovery of the ESA listed species.

Information in Section 2.3 described the environmental baseline in the action area as widely variable but NMFS assumes that restoration projects will occur as sites where the environmental baseline does not fully meet the biological requirements of individual fish due to the presence of impaired fish passage, floodplain fill, streambank degradation, or degraded riparian conditions. Similarly, it is likely that the environmental baseline is also not meeting the biological requirements of individual fish of ESA-listed species at sites where restoration projects will occur due to one or more impaired aquatic habitat functions related to any of the habitat factors limiting the recovery of the species in that area, but the quality of critical habitat at those sites is likely to be improved due to completion of the restoration projects.

Habitat improvement projects are being actively implemented through salmon recovery efforts, the FCRPS, and a combination of Federal, tribal, state and local actions. At the same time population growth and development pressures on aquatic systems are increasing, particularly in the Willamette Valley. The extent to which these trends may further reduce populations, degrade the quality and function of critical habitat, or preclude some restoration actions, is unknown.

As described in Section 2.4, the most short-term effects of restoration actions on ESA-listed fish and designated critical habitat include effects related to erosion and runoff from the construction site, work area isolation, and the use of herbicides. Each project that eventually will be implemented under this opinion will be carefully designed and constrained by conservation measures such that construction impacts of restoration projects will cause only short-term, localized, and minor effects. The longer-term impacts of restoration projects are likely to include corrections of engineering flaws in existing stream crossings that do not currently allow for adequate fish passage or the functional riparian area or floodplains. Restoration projects will have short term impacts due to construction, but long-term will contribute to reducing many of the factors limiting the recovery of these species including fish passage, floodplain connectivity and function, channel structure and complexity, and riparian vegetation and bank conditions.

As noted in Sections 2.2 and 2.3, climate change is likely to affect all species considered in this opinion and their habitat in the program area. These effects are expected to be positive and negative, but are likely to result in a generally negative trend for stream flow and temperature.

As described in Section 2.5, the cumulative effects of state and private actions that are reasonably certain to occur within the action area are also variable across the program action area. In urban areas there will be continued population growth, but redevelopment will begin to improve negative baseline conditions. Agricultural and forestry practices in rural areas will also likely become restorative in nature. Federal efforts to improve aquatic habitat conditions throughout the State of Oregon action area will gradually improve habitat conditions overall.

In summary, projects completed under the proposed program will result in relatively intense but brief disturbances to a small number of areas distributed throughout each recovery domain, but these disturbances will not appreciably reduce or prevent the increase of abundance or productivity of the populations addressed by this consultation. This is because: (1) Effects from construction related activities are short-term and temporary, (2) A very small portion of the total number of fish in any one population will be exposed to the adverse effects of the proposed action, (3) The geographic extent of the adverse effects is small when compared to the size of any watershed where an action will occur or the total area occupied by any of the species affected. Similarly, projects completed under the proposed program will not affect the diversity of any populations or species because the effects of the action will not impact factors that primarily influence population diversity such as management of hatchery fish or selective harvest practices. Projects that improve fish passage may improve population spatial structure. By contributing to improved habitat conditions that will, over the long term, support populations with higher abundance and productivity, projects completed under the proposed program are consistent with the recovery strategies of increasing productivity and spatial diversity, a critical step toward recovery of these species as whole.

The conservation value of critical habitat within the action area for salmon and steelhead varies by life history strategy, and is higher for species with stream-type histories than for the ocean-type. That is because the latter group is more reliant on shallow-water habitats and small tributaries that are easily affected by a wide range of natural and human disturbances. In Oregon, critical habitat for eulachon is designated in the Lower Columbia River, Umpqua River, Ten Mile Creek, and the Sandy River. For habitat in the Columbia River, the size of the river helps to intercept and buffer the short-term impact of construction actions, and to attenuate the benefits of local restoration, although it is likely that increasing the conservation function of estuaries will be a focus of future restoration projects.

For the most part, the conservation value of these critical habitats is high and the projects completed under the proposed program will have minor short-term effects on the quality and function of critical habitat PCEs. The full set of management measures proposed by the Corps will ensure that these short-term effects to PCEs remain minimal. As restoration projects accumulate over time, habitat conditions may improve and critical habitat will be able to better serve its intended conservation role, supporting viable populations of ESA-listed salmon, steelhead, and eulachon.

Thus, the proposed program is not likely to 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 reduce the value of designated or proposed critical habitat for the conservation of the species.

2.7 Conclusion

After reviewing the current status of the listed species, the environmental baseline within the action area, the effects of the proposed program, any effects of interrelated and interdependent actions, and cumulative effects, it is NMFS's biological opinion that the proposed program is not likely to jeopardize the continued existence of LCR Chinook salmon, UWR Chinook salmon, UCR spring-run Chinook salmon, SR spring/summer run Chinook salmon, SR fall-run Chinook salmon, CR chum salmon, LCR coho salmon, OC coho salmon, SONCC coho salmon, SR sockeye salmon, LCR steelhead, UWR steelhead, MCR steelhead, UCR steelhead, SRB steelhead, or eulachon, or result in the destruction or adverse modification of their designated critical habitats.

We also conclude that that the proposed action will not adversely modify critical habitat proposed for LCR coho salmon. You 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 regulations 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 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.[31] 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

Work necessary to construct and maintain the restoration projects that will be authorized or carried out each year under this Opinion will take place beside and within aquatic habitats that are reasonably certain to be occupied by individuals of the 16 ESA-listed species considered in this consultation. As described below, each type of restoration action is likely to cause incidental take of one or more of those species. Juvenile life stages are most likely to be affected, although adults will sometimes also be present when the actions occur in coastal areas or the Willamette Valley, and when actions do not involve work within the active channel and therefore may not be constrained by application of an in-water work window.

[31] 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.

Juvenile fish will be captured during work area isolation necessary to minimize construction-related disturbance of streambank and channel areas caused by fish passage restoration; off- or side channel reconstruction; set-back of an existing berm, dike or levee; streambank restoration; water control structure removal; or wetland restoration. In-stream disturbance that cannot be avoided by work area isolation will lead to short-term increases in suspended sediment, temperature, dissolved oxygen demand, or other contaminants, and an overall decrease in habitat function that harms adult and juvenile fish by denying them normal use of the action area for reproduction, rearing, feeding, or migration. Exclusion from preferred habitat areas causes increased energy use and an increased likelihood of predation, competition and disease that is reasonably likely to result in injury or death of some individual fish.

Similarly, adult and juvenile fish will be harmed by construction-related disturbance of upland, riparian and in-stream areas for actions related to boulder placement, large wood restoration, pile removal, streambank restoration, spawning gravel restoration, and related in-stream work. The effects of those actions will include additional short-term reductions in water quality, as described above, and will also harm adult and juvenile fish as described above. Herbicide applications will result in herbicide drift or transportation into streams that will harm listed species by chemically impairing normal fish behavioral patterns related to feeding, rearing, and migration that is reasonably likely to result in injury or death of some individual fish.

This take will typically occur within an area that includes the streamside and channel footprint of each project and upstream to the extent that the effects of the project improve fish passage above the construction site. Projects that require two or more years of work to complete will cause adverse effects that last proportionally longer, and effects related to runoff from the construction site may be exacerbated by winter precipitation. These adverse effects may continue intermittently for weeks, months, or years until riparian vegetation and floodplain vegetation are restored and a new topographic equilibrium is reached. Incidental take within that area that meets the terms and conditions of this incidental take statement will be exempt from the taking prohibition.

***Capture of juvenile fish during in-water work area isolation*.**

NMFS does not anticipate that any eulachon will be captured as a result of work necessary to isolate in-water construction areas, although up to 2480 juvenile individuals, per year, of the salmon and steelhead species considered in the consultation will be captured (Table 27). However, of those individual juvenile salmon and steelhead that are captured, NMFS anticipates that no more than 124 individuals will be killed per year. 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. Capture and release of adult fish is not likely to occur as part of the proposed isolation of in-water work areas. No adult fish are likely to be included in this total as they can be effectively excluded from the work area before it is completely isolated from flowing water. Of the juvenile fish that will be collected, fewer than 2% are likely to be killed while the remaining fish are likely to be released and survive with no adverse effects (Table 27). We estimated the adult-equivalent for this mortality is about less than two adults, which will not delay recovery of any species regardless of the recovery status of the population those juveniles are drawn from.

***Harm due to habitat-related effects*.**

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 may operate across far broader temporal and spatial scales than are affected by projects that will be completed under the proposed program. Thus, the distribution and abundance of fish within the program action area cannot be attributed entirely to habitat conditions, nor can NMFS precisely predict the number of fish that are reasonably certain to be injured or killed if their habitat is modified or degraded by actions that will be completed under the proposed program. Additionally, there is no practical way to count the number of fish exposed to the adverse effects of the proposed action without causing additional stress and injury. In such circumstances, 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.

Construction-related disturbance of streambank and channel areas. The best available indicator for the extent of take due to construction-related disturbance of streambank and channel areas is the total length of stream reach that will be modified by construction each year. This variable is proportional to the amounts of harm that each action is likely to cause through short-term degradation of water quality and physical habitat. NMFS assumes that up 80 actions per year may be funded or carried out under this Opinion, and that each action may modify up to 300 lineal feet of riparian and shallow-water habitat; therefore, the extent of take for construction-related disturbance of streambank and channel areas is 24,000 linear stream feet per year.

Construction-related disturbance of upland and wetland areas, or piling removal. The best available indicator for the extent of take caused due to construction-related disturbance of upland and wetland areas during off-and side-channel habitat restoration, set-back of existing berms, dikes and levees, streambank restoration, water control structure removal, and wetland restoration, and in-stream disturbance due to piling removal, is an increase in visible suspended sediment. This variable is proportional to the water quality impairment those actions will cause, including increased sediment, temperature, and contaminants, and reduced dissolved oxygen. NMFS assumes that an increase in sediment will be visible in the immediate vicinity of the action area and for 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, the extent of take for this category is as follows – a visible increase in suspended sediment up to 50 feet from the project area in streams that are 30 feet wide or less, up to 100 feet from the discharge point or nonpoint source of runoff for streams between 30 and 100 feet wide, up to 200 feet from the discharge point or nonpoint source for streams greater than 100 feet wide, or up to 300 feet from the discharge point or nonpoint source for areas subject to tidal or coastal scour.

The applicant will complete and record the following water quality observations to ensure that any increase in turbidity is not exceeding this limit:

1. Take a turbidity sample using an appropriately and regularly calibrated turbidimeter, or a visual turbidity observation, every four hours when work is being completed, or more often as necessary to ensure that the in-water work area is not contributing visible sediment to water, at a relatively undisturbed area approximately 100 feet upstream from the project area, or 300 feet from the project area if subject to tidal or coastal scour. Record the observation, location, and time before monitoring at the downstream point.
2. Take a second visual observation, immediately after each upstream observation, approximately 50 feet upstream from the project area in streams that are 30 feet wide or less, 100 feet from the project area for streams between 30 and 100 feet wide, 200 feet from the discharge point or nonpoint source for streams greater than 100 feet wide, and 300 feet from the discharge point or nonpoint source for areas subject to tidal or coastal scour. Record the downstream observation, location, and time.
3. Compare the upstream and downstream observations - if more turbidity or pollutants are visible downstream than upstream, the activity must be modified to reduce pollution and continue to monitor every four hours, or more often as necessary.
4. If the exceedance continues after the second monitoring interval, the activity must stop until the pollutant level returns to background.
5. If monitoring or inspections show that the pollution controls are ineffective, immediately mobilize work crews to repair, replace, or reinforce controls as necessary.

Application of herbicides to control invasive and non-native plant species. Direct measurement of herbicide transport using the most commonly accepted method of residue analysis (*e.g.*, liquid chromatography–mass spectrometry; Pico *et al*. 2004) are burdensome and expensive for the type and scale of herbicide applications proposed. Thus, use of those measurements in this take statement as an extent of take indicator is likely to outweigh any benefits of using herbicide as a simple and economical restoration tool, and act as an insurmountable disincentive to their use for plant control under this Opinion. Further, the use of simpler, indirect methods, such as olfactometric tests, do not correlate well with measured levels of the airborne pesticides, and may raise ethical questions (Brown *et al*. 2000) that cannot be resolved in consultation. Therefore, the best available indicators for the extent of take due to the proposed application of herbicides within riparian areas is the extent of treated areas. As described above, a typical SLOPES restoration project averages approximately 300 feet in length and, assuming a 100-foot wide application zone, the typical acreage of herbicide application is approximately 0.7 acres or a total of 56 acres.

In summary, the best available indicators for amount and extent of take for these proposed actions are as follows. For actions that involve:

- ***Capture of juvenile fish during in-water work area isolation –*** the amount of take is 2480 ESA-listed fish per year.
- ***Construction-related disturbance of streambank and channel*** – the extent of take indicator is 24,000 linear stream feet per year.
- C***onstruction-related disturbance of upland and wetland areas, or piling removal*** – the extent of take indicator is an increase of visible sediment beyond the discharge point or nonpoint source of runoff.
- A***pplication of herbicide within the riparian area –*** the extent of take indicator is a treated area of up to 56 acres, per year.

NMFS assumes that the proposed actions will continue to be distributed among the recovery domains in the same proportion as in the past and has assigned this take to individual recovery domains whenever possible (Table 32).

Table 32. Extent of take indicators for action authorized or carried out under the SLOPES V Restoration Opinion, by NMFS recovery domain. "WLC" means Willamette/ Lower Columbia; "IC" means Interior Columbia; "OC" means Oregon Coast; "SONCC" means Southern Oregon California Coasts; "n" means the estimated number of projects per year.

Extent of Take Indicator	Recovery Domains			
	WLC n=33	IC n=9	OC n=20	SONCC n=18
ESA-listed fish captured (number salvaged)	1023	279	620	558
Visible suspended sediment (turbidity)	≤10% increase in natural stream turbidity			
Streambank alteration (linear feet)	9900	2700	6000	5400
Herbicide applications (acres)	2.3	6.3	14.0	12.6

2.8.2 Effect of the Take

In Section 2.7, NMFS determined that the level of anticipated take, coupled with other effects of the proposed program, is not likely to result in jeopardy to the species or destruction or adverse modification of critical habitat.

2.8.3 Reasonable and Prudent Measures

"Reasonable and prudent measures" are nondiscretionary measures to minimize the amount or extent of incidental take (50 CFR 402.02).

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

The Corps shall:

1. Minimize incidental take due to authorizing or conducting restoration projects by ensuring that all such projects use the conservation measures described in this opinion, as appropriate.
2. Ensure completion of a comprehensive monitoring and reporting program regarding all restoration projects authorized or conducted by the Corps.

2.8.4 Terms and Conditions

The terms and conditions described below are non-discretionary, and the Corps, or any other party affected by these terms and conditions must comply with them to implement the reasonable and prudent measures (50 CFR 402.14). The Corps has a continuing duty to monitor the impacts of incidental take and must report the progress of the action and its impact on the species as specified in this incidental take statement (50 CFR 402.14). If the following terms and conditions are not complied with, the protective coverage of section 7(o)(2) will likely lapse.

1. To implement reasonable and prudent measure #1 (conservation measures for restoration projects), the Corps shall ensure that:
    a. Every action funded or carried out under this opinion will be administered by the Corps consistent with conservation measures 1 through 13.
    b. For each action involving construction, conservation measures 14 through 49, as appropriate, will be added as conditions of funding.
    c. For specific types of actions, the Corps will apply criteria 28 through 37 as appropriate.

2. To implement reasonable and prudent measure #2 (monitoring and reporting), the Corps shall ensure that:
    a. The following notifications and reports (Appendix A) are submitted to NMFS for each project to be completed under this opinion. All notifications and reports are to be submitted electronically to NMFS at slopes.nwr@noaa.gov.
        i. Project notification within 60-days before start of construction (Part 1).
        ii. Project completion within 60-days of end of construction (Part 1 with Part 2 completed).

iii. Fish salvage within 60 -days of work area isolation with fish capture (Part 1 with Part 3 completed).

b. The Corps' Regulatory and Civil Works Branches will each submit a monitoring report to NMFS by February 15 each year that describes the Corps efforts to carry out this Opinion. The report will include an assessment of overall program activity, a map showing the location and type of each action authorized and carried out under this Opinion, and any other data or analyses the Corps deems necessary or helpful to assess habitat trends as a result of actions authorized under this Opinion.

c. The Corps' Regulatory and Civil Works Branches will each attend an annual coordination meeting with NMFS by March 31 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.

d. Failure to provide timely reporting may constitute a modification of SLOPES that has an effect to listed species or critical habitat that was not considered in the biological opinion and thus may require reinitiation of this consultation.

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 recommendations are discretionary measures that NMFS believes are consistent with this obligation and therefore should be carried out by the Corps:

- The effectiveness of some types of stream restoration actions are not well documented, partly because decisions about which restoration actions deserve support do not always address the underlying processes that led to habitat loss. NMFS recommends that the Corps encourage applicants to use species' recovery plans to help ensure that their actions will address those underlying processes that limit fish recovery.
- Project completion and fish salvage reporting and tracking as required by the SLOPES-IV mailbox system has been somewhat difficult to achieve. Therefore, we have modified the forms and reporting procedure for SLOPES V. Additionally, NMFS also recommends that the Corps evaluate web-based reporting to lessen the administrative burden, with the goal of improving completion reporting and tracking of incidental take.

Please notify NMFS if the Corps carries out these recommendations so that we will be kept informed of actions that minimize or avoid adverse effects and those that benefit the listed species or their designated critical habitats.

2.10 Reinitiation of Consultation

As provided in 50 CFR 402.16, reinitiation of formal consultation is required where discretionary Federal 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 that may affect listed species or 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 to the listed species or critical habitat that was 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" Determination

For purposes of the ESA, "effects of the action" means the direct and indirect effects of an action on the listed species or critical habitat, together with the effects of other activities that are interrelated or interdependent with that action (50 CFR 402.02). The applicable standard to find that a proposed action is NLAA listed species or critical habitat is that all of the effects of the action are expected to be discountable, insignificant, or completely beneficial (USFWS and NMFS 1998). Beneficial effects are contemporaneous positive effects without any adverse effects to the species. Insignificant effects relate to the size of the impact and should never reach the scale where take occurs. Discountable effects are those extremely unlikely to occur.

Southern DPS Green Sturgeon Determination. Southern DPS green sturgeon occur in Oregon in nearshore marine areas, bays, estuaries, and the deep, low elevation, riverine mainstem of coastal rivers. Southern green sturgeon only spawn in the Sacramento River system, well outside the area covered by this consultation. The proposed action will have no effect on green sturgeon spawning.

NMFS has not completed a detailed viability assessment of southern green sturgeon but has determined that the primary threat facing this species is the reduction in the number and geographic distribution of spawning areas, which do not occur within the action area of this proposed action.

Other identified threats related to these species destruction, modification, or curtailment of green sturgeon habitats are also limited to the geographic range of green sturgeon outside the action area for this proposed action. Fisheries, including trophy poaching, are another significant threat to this species, but will not be affected by the proposed action. The only possible adverse effects of the proposed action on southern green sturgeon is likely to occur as a result of the proposed action is short-term degradation of water quality due to increased total suspended solids, dissolved oxygen demand, and temperature due to minor riparian and channel disturbance. Those effects are likely to be insignificant because the intensity will be very low and confined primarily to shallow water habitats not frequented by southern green sturgeon. Green sturgeon mainly use deep waters of the mainstem Columbia where they will never experience the effects of the proposed action.

Steller Sea Lion Determination. The eastern Steller sea lion ranges from southeast Alaska to southern California. The best available information indicates the eastern DPS has increased from an estimated1 18,040 animals in 1979 (90% CI: 14,076-24,761) to an estimated 63,488 animals in 2009 (90% CI: 53,082 - 80,497); thus an estimate of an overall rate of increase for the eastern DPS of 4.3% per year (90% confidence bounds of 1.99% – 7.33%) (NMFS 2012b). The greatest increases have occurred in southeast Alaska and British Columbia (together accounting for 82 percent of pup production), but performance has remained poor in California at the southern extent of their range. In Southeast Alaska, British Columbia and Oregon, the number of Steller sea lions has more than doubled since the 1970s. There are no substantial threats to the species, and the population continues to increase at approximately 3 percent per year. The final Steller sea lion recovery plan identifies the need to initiate a status review for the eastern DPS and consider removing it from the federal List of Endangered Wildlife and Plants (NMFS 2008c). The eastern Steller sea lions breeds on rookeries located in southeast Alaska, British Columbia, Oregon, and California; there are no rookeries located in Washington. Haulouts are located throughout the eastern Steller sea lion range (NMFS 2008c).

Steller sea lions are generalist predators, able to respond to changes in prey abundance. Their primary prey includes a variety of fishes and cephalopods. Some prey species are eaten seasonally when locally available or abundant, and other species are available and eaten year-round (NMFS 2008c). Pacific hake appears to be the primary prey item across the eastern Steller sea lion range (NMFS 2008c). Other prey items include Pacific cod, walleye Pollock, salmon, and herring, among other species.

Steller sea lions occur in Oregon waters throughout the year, and use breeding rookeries at Rogue Reef and Orford Reef and haulout locations along the Oregon coast. Four haulout sites are used by Steller sea lions in the Columbia River, including the tip of the South Jetty, where greater than 500 Steller sea lions commonly occur, and three locations proximate to and at the Bonneville Dam tailrace area where Steller sea lions occasionally occur.

Over the last nine years, the number of Steller sea lions seasonally present at the Bonneville Dam has increased from zero individuals in 2002 to a minimum estimate of 53 subadult and adult male Steller sea lions in 2010, which although an increase is still a relatively small number of individuals (NMFS 2008c; Stansell and Gibbons 2010; Stansell *et al.* 2008; Stansell *et al.* 2009). The few Steller sea lions that travel up the Columbia River to the tailrace area of Bonneville Dam travel there to forage on anadromous fishes. Some individual Steller sea lions occur at the tailrace area as early as fall; their numbers peak in winter to early spring and they depart by late spring (Stansell and Gibbons 2010; Stansell *et al.* 2008; Stansell *et al.* 2009). Individuals are likely to transit through the river up to the tailrace area within 1-2 days based on the transit times of California sea lions. Median downriver and upriver speeds were 6.7 km/hr and 3.7 km/hr, respectively (Brown *et al.* 2011).

Steller sea lions may be present in the Lower Columbia River or near the mouths of other coastal rivers during the proposed in-water work window. It is unlikely that Steller sea lions exposed to sound levels above disturbance thresholds will temporarily avoid traveling through the affected area. For example, Steller sea lions en route to the Bonneville tailrace area are highly motivated to travel through the action area in pursuit of foraging opportunities upriver (NMFS 2008c).

Steller sea lions have shown increasing habituation in recent years to various hazing techniques used to deter the animals from foraging on sturgeon and salmon in the Bonneville tailrace area, including acoustic deterrent devices, boat chasing, and above-water pyrotechnics (Stansell *et al.* 2009). Many of the individuals that travel to the tailrace area return in subsequent years (NMFS 2008c).

The amount of disturbance that may occur before a Steller sea lion is detected is unlikely to significantly change Steller sea lions' behavior, or the amount of time they would otherwise spend in the foraging areas. Even in the event that either change was significant and animals were displaced from foraging areas in the Columbia River, there are alternative foraging areas available to the affected individuals. NMFS does not anticipate any effects on haulout behavior because there are no proximate haulouts within the areas proposed for projects by the Corps. All other effects of actions completed under the proposed program are at most expected to have a discountable or insignificant effect on Steller sea lions, including an insignificant reduction in the quantity and quality of prey otherwise available to Steller sea lions where they would intercept the affected species (*i.e.,* salmonids and green sturgeon as described in the respective sections above).

NMFS finds that any affect the proposed program is may have on Steller sea lions, including any indirect effects on their prey, is likely to be discountable, insignificant or beneficial. Sea lions are unlikely to be close enough to any project site to experience the adverse effects of the proposed action.

Southern Resident Killer Whale Determination. Southern Resident killer whales spend considerable time in the Georgia Basin from late spring to early autumn, with concentrated activity in the inland waters of Washington State around the San Juan Islands, and typically move south into Puget Sound in early autumn (NMFS 2008a). Pods make frequent trips to the outer coast during this season. In the winter and early spring, Southern Resident killer whales move into the coastal waters along the outer coast from the Queen Charlotte Islands south to central California, including coastal Oregon and off the Columbia River (NMFS 2008a).

No documented sightings exist of Southern Resident killer whales in Oregon coastal bays, and there is no documented pattern of predictable Southern Resident occurrence along the Oregon outer coast and any potential occurrence would be infrequent and transitory. Southern Residents primarily eat salmon and prefer Chinook salmon (Hanson *et al.* 2010; NMFS 2008a).

As stated above for Steller sea lions, the proposed program may affect the quantity of their preferred prey, Chinook salmon. Any salmonid take including Chinook salmon up to the aforementioned amount and extent of take would result in an insignificant reduction in adult equivalent prey resources for Southern Resident killer whales that may intercept these species within their range.

NMFS finds that any affect the proposed program is may have on Southern Resident killer whales, including indirect effects on their prey, is likely to be discountable, insignificant or beneficial. Therefore, NMFS finds that the proposed program may affect, but is not likely to adversely affect Southern Resident killer whales.

3. MAGNUSON-STEVENS FISHERY CONSERVATION AND MANAGEMENT ACT ESSENTIAL FISH HABITAT CONSULTATION

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 occur when EFH quality or quantity is reduced by a direct or indirect physical, chemical, or biological alteration of the waters or substrate, or by the loss of (or injury to) benthic organisms, prey species and their habitat, or other ecosystem components. Adverse effects on EFH may result from actions occurring within EFH or outside of it 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 Corps and descriptions of EFH for Pacific coast groundfish (PFMC 2005), coastal pelagic species (PFMC 1998), and Pacific coast salmon(PFMC 1999) contained in the fishery management plans developed by the Pacific Fishery Management Council (PFMC) and approved by the Secretary of Commerce.

3.1 Essential Fish Habitat Affected by the Project

The Pacific Fishery Management Council (PFMC) described and identified EFH for groundfish (PFMC 2005), coastal pelagic species (PFMC 1998), and Chinook salmon, coho salmon, and Puget Sound pink salmon (PFMC 1999). The proposed action and action area for this consultation are described in the Introduction to this document. The action area includes areas designated as EFH for various life-history stages of groundfish, coastal pelagic species, and Chinook and coho. Based on information provided by the action agency and the analysis of effects presented in the ESA portion of this document, NMFS concludes that proposed action will have the following adverse effects on EFH designated for Pacific Coast salmon:

3.2 Adverse Effects on Essential Fish Habitat

Based on information provided in the BA and the analysis of effects presented in the ESA portion of this document, NMFS concludes that proposed action will have the following adverse effects on EFH designated for those species, including estuarine areas designated at habitat areas of critical concern in the Lower Columbia River and at other river mouths, bays, estuaries, and coastal waters where restoration projects will occur:

1. Freshwater EFH quantity will be reduced due to short-term construction needs, reduced riparian permeability, and increased riparian runoff, and a slight longer-term increase based on improved riparian function and floodplain connectivity.
2. Freshwater EFH quality will be reduced due to a short-term increase in turbidity, dissolved oxygen demand, and temperature due to riparian and channel disturbance, and longer-term improvement due to improved riparian function and floodplain connectivity.

3. Tributary substrate will have a short-term reduction in quality due to increased compaction and sedimentation, and a long-term increase due to gravel placement, increased sediment storage from boulders and large wood.

4. Floodplain connectivity will have a short-term decrease due to increased compaction and riparian disturbance during construction, and a long-term improvement due to off- and side channel habitat restoration, set-back of existing berms, dikes, and levees, and removal of water control structures.

5. Forage will have a short-term decrease in availability due to riparian and channel disturbance, and a long-term improvement due to improved habitat diversity and complexity, and improved riparian function and floodplain connectivity.

6. Natural cover will have short-term decrease due to riparian and channel disturbance, and a long-term increase due to improved habitat diversity and complexity, improved riparian function and floodplain connectivity, off- and side channel habitat restoration.

7. Fish passage will be impaired in the short-term due to decreased water quality and in-water work isolation, and improved over the long-term due to improved water quantity and quality, habitat diversity and complexity, forage, and natural cover.

3.3 Essential Fish Habitat Conservation Recommendations

The following four conservation recommendations are necessary to avoid, mitigate, or offset the impact of the proposed action on EFH. These conservation recommendations are a subset of the ESA terms and conditions:

1. The effectiveness of stream restoration actions is not well documented, partly because decisions about which restoration actions deserve support do not always address the underlying processes that led to habitat loss. NMFS recommends that the Corps encourage applicants to use species' recovery plans to help ensure that their actions will address those underlying processes that limit fish recovery.
2. NMFS also recommends that the Corps evaluate whether the availability of regulatory streamlining provided by this opinion influences the design of restoration actions, or acts as an incentive that increases the likelihood that restoration actions will be completed.
3. As appropriate to each action issued a regulatory permit under this opinion, include the design criteria for construction and types of actions (*i.e.*, 14 through 49) as enforceable permit conditions, except 23 (fish capture and release) and 24 (electrofishing).
4. Include each applicable design criteria for construction and types of actions (*i.e.*, 14 through 49) as a final action specification of every WRDA civil works action carried out under this opinion, except 23 (fish capture and release), and 24 (electrofishing).

3.4 Statutory Response Requirement

As required by section 305(b)(4)(B) of the MSA, the Corps must provide a detailed response in writing to NMFS within 30 days after receiving an EFH Conservation Recommendation. 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 agency have agreed to use alternative time frames for the Federal 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 the Conservation Recommendations, the Federal 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 consultation 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 Corps 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

The DQA specifies three components contributing to the quality of a document. They are utility, integrity, and objectivity. This section of the opinion addresses these 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 user of this opinion is the Army Corps of Engineers. Other interested users could include organizations throughout the state that are engaged in fish habitat restoration. Individual copies of this opinion were provided to the Corps. This opinion will be posted on the NMFS Northwest Region web site (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.

Best Available Information: This consultation and supporting documents use the best available information, as referenced in the References Section. The analyses in this opinion and 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.

5. LITERATURE CITED

Baldwin, D.H., J.F. Sandahl, J.S. Labenia, and N.L. Scholz. 2003. Sublethal effects of copper on coho salmon: Impacts on nonoverlapping receptor pathways in the peripheral olfactory nervous system. Environmental Toxicology and Chemistry 22:2266-2274.

Baldwin, D.H., and N.L. Scholz. 2005. The electro-olfactogram: An *in vivo* measure of peripheral olfactory function and sublethal neurotoxicity in fish. Pages 257-276 G.K. Ostrander (editor). *In:* Techniques in Aquatic Toxicology. CRC Press, Inc. Boca Raton, Florida.

Bindoff, N.L., J. Willebrand, V. Artale, A. Cazenave, J. Gregory, S. Gulev, K. Hanawa, C. Le Quéré, S. Levitus, Y. Nojiri, C.K. Shum, L.D. Talley, and A. Unnikrishnan. 2007. Observations: Oceanic climate change and sea levelS. Solomon, D. Qin, M. Manning, Z. Chen, M. Marquis, K.B. Averyt, M. Tignor, and H.L. Miller (editors). *In:* Climate Change 2007: The physical science basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge University Press. Cambridge, United Kingdom and New York.

Bottom, D.L., C.A. Simenstad, J. Burke, A.M. Baptista, D.A. Jay, K.K. Jones, E. Casillas, and M.H. Schiewe. 2005. Salmon at river's end: The role of the estuary in the decline and recovery of Columbia River salmon. U.S. Department of Commerce, NOAA Technical Memorandum NMFS-NWFSC-68. 246 p.

Bradbury, B., W. Nehlsen, T.E. Nickelson, K.M.S. Moore, R.M. Hughes, D. Heller, J. Nicholas, D.L. Bottom, W.E. Weaver, and R.L. Beschta. 1995. Handbook for prioritizing watershed protection and restoration to aid recovery of native salmon: Ad hoc working group sponsored by Oregon State Senator Bill Bradbury, Pacific Rivers Council. 56 p.

Brown, J.N., S.R. Gooneratne, and R.B. Chapman. 2000. Herbicide spray drift odor: Measurement and toxicological significance. Archives of Environmental Contamination and Toxicology 38:390–397.

Brown, K. (compiler and producer). 2011. Oregon Blue Book: 2011-2012. Oregon State Archives, Office of the Secretary of State of Oregon. Salem, Oregon. http://bluebook.state.or.us/.

Brown, R., S. Jeffries, D. Hatch, B. Wright, and S. Jonker. 2011. Field Report: 2011 Pinniped management activities at and below Bonneville Dam. Oregon Department of Fish and Wildlife, Washington Department of Fish and Wildlife, and Columbia River Inter-Tribal Fish Commission. Report. October 4. http://www.mediate.com/DSConsulting/docs/Bonneville%202011%20Field%20Report.pdf.

Busch, S., P. McElhany, and M. Ruckelshaus. 2008. A comparison of the viability criteria developed for management of ESA listed Pacific salmon and steelhead. National Marine

Fisheries Service, Northwest Fisheries Science Center. Seattle. http://www.nwfsc.noaa.gov/trt/trt_documents/viability_criteria_comparison_essay_oct_10.pdf.

Cannon, K. 2008. Email from Ken Cannon, Oregon Department of Transportation transmitting ODOT 2007 Fish Salvage Report. Personal Communication to Marc Liverman, National Marine Fisheries Service. July 29, 2008.

Cannon, K. 2012. Email from Ken Cannon, Oregon Department of Transportation transmitting ODOT 2012 Fish Salvage Report. Personal Communication to Marc Liverman, National Marine Fisheries Service. February 4, 2012.

Carls, M.G., L. Holland, M. Larsen, T.K. Collier, N.L. Scholz, and J. Incardona. 2008. Fish embryos are damaged by dissolved PAHs, not oil particles. Aquatic Toxicology 88(2):121-127.

Cederholm, C.J., L.G. Dominguez, and T.W. Bumstead. 1997. Rehabilitating stream channels and fish habitat using large woody debris. Pages 8-1 to 8-28 P.A. Slaney, and D. Zaldokas (editors). *In:* Fish Habitat Rehabilitation Procedures. Watershed Restoration Technical Circular No. 9. British Columbia Ministry of Environment, Lands and Parks. Vancouver, British Columbia.

Collier, T.K., J.P. Meador, and L.L. Johnson. 2002. Introduction: Fish tissue and sediment effects thresholds for polychlorinated biphenyls, polycyclic aromatic hydrocarbons, and tributyltin. Aquatic Conservation: Marine and Freshwater Ecosystems 12:489-492.

Cramer, M., K. Bates, D. Miller, K. Boyd, L. Fotherby, P. Skidmore, T. Hoitsma, B. Heiner, K. Buchanan, P. Powers, G. Birkeland, M. Rotar, and D. White. 2003. Integrated streambank protection guidelines. Washington Department of Fish and Wildlife, Habitat Technical Assistance. Olympia, Washington. http://wdfw.wa.gov/publications/00046/wdfw00046.pdf.

Cramer, M.L., (editor). 2012. Stream habitat restoration guidelines. Co-published by the Washington Departments of Fish and Wildlife, Natural Resources, Transportation and Ecology, Washington State Recreation and Conservation Office, Puget Sound Partnership, and the U.S. Fish and Wildlife Service. Olympia, Washington.

CRITFC. 1995. Wy-Kan-Ush-Mi Wa-Kish-Wit: Spirit of the Salmon, the Columbia River Anadromous Fish Restoration Plan of the Nez Perce, Umatilla, Warm Springs, and Yakama Tribes. Two Volumes. Columbia River Inter-Tribal Fish Commission and member Tribes. Portland, Oregon. http://www.critfc.org/fish-and-watersheds/fish-and-habitat-restoration/the-plan-wy-kan-ush-mi-wa-kish-wit/.

Darnell, R.M. 1976. Impacts of construction activities in wetlands of the United States. U.S. Environmental Protection Agency, Environmental Research Laboratory. Ecological Research Series, Report No. EPA-600/3-76-045. U.S. Environmental Protection Agency, Environmental Research Laboratory. Corvallis, Oregon.

Doyle, M.W., and F.D. Shields. 2012. Compensatory mitigation for streams under the Clean Water Act: Reassessing science and redirecting policy. Journal of the American Water Resources Association 48(3):494-509.

Drake, J., R. Emmett, K. Fresh, R. Gustafson, M. Rowse, D. Teel, M. Wilson, P. Adams, E.A.K. Spangler, and R. Spangler. 2008. Summary of scientific conclusions of the review of the status of eulachon (*Thaleichthys pacificus*) in Washington, Oregon and California. Northwest Fisheries Science Center, National Marine Fisheries Service. Seattle.

Ebersole, J.L., W.J. Liss, and C.A. Frissell. 2001. Relationship between stream temperature, thermal refugia and rainbow trout *Oncorhynchus mykiss* abundance in arid-land streams in the northwestern United States. Ecology of Freshwater Fish 10(1-10).

Ferguson, J.W., G.M. Matthews, R.L. McComas, R.F. Absolon, D.A. Brege, M.H. Gessel, and L.G. Gilbreath. 2005. Passage of adult and juvenile salmonids through federal Columbia River power system dams. U.S.D.o. Commerce. NOAA Technical Memorandum NMFS-NWFSC-64. 160 p.

Fernald, A.G., P.J. Wigington, and D.H. Landers. 2001. Transient storage and hyporheic flow along the Willamette River, Oregon: Field measurements and model estimates. Water Resources Research 37(6):1681-1694.

Ford, M.J., (editor). 2011. Status review update for Pacific salmon and steelhead listed under the Endangered Species Act: Pacific Northwest. U.S. Department of Commerce, NOAA Technical Memorandum NMFS-NWFSC-113. 281 p.

Fox, W.W. 1992. Stemming the tide: Challenges for conserving the nation's coastal fish habitat. Pages 9-13 R.H. Stroud (editor). *In:* Stemming the tide of coastal fish habitat loss. National Coalition for Marine Conservation, Inc. Savannah, Georgia.

Fresh, K.L., E. Casillas, L.L. Johnson, and D.L. Bottom. 2005. Role of the estuary in the recovery of Columbia River Basin salmon and steelhead: An evaluation of the effects of selected factors on salmonid population viability. U.S. Department of Commerce, NOAA Technical Memorandum NMFS-NWFSC-69. 105 p.

Giannico, G.A., and J.A. Souder. 2004. The effects of tide gates on estuarine areas and migratory fish. Oregon Sea Grant, Oregon State University. Corvallis, Oregon. Report. 9 p. http://seagrant.oregonstate.edu/sites/default/files/sgpubs/onlinepubs/g04002.pdf.

Giannico, G.A., and J.A. Souder. 2005. Tide gates in the Pacific Northwest: Operation, types and environmental effects. Oregon Sea Grant. ORESU-T-05-001. Corvallis, Oregon. Report. http://www.cooswatershed.org/Publications/tidegates_PACNW.pdf.

Good, T.P., R.S. Waples, and P. Adams, (editors). 2005. Updated status of federally listed ESUs of west coast salmon and steelhead. West Coast Salmon Biological Review Team. U.S. Department of Commerce, NOAA Technical Memorandum, NMFS-NWFSC-66. 598 p.

Gregory, S., L. Ashkenas, D. Oetter, P. Minear, and K. Wildman. 2002a. Historical Willamette River channel change. Pages 18-26 D. Hulse, S. Gregory, and J. Baker (editors). *In:* Willamette River Basin planning atlas: Trajectories of environmental and ecological change. Oregon State University Press. Corvallis, Oregon.

Gregory, S., L. Ashkenas, D. Oetter, P. Minear, R. Wildman, P. Minear, S. Jett, and K. Wildman. 2002b. Revetments. Pages 32-33 D. Hulse, S. Gregory, and J. Baker (editors). *In:* Willamette River Basin planning atlas: Trajectories of environmental and ecological change. Oregon State University Press. Corvallis, Oregon.

Gregory, S., L. Ashkenas, P. Haggerty, D. Oetter, K. Wildman, D. Hulse, A. Branscomb, and J. Van Sickle. 2002c. Riparian vegetation. Pages 40-43 D. Hulse, S. Gregory, and J. Baker (editors). *In:* Willamette River Basin planning atlas: Trajectories of environmental and ecological change. Oregon State University Press. Corvallis, Oregon.

Gustafson, R.G., M.J. Ford, D. Teel, and J.S. Drake. 2010. Status review of eulachon (*Thaleichthys pacificus*) in Washington, Oregon, and California. U.S. Department of Commerce, NOAA Technical Memorandum NMFS-NWFSC-105. 360 p.

Gustafson, R.G., M.J. Ford, P.B. Adams, J.S. Drake, R.L. Emmett, K.L. Fresh, M. Rowse, E.A.K. Spangler, R.E. Spangler, D.J. Teel, and M.T. Wilson. 2011. Conservation status of eulachon in the California Current. Fish and Fisheries.

Hanson, M.B., R.W. Baird, J.K.B. Ford, J. Hempelmann-Halos, D.M. Van Doornik, J.R. Candy, C.K. Emmons, G.S. Schorr, B. Gisborne, K.L. Ayers, S.K. Wasser, K.C. Balcomb, K. Balcomb-Bartok, J.G. Sneva, and M.J. Ford. 2010. Species and stock identification of prey selected by endangered "southern resident" killer whales in their summer range. Endangered Species Research 11:69-82.

Hebdon, J.L., P. Kline, D. Taki, and T.A. Flagg. 2004. Evaluating reintroduction strategies for Redfish Lake sockeye salmon captive brood progeny. American Fisheries Society Symposium 44:401-413.

Hecht, S.A., D.H. Baldwin, C.A. Mebane, T. Hawkes, S.J. Gross, and N.L. Scholz. 2007. An overview of sensory effects on juvenile salmonids exposed to dissolved copper: Applying a benchmark concentration approach to evaluate sublethal neurobehavioral toxicity. U.S. Department of Commerce, NOAA Fisheries, NOAA Technical Memorandum NMFS-NWFSC-83. 39 p.

Heintz, R.A., J.W. Short, and S.D. Rice. 1999. Sensitivity of fish embryos to weathered crude oil: Part II. Increased mortality of pink salmon (*Oncorhynchus gorbuscha*) embryos incubating downstream from weathered Exxon Valdez crude oil. Environmental Toxicology and Chemistry 18:494-503.

Heintz, R.A., S.D. Rice, A.C. Wertheimer, R.F. Bradshaw, F.P. Thrower, J.E. Joyce, and J.W. Short. 2000. Delayed effects on growth and marine survival of pink salmon *Oncorhynchus gorbuscha* after exposure to crude oil during embryonic development. Marine Ecology Progress Series 208:205-216.

Hicks, D. 2005. Lower Rogue watershed assessment. South Coast Watershed Council. Gold Beach, Oregon. Report. https://nrimp.dfw.state.or.us/web%20stores/data%20libraries/files/OWEB/OWEB_966_2_LowerRogue_WatershedAssessment_August2005.pdf.

IC-TRT. 2003. Working draft. Independent populations of Chinook, steelhead, and sockeye for listed evolutionarily significant units within the Interior Columbia River domain. July. U.S. Department of Commerce, NOAA Fisheries.

IC-TRT. 2007. Viability criteria for application to Interior Columbia Basin salmonid ESUs. Interior Columbia Tecnical Recovery Team, review draft (March). Northwest Fisheries Science Center, National Marine Fisheries Service. Seattle.

IC-TRT. 2011. Draft recovery plan for Idaho Snake River spring/summer Chinook and steelhead populations in the Snake River spring/summer Chinook salmon evolutionarily significant unit and Snake River steelhead distinct population segment (chapters 1-3) National Marine Fisheries Service, Northwest Region, Protected Resources Division. Boise, Idaho. http://www.idahosalmonrecovery.net.

Idaho Department of Environmental Quality. 2011. Idaho Department of Environmental Quality final 2010 integrated report. Boise, Idaho.

Incardona, J.P., T.K. Collier, and N.L. Scholz. 2004. Defects in cardiac function precede morphological abnormalities in fish embryos exposed to polycyclic aromatic hydrocarbons. Toxicology and Applied Pharmacology 196:191-205.

Incardona, J.P., M.G. Carls, H. Teraoka, C.A. Sloan, T.K. Collier, and N.L. Scholz. 2005. Aryl hydrocarbon receptor-independent toxicity of weathered crude oil during fish development. Environmental Health Perspectives 113:1755-1762.

Incardona, J.P., H.L. Day, T.K. Collier, and N.L. Scholz. 2006. Developmental toxicity of 4-ring polycyclic aromatic hydrocarbons in zebrafish is differentially dependent on AH receptor isoforms and hepatic cytochrome P450 1A metabolism. Toxicology and Applied Pharmacology 217:308-321.

ISAB, (editor). 2007. Climate change impacts on Columbia River Basin fish and wildlife.*In:* Climate Change Report, ISAB 2007-2. Independent Scientific Advisory Board, Northwest Power and Conservation Council. Portland, Oregon.

Johnson, L. 2000. An analysis in support of sediment quality thresholds for polycyclic aromatic hydrocarbons (PAHs) to protect estuarine fish. National Marine Fisheries Service, Northwest Fisheries Science Center. Seattle, Washington. Report. 29 p. ftp://ftp.pcouncil.org/pub/Salmon%20EFH/302-Johnson_2000.pdf.

Johnson, L.L., S.Y. Sol, G.M. Ylitalo, T. Hom, B. French, O.P. Olson, and T.K. Collier. 1999. Reproductive injury in English sole (*Pleuronectes vetulus*) from the Hylebos Waterway, Commencement Bay, Washington. Journal of Aquatic Ecosystem Stress and Recovery 6:289-310.

Johnson, L.L., T.K. Collier, and J.E. Stein. 2002. An analysis in support of sediment quality thresholds for polycyclic aromatic hydrocarbons (PAHs) to protect estuarine fish. Aquatic Conservation: Marine and Freshwater Ecosystems 12:517-538.

Joint Columbia River Management Staff. 2009. 2010 joint staff report concerning stock status and fisheries for sturgeon and smelt. Oregon Department of Fish and Wildlife and Washington Department of Fish and Wildlife. http://wdfw.wa.gov/publications/00886/wdfw00886.pdf.

Keefer, M.L., C.A. Peery, and M.J. Henrich. 2008. Temperature mediated en route migration mortality and travel rates of endangered Snake River sockeye salmon. Ecology of Freshwater Fish 17:136-145.

Lawson, P.W., E.P. Bjorkstedt, M.W. Chilcote, C.W. Huntington, J.S. Mills, K.M. Moores, T.E. Nickelson, G.H. Reeves, H.A. Stout, T.C. Wainwright, and L.A. Weitkamp. 2007. Identification of historical populations of coho salmon (*Onchorynchus kisutch*) in the Oregon Coast evolutionarily significant unit. NMFS-NWFSC-79. U.S. Department of Commerce, NOAA Technical Memorandum. 129 p.

Linbo, T.L., C.M. Stehr, J. Incardona, and N.L. Scholz. 2006. Dissolved copper triggers cell death in the peripheral mechanosensory system of larval fish. Environmental Toxicology and Chemistry 25(2):597-603.

Lower Columbia Fish Recovery Board. 2010. Washington lower Columbia salmon recovery & fish and wildlife subbasin plan. Olympia, Washington. May 28. http://www.lcfrb.gen.wa.us/Recovery%20Plans/RP%20Frontpage.htm.

Lower Columbia River Estuary Partnership. 2007. Lower Columbia River and estuary ecosystem monitoring: Water quality and salmon sampling report Portland, Oregon. Report. http://www.lcrep.org/ecosystem-monitoring.

Maguire, M. 2001. Chetco River watershed assessment. South Coast Watershed Council. Gold Beach, Oregon. Report.

McElhany, P., M.H. Ruckelshaus, M.J. Ford, T.C. Wainwright, and E.P. Bjorkstedt. 2000. Viable salmonid populations and the recovery of evolutionarily significant units. U.S. Department of Commerce, NOAA Technical Memorandum NMFS-NWFSC-42. Seattle. 156 p.

McElhany, P., C. Busack, M. Chilcote, S. Kolmes, B. McIntosh, J. Myers, D. Rawding, A. Steel, C. Steward, D. Ward, T. Whitesel, and C. Willis. 2006. Revised viability criteria for salmon and steelhead in the Willamette and Lower Columbia basins. Review Draft. Willamette/Lower Columbia Technical Recovery Team and Oregon Department of Fish and Wildlife.

McElhany, P., M. Chilcote, J. Myers, and R. Beamesderfer. 2007. Viability status of Oregon salmon and steelhead populations in the Willamette and Lower Columbia Basins. Prepared for Oregon Department of Fish and Wildlife and National Marine Fisheries Service, Portland, Oregon.

McIntyre, J.K., D.H. Baldwin, J.P. Meador, and N.L. Scholz. 2008. Chemosensory deprivation in juvenile coho salmon exposed to dissolved copper under varying water chemistry conditions. Environmental Science & Technology 42(4):1352-1358.

McMichael, G.A., A.L. Fritts, and T.N. Pearsons. 1998. Electrofishing injury to stream salmonids; injury assessment at the sample, reach, and stream scales. North American Journal of Fisheries Management 18:894-904.

Merz, J.E., and L.K.O. Chan. 2005. Effects of gravel augmentation on macroinvertebrate assemblages in a regulated California river. River Research Application 21:61-74.

Metro. 2000. The nature of 2040: The region's 50-year plan for managing growth. Metro. Portland, Oregon. http://library.oregonmetro.gov/files/natureof2040.pdf.

Metro. 2008. The Portland metro region: Our place in the world – global challenges, regional strategies, homegrown solutions. Metro. Portland, Oregon. http://library.oregonmetro.gov/files/our_place_in_the_world.pdf.

Metro. 2010. Urban Growth Report: 2009-2030, Employment and Residential. Metro. Portland, Oregon. January. http://library.oregonmetro.gov/files/ugr.pdf.

Metro. 2011. Regional Framework Plan: 2011 Update. Metro. Portland, Oregon. http://library.oregonmetro.gov/files//rfp.00_cover.toc.intro_011311.pdf.

Moberg, G.P. 2000. Biological response to stress: Implications for animal welfare. Pages 1-21 G.P. Moberg, and J.A. Mench (editors). *In:* The biology of animal stress - basic principles and implications for animal welfare. CABI Publishing. Cambridge, Massachusetts.

Myers, J.M., C. Busack, D. Rawding, A.R. Marshall, D.J. Teel, D.M. Van Doornik, and M.T. Maher. 2006. Historical population structure of Pacific salmonids in the Willamette River and lower Columbia River basins. U.S. Department of Commerce, NOAA Technical Memorandum NMFS-NWFSC-73. 311 p. http://www.nwfsc.noaa.gov/assets/25/6490_04042006_153011_PopIdTM73Final.pdf.

Newcombe, C.P., and J.O.T. Jensen. 1996. Channel suspended sediment and fisheries: A synthesis for quantitative assessment of risk and impact. North American Journal of Fisheries Management 16:693-727.

Nicholas, J., B. McIntosh, E. Bowles, Oregon Watershed Enhancement Board, and Oregon Department of Fish and Wildlife. 2005. Coho assessment, Part 1: Synthesis Final Report. Salem, Oregon. May 6.

NMFS. 2000. Guidelines for electrofishing waters containing salmonids listed under the Endangered Species Act. National Marine Fisheries Service. Portland, Oregon and Santa Rosa, California. http://www.nwr.noaa.gov/ESA-Salmon-Regulations-Permits/4d-Rules/upload/electro2000.pdf.

NMFS. 2002. Biological opinion on the collection, rearing, and release of salmonids associated with artificial propagation programs in the middle Columbia River steelhead evolutionarily significant unit (ESU). National Marine Fisheries Service. Portland, Oregon. February 14, 2002.

NMFS. 2005. Endangered Species Act Section 7 Formal Consultation and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Consultation for the Pacific Northwest Region Invasive Plant Program, Oregon and Washington (September 8, 2005.) (Refer to NMFS No. 2005/03140). National Marine Fisheries Service, Northwest Region. Portland, Oregon.

NMFS. 2007. 2007 Report to Congress: Pacific Coastal Salmon Recovery Fund, FY 2000-2006. U.S. Department of Commerce, NOAA, National Marine Fisheries Service. Washington, D.C.

NMFS. 2008a. Recovery Plan for Southern Resident Killer Whales (*Orcinus orca*). National Marine Fisheries Service, Northwest Regional Office. http://www.nmfs.noaa.gov/pr/pdfs/recovery/whale_killer.pdf.

NMFS. 2008b. Endangered Species Act Section 7 Formal and Informal Programmatic Opinion and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Consultation for Revisions to Standard Local Operating Procedures for endangered species to administer stream restoration and fish passage improvement actions authorized or carried out by the U.S. Army Corps of Engineers in Oregon (SLOPES IV Restoration). (February 25, 2008)(Refer to NMFS No.: 2007/07790).

NMFS. 2008c. Steller Sea Lion Recovery Plan, Eastern and Western Distinct Population Segments (*Eumetopias jubatus*) (Revision, Original Version: December 1992) (March 2008). National Marine Fisheries Service, Office of Protected Resources. Silver Springs, Maryland.

NMFS. 2008d. Programmatic biological opinion and Magnuson-Stevens Fishery Conservation and Management Act essential fish habitat consultation for revisions to Standard Local

Operating Procedures for Endangered Species to administer maintenance or improvement of road, culvert, bridge and utility line actions authorized or carried out by the U.S. Army Corps of Engineers in Oregon (SLOPES IV Roads, Culverts, Bridges and Utility Lines, August 13, 2008) (Refer to NMFS No.:2008/04070).

NMFS. 2009. Middle Columbia River steelhead distinct population segment ESA recovery plan. November 30. http://www.nwr.noaa.gov/Salmon-Recovery-Planning/Recovery-Domains/Interior-Columbia/Mid-Columbia/Mid-Col-Plan.cfm.

NMFS. 2011a. 2011 Report to Congress: Pacific Coastal Salmon Recovery Fund FY 2000 – 2010. National Marine Fisheries Service, Northwest Region. Portland, Oregon. http://www.nwr.noaa.gov/Salmon-Recovery-Planning/PCSRF/upload/PCSRF-Rpt-2011.pdf.

NMFS. 2011b. 5-year review: summary and evaluation of Lower Columbia River Chinook, Columbia River chum, Lower Columbia River coho, and Lower Columbia River steelhead. National Marine Fisheries Service. Portland, Oregon.

NMFS. 2011c. 5-year review: summary and evaluation of Snake River sockeye, Snake River spring-summer Chinook, Snake River fall-run Chinook, Snake River Basin steelhead. National Marine Fisheries Service, Portland, Oregon.

NMFS. 2011d. Columbia River estuary ESA recovery plan module for salmon and steelhead. Prepared for NMFS by the Lower Columbia River Estuary Partnership (contractor) and PC Trask & Associates, Inc. (subcontractor). National Marine Fisheries Service, Northwest Region. Portland, Oregon. January. http://www.nwr.noaa.gov/Salmon-Recovery-Planning/ESA-Recovery-Plans/upload/Estuary-Mod.pdf.

NMFS. 2011e. Anadromous salmonid passage facility design. NMFS, Northwest Region, Portland, Oregon. http://www.habitat.noaa.gov/pdf/salmon_passage_facility_design.pdf.

NMFS. 2012a. Designation of critical habitat for Lower Columbia River Coho Salmon and Puget Sound Steelhead, DRAFT Biological Report. NMFS, Protected Resources Division. Portland, Oregon. November. http://www.nwr.noaa.gov/Salmon-Habitat/Critical-Habitat/upload/LCRC-PSS-chart1.pdf.

NMFS. 2012b. (Draft) Status review of the eastern distinct population segment of Steller sea lion (*Eumetopias jubatus*). Protected Resources Division, Alaska Region, National Marine Fisheries Service. Juneau, Alaska. 106 pp. + Appendices. http://www.fakr.noaa.gov/protectedresources/stellers/edps/draftedps0412.pdf.

NMFS. 2012c. Proposed ESA recovery plan for Lower Columbia River coho salmon, Lower Columbia River Chinook salmon, Columbia River chum salmon, and Lower Columbia River steelhead. National Marine Fisheries Service, Northwest Region. April. http://www.nwr.noaa.gov/Salmon-Recovery-Planning/Recovery-Domains/Willamette-Lower-Columbia/LC/upload/LC-plan.pdf.

NMFS. 2012d. Public draft recovery plan for southern Oregon/northern California coast coho salmon (*Oncorhynchus kisutch*). National Marine Fisheries Service. Arcata, California.

NOAA Fisheries. 2005. Assessment of NOAA Fisheries' critical habitat analytical review teams for 12 evolutionarily significant units of West Coast salmon and steelhead. National Oceanic and Atmospheric Administration, NMFS-Protected Resources Division. Portland, Oregon.

NOAA Fisheries. 2011. Biennial report to Congress on the recovery program for threatened and endangered species October 1, 2008 – September 30, 2010. NOAA-National Marine Fisheries Service. Washington, D.C.

NRC. 1995. Science and the Endangered Species Act. Committee on Scientific Issues in the Endangered Species Act, Board on Environmental Studies and Toxicology, Commission on Life Sciences. National Research Council, National Academy Press. Washington, D.C.

NWPCC. 2012. The State of the Columbia River Basin. Northwest Power and Conservation Council. Portland, Oregon. http://www.nwcouncil.org/library/2012/2012-08.pdf.

ODF, and ODFW. 1995. Guide to placing large wood in streams. Oregon Department of Forestry, and Oregon Department of Fish and Wildlife--Wildlife Division. Salem, Oregon. http://www.oregon.gov/odf/privateforests/docs/woodplacmntguide1995.pdf.

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

ODFW. 2010. Lower Columbia River conservation and recovery plan for Oregon populations of salmon and steelhead. Oregon Department of Fish and Wildlife. Salem, Oregon.

ODFW, and NMFS. 2011. Upper Willamette River conservation and recovery plan for Chinook salmon and steelhead. Oregon Department of Fish and Wildlife and National Marine Fisheries Service, Northwest Region. August 5.

OWEB. 2011. The Oregon Plan for Salmon and Watersheds: Biennial Report Executive Summary. Oregon Watershed Enhancement Board. Salem, Oregon. Revised January 24, 2011. http://www.oregon.gov/OWEB/biennialreport_0911/opbiennial_2009_2011.pdf.

PFMC. 1998. Description and identification of essential fish habitat for the Coastal Pelagic Species Fishery Management Plan. Appendix D to Amendment 8 to the Coastal Pelagic Species Fishery Management Plan. Pacific Fishery Management Council. Portland, Oregon. December. http://www.pcouncil.org/wp-content/uploads/a8apdxd.pdf.

PFMC. 1999. Description and identification of essential fish habitat, adverse impacts and recommended conservation measures for salmon. Appendix A to Amendment 14 to the Pacific Coast Salmon Plan. Pacific Fishery Management Council. Portland, Oregon. http://www.pcouncil.org/salmon/fishery-management-plan/adoptedapproved-amendments/amendment-14-to-the-pacific-coast-salmon-plan-1997/.

PFMC. 2005. Amendment 18 (bycatch mitigation program), Amendment 19 (essential fish habitat) to the Pacific Coast Groundfish Fishery Management Plan for the California, Oregon, and Washington groundfish fishery. Pacific Fishery Management Council. Portland, Oregon. November. http://www.pcouncil.org/groundfish/fishery-management-plan/fmp-amendment-19/.

Pico, Y., C. Blasco, and F. Guillermina. 2004. Environmental and food applications of LC-tandem mass spectrometry in pesticide-residue analysis: An overview. Mass Spectrometry Reviews 23:45–85.

Poff, N.L., and D.D. Hart. 2002. How dams vary and why it matters for the emerging science of dam removal. BioScience 52:659-668.

Poston, T. 2001. Treated wood issues associated with overwater structures in marine and freshwater environments Olympia, Washington. Report. E. Washington Departments of Fish and Wildlife, and Transportation. April. http://wdfw.wa.gov/publications/00053/wdfw00053.pdf.

Reed, D.H., J.J. O'Grady, J.D. Ballou, and R. Frankham. 2003. The frequency and severity of catastrophic die-offs in vertebrates. Animal Conservation 6:109-114.

Rogue Basin Coordinating Council. 2006. Watershed health factors assessment: Rogue River Basin. Rogue Basin Coordinating Council. Talent, Oregon. Report.

Roni, P., S.A. Morley, P. Garcia, C. Detrick, D. King, and E. Beamer. 2006a. Coho salmon smolt production from constructed and natural floodplain habitats. Transactions of the American Fisheries Society 135:1398-1408.

Roni, P., T. Bennett, S. Morely, G.R. Pess, K. Hasnon, D. Van Slyke, and P. Olmstead. 2006b. Rehabilitation of bedrock stream channels: The effects of boulder weir placement on aquatic habitat and biota. River Research and Applications 22:967-980.

Roni, R., T.J. Beechie, R.E. Bilby, F.E. Leonetti, M.M. Pollock, and G.R. Pess. 2002. A review of stream restoration techniques and a hierarchical strategy for prioritizing restoration in Pacific Northwest watersheds. North American Journal of Fisheries Management 22:1-20.

Roper, B.B., J.J. Dose, and J.E. Williams. 1997. Stream restoration: Is fisheries biology enough? Fisheries 22(5):6-11.

Rosetta, T. 2005. Technical basis for revising turbidity criteria (draft). Water Quality Division, Oregon Department of Environmental Quality, Portland, Oregon, October.

Scheuerell, M.D., and J.G. Williams. 2005. Forecasting climate-induced changes in the survival of Snake River spring/summer Chinook salmon (*Oncorhynchus tshawytscha*). Fisheries Oceanography 14:448-457.

Sedell, J.R., and J.L. Froggatt. 1984. Importance of streamside forests to large rivers: The isolation of the Willamette River, Oregon, USA from its floodplain by snagging and streamside forest removal. Internationale Vereinigung für Theoretische und angewandte Limnologie Verhandlungen 22:1828-1834.

SERA. 1997. Use and assessment of marker dyes used with herbicides. Submitted to: Animal and Plant Health Inspection Service, U.S. Department of Agriculture. TR 96-21-07-03b. Syracuse Environmental Research Associates, Inc. Riverdale, Maryland.

Sherwood, C.R., D.A. Jay, R.B. Harvey, P. Hamilton, and C.A. Simenstad. 1990. Historical changes in the Columbia River estuary. Progress in Oceanography 25(1-4):299-352.

Shreck, C.B. 2000. Accumulation and long-term effects of stress in fish. Pages 147-158 G.P. Moberg, and J.A. Mench (editors). *In:* The biology of animal stress - basic principles and implications for animal welfare. CABI Publishing. Cambridge, Massachusetts.

Simenstad, C.A., and R.M. Thom. 1996. Assessing functional equivalency of habitat and food web support in a restored Gog-Le-Hi-Te estuarine wetland. Ecological Applications 6:38-56.

Smoker, W.W., I.A. Wang, A.J. Gharrett, and J.J. Hard. 2004. Embryo survival and smolt to adult survival in second-generation outbred coho salmon. Journal of Fish Biology 65 (Supplement A):254-262.

Spence, B.C., G.A. Lomnicky, R.M. Hughes, and R.P. Novitzki. 1996. An ecosystem approach to salmonid conservation. ManTech Environmental Research Services, Inc. Corvallis, Oregon. Report. National Marine Fisheries Service, Portland, Oregon.

Sprague, J.B., and D.E. Drury. 1969. Avoidance reactions of salmonid fish to representative pollutants. Pages 169-179 S.H. Jenkins (editor). *In:* Advances in Water Pollution Research. Proceedings of the Fourth International Conference, Prague. Pergamon Press. New York.

Stansell, R., S. Tackley, and K. Gibbons. 2008. Status Report – Pinniped Predation and Hazing at Bonneville Dam in 2008. U.S. Army Corps of Engineers. Cascade Locks, Oregon. Report. April 8. 6 p. http://www.nwd-wc.usace.army.mil/tmt/documents/fish/2008/update20080408.pdf.

Stansell, R., S. Tackley, and K. Gibbons. 2009. Status Report – Pinniped predation and deterrent activities at Bonneville Dam, 2009. U.S. Army Corps of Engineers. Bonneville Dam, Cascade Locks, Oregon. Report. May 22. 11 p. http://www.nwd-wc.usace.army.mil/tmt/documents/fish/2009/update20090522.pdf.

Stansell, R., and K. Gibbons. 2010. Status Report – Pinniped Predation and Deterrent Activities at Bonneville Dam, 2010. Cascade Locks, Oregon. Report. May 26. 9 p. http://www.nwd-wc.usace.army.mil/tmt/documents/fish/2010/update20100326.pdf.

Stehr, C.M., T.L. Linbo, D.H. Baldwin, N.L. Scholz, and J.P. Incardona. 2009. Evaluating the effects of forestry herbicides on fish development using rapid phenotypic screens. North American Journal of Fisheries Management 29(4):975-984.

Stout, H.A., P.W. Lawson, D. Bottom, T. Cooney, M. Ford, C. Jordan, R. Kope, L. Kruzic, G. Pess, G. Reeves, M. Scheuerell, T. Wainwright, R. Waples, L. Weitkamp, J. Williams, and T. Williams. 2011. Scientific conclusions of the status review for Oregon Coast coho salmon (*Oncorhynchus kisutch*). Draft revised report of the Oregon Coast Coho Salmon Biological Review Team. National Marine Fisheries Service, Northwest Fisheries Science Center. Seattle.

U.S. Census Bureau. 2011. Statistical Abstract of the United States: 2011. Washington, D.C. http://www.census.gov/prod/2011pubs/11statab/pop.pdf.

U.S. EPA. 2011. Environmentally Acceptable Lubricants. U.S. Environmental Protection Agency, Office of Wastewater Management. EPA 800-R-11-002. Washington, DC. November. http://nepis.epa.gov/Exe/ZyPDF.cgi?Dockey=P100DCJI.PDF.

Upper Columbia Salmon Recovery Board. 2007. Upper Columbia spring Chinook salmon and steelhead recovery plan. http://www.nwr.noaa.gov/Salmon-Recovery-Planning/Recovery-Domains/Interior-Columbia/Upper-Columbia/upload/UC_Plan.pdf.

USDC. 2011. Endangered and threatened species: Designation of critical habitat for the southern distinct population segment of eulachon. U.S. Department of Commerce, National Marine Fisheries Service. Federal Register 76(203):65324-65352.

USDC. 2013. Endangered and threatened species; Designation of critical habitat for Lower Columbia River Coho salmon and Puget Sound steelhead; Proposed Rule. Federal Register 78(9):2726. January 14, 2013.

USFWS. 2010. Best management practices to minimize adverse effects to Pacific lamprey (*Entosphenus tridentatus*). U.S. Fish and Wildlife Service, Pacific Region, Fisheries Resources. Portland, Oregon.

USGCRP. 2009. Global climate change impacts in the United States. U.S. Global Change Research Program. Washington, D.C. 188 p. http://waterwebster.org/documents/climate-impacts-report.pdf.

Wainwright, T.C., M.W. Chilcote, P.W. Lawson, T.E. Nickelson, C.W. Huntington, J.S. Mills, K.M.S. Moore, G.H. Reeves, H.A. Stout, and L.A. Weitkamp. 2008. Biological recovery criteria for the Oregon Coast coho salmon evolutionarily significant unit. U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service. NOAA Technical Memorandum NMFS-NWFSC-91. Seattle. http://docs.lib.noaa.gov/noaa_documents/NMFS/NWFSC/TM_NMFS_NWFSC/TM_NMFS_NWFSC_91.pdf

WDFW, and ODFW. 2001. Joint state eulachon management plan. Washington Department of Fish and Wildlife and Oregon Department of Fish and Wildlife.

Wentz, D.A., B.A. Bonn, K.D. Carpenter, S.R. Hinkle, M.L. Janet, F.A. Rinella, M.A. Uhrich, I.R. Waite, A. Laenen, and K.E. Bencala. 1998. Water quality in the Willamette Basin, 1991-1995. U.S. Geological Survey Circular 1161. May 20.

Williams, J.G., S.G. Smith, R.W. Zabel, W.D. Muir, M.D. Scheuerell, B.P. Sandford, D.M. Marsh, R.A. McNatt, and S. Achord. 2005. Effects of the Federal Columbia River Power System on salmon populations. U.S. Department of Commerce. NOAA Technical Memorandum NMFS-NWFSC-63. 150 p. http://www.nwfsc.noaa.gov/assets/25/6061_04142005_152601_effectstechmemo63final.pdf.

Williams, T.H., E.P. Bjorkstedt, W.G. Duffy, D. Hillemeier, G. Kautsky, T.E. Lisle, M. McCain, M. Rode, R.G. Szerlong, R.S. Schick, M.N. Goslin, and A. Agrawal. 2006. Historical population structure of coho salmon in the Southern Oregon/Northern California coasts evolutionarily significant unit. U.S. Department of Commerce, NOAA Technical Memorandum NOAA-TM-NMFS-SWFSC-390, 71 p.

Williams, T.H., B.C. Spence, W. Duffy, D. Hillemeier, G. Kautsky, T.E. Lisle, M. McCain, T.E. Nickelson, E. Mora, and T. Pearson. 2008. Framework for assessing viability of threatened coho salmon in the Southern Oregon/Northern California coast evolutionarily significant unit. U.S. Department of Commerce, NOAA Fisheries, NOAA Technical Memorandum NMFS-SWFSC-432. La Jolla, California.

Wimberly, M.C., T.A. Spies, C.J. Long, and C. Whitlock. 2000. Simulating historical variability in the amount of old forests in the Oregon Coast Range. Conservation Biology 14(1):167-180.

Wissmar, R.C., J.E. Smith, B.A. McIntosh, H.W. Li, G.H. Reeves, and J.R. Sedell. 1994. Ecological health of river basins in forested regions of eastern Washington and Oregon. General Technical Report PNW-GTR-326, U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. Portland, Oregon.

Zabel, R.W., M.D. Scheuerell, M.M. McClure, and J.G. Williams. 2006. The interplay between climate variability and density dependence in the population viability of Chinook salmon. Conservation Biology 20(1):190-200.

Zedler, J.B. 1996. Ecological issues in wetland mitigation: An introduction to the forum. Ecological Applications 6(1):33-37.

Appendix A: E-mail Guidelines and Action Implementation Form for SLOPES V Restoration Programmatic

The **SLOPES V** programmatic e-mail box (slopes.nwr@noaa.gov) is to be used for actions submitted to the National Marine Fisheries Service (NMFS) by the Federal Action Agencies for formal consultation (50 CFR § 402.14) under SLOPES V.

The Federal Action Agency must ensure the final project is being submitted to avoid multiple submittals and withdrawals. In rare occurrences, a withdrawal may be necessary and unavoidable. In this situation, please specify in the e-mail subject line that the project is being withdrawn. There is no form for a withdrawal, simply state the reason for the withdrawal and submit to the e-mail box, following the email titling conventions. If a previously withdrawn notification is resubmitted later, this resubmittal will be regarded as a new action notification.

An automatic reply will be sent upon receipt, but no other communication will be sent from the programmatic e-mail box; this box is used for **Incoming Only**. All other pre-decisional communication should be conducted **outside** the use of the slopes.nwr@noaa.gov e-mail.

The Federal Action Agency will send only **one** project per e-mail submittal, and will attach all related documents. These documents will include the following:

1. Action implementation Form, containing Action Notification and Action Completion and Fish Salvage reports (if fish salvage is conducted.
2. Map(s) and project design drawings (if applicable);
3. Final project plan.

The Corps shall ensure that NMFS receives a Fish Salvage reports (if fish salvage is conducted) and Action Completion, within 10 days after fish salvage and 60 after in-water work completion, respectively.

E-mail Titling Conventions

In the subject line of the email (see below for requirements), clearly identify which SLOPES V programmatic you are submitting under (Restoration, Transportation, or In-water/Over Water Structures), the specific submittal category (30-day approval, no approval, project completion, withdrawal, or salvage report), the Corps Permit Number, the Applicant Name, County, Waterway, and State

Use caution when entering the necessary information in the subject line. **If these titling conventions are not used, the e-mail will not be accepted.** Ensure that you clearly identify:

1. Which SLOPES V programmatic you are submitting under (Restoration, Bank Stabilization, Boat Docks, or Transportation.);
2. The specific submittal category (30-day approval, no approval, action completion, withdrawal, or salvage report);
3. Corps Permit number;
4. Applicant Name (you may use last name only, or **commonly used** abbreviations);
5. County;
6. Waterway; and
7. State.

Examples:

SLOPES V Programmatic_Specific Submittal Category, Corps Permit #, Applicant Name, County, Waterway, State

Action Notification

Restoration_No Approval, 200600999, Smith, Multnomah, Willamette, Oregon
Restoration_30-day Approval, 200600999, Smith, Multnomah, Willamette, Oregon

Project Completion

Banks_Completion, 200600999, Smith, Multnomah, Willamette, Oregon

Salvage Report

Union Creek culvert_Salvage, 200600999, Smith, Multnomah, Willamette, Oregon

Withdrawal

Restoration_Withdrawal, 200600999, Smith, Multnomah, Willamette, Oregon

Project Description

Please provide enough information for NMFS to be able to determine the effects of the action and whether the project fits the SLOPES criteria. Attach additional sheets if necessary. The project description should include information such as (but not limited to):

- Proposed in-water work including timing and duration
- Work area isolation and salvage plan including pumping, screening, electroshocking, fish handling, *etc*.
- Discussion of alternatives considered

SLOPES V PROGRAMMATIC – RESTORATION ACTION IMPLEMENTATION FORM

NMFS Review and Approval. The Corps project manager shall submit this form with the Action Notification portion completed to NMFS at *slopes.nwr@noaa.gov* for notification or approval.

The Following Actions Require Approval from NMFS. Any action that involves (a) fish passage restoration; (b) off- and side-channel habitat restoration; (c) set-back of a berm, dike or levee; or (d) removal of a water control structure, must be individually reviewed and approved by NMFS as consistent with this SLOPES V before that action is authorized. NMFS will notify the Corps within 30 calendar days if the action is approved or disqualified.

Attach information to e-mail message if required or relevant to NMFS's review:

- Erosion and pollution control plan
- Engineering designs
- Site assessment for contaminants to identify the type, quantity, and extent of any potential contamination.

The Following Actions Do Not Require Approval from NMFS. Any action that involves (a) placement of boulders, (b) placement of large wood, (c) placement of spawning gravel, (d) streambank restoration, or (e) piling removal, do not require NMFS approval.

Project Reporting. The Corps project manager shall submit the following reports as necessary:

Action Completion Reporting. It is the applicant's responsibility to submit this form to the Corps within 60 days of completing all work below ordinary high water (OHW). Upon receipt, the Corps must resubmit this form with the Action Completion Report portion completed to NMFS at *slopes.nwr@noaa.gov*. If it is a Corps project, the Corps shall complete and submit this form within 60 days of completing the project.

Fish Salvage Reporting. It is the applicant's responsibility to submit this form to the Corps within 10 days of completing a capture and release as part of an action completed under SLOPES V Restoration. Upon receipt, the Corps must resubmit this form with the Fish Salvage Report portion completed with the following information to NMFS at *slopes.nwr@noaa.gov*. If it is a Corps project, the Corps shall complete and submit this form within 10 days of completing fish salvage operations.

1. Action Notification

DATE OF REQUEST:		**NMFS TRACKING #: NWR-2013-9717**	
TYPE OF REQUEST:	☐ ACTION NOTIFICATION (NO APPROVAL) ☐ ACTION NOTIFICATION (APPROVAL REQUIRED)		
Statutory Authority:	☐ ESA ONLY ☐ EFH ONLY ☐ ESA & EFH COMBINED		
Lead Action Agency:	**Corps of Engineers**		
Action Agency Contact:		Corps Action ID #:	
Applicant:		Individual DSL Permit #:	
Project Name:			
6th Field HUC & Name:			
Latitude & Longitude (including degrees, minutes, and seconds)			
Proposed Construction Period:	***Start Date:***		***End Date:***
Proposed Length of Channel and/or Riparian Modification in linear feet:			
Proposed Area of Herbicide Application in acres:			

Project Description:

Type of Action:
Identify the type of action proposed.

Actions Requiring **No Approval** from NMFS:

- ☐ Boulder Placement
- ☐ Spawning Gravel Restoration
- ☐ Large Wood Restoration
- ☐ Piling Removal
- ☐ Streambank Restoration

Actions Requiring **Approval** from NMFS:

- ☐ Fish Passage Restoration
- ☐ Off- and Side-Channel Habitat Restoration
- ☐ Set-back Berms, Dikes and Levees
- ☐ Water Control Structure Removal

NMFS Species/Critical Habitat Present in Action Area:
Identify the species found in the action area:

ESA Species

- ☐ Upper Willamette River spring-run Chinook
- ☐ Upper Willamette River steelhead
- ☐ Lower Columbia River Chinook
- ☐ Lower Columbia River steelhead
- ☐ Lower Columbia River coho
- ☐ Columbia River chum
- ☐ MCR steelhead
- ☐ UCR spring-run Chinook
- ☐ UCR steelhead
- ☐ SR spring/summer run Chinook
- ☐ SR fall-run Chinook
- ☐ SR steelhead
- ☐ Snake River sockeye
- ☐ Green sturgeon
- ☐ Eulachon
- ☐ Steller sea lion
- ☐ Oregon Coast coho
- ☐ Southern Oregon/Northern California Coasts coho

EFH Species

- ☐ Salmon, Chinook
- ☐ Salmon, coho
- ☐ Coastal Pelagics
- ☐ Groundfish

Terms and Conditions:

Check the Terms and Conditions from the biological opinion that will be included as conditions on the permit issued for this proposed action. Please attach the appropriate plan(s) for this proposed action.

Administrative:	**Types of Actions:**	
☐ Electronic notification ☐ Site assessment for contaminants ☐ Action completion report ☐ Site access ☐ Salvage notice **Construction:** General Construction Measures ☐ Flagging sensitive areas ☐ Temporary erosion controls ☐ Temporary access roads ☐ Fish passage criteria ☐ In-water work period ☐ Work area isolation ☐ Capture and release ☐ Electrofishing ☐ Construction water ☐ Fish screen criteria ☐ Erosion/pollution control plan ☐ Choice of equipment ☐ Vehicle staging and use ☐ Stationary power equipment ☐ Work from top of bank ☐ Site restoration ☐ Turbidity monitoring	Fish Passage Restoration ☐ **Needs NMFS Approval** Off- and Side-Channel Habitat ☐ **Needs NMFS Approval** Set-back Berm, Dike, and Levee ☐ **Needs NMFS Approval** Water Control Structure Removal ☐ **Needs NMFS Approval** Boulder Placement ☐ Site selection ☐ Installation Large Wood Restoration ☐ Large wood condition Piling Removal ☐ Pile removal ☐ Broken piles Spawning Gravel Restoration ☐ Gravel placement ☐ Gravel source	Streambank Restoration ☐ Streambank shaping ☐ Soil reinforcement ☐ Large Wood ☐ Use of Rock in Streambank ☐ Planting or installing vegetation ☐ Fertilizer ☐ Fencing Invasive and Non-native Plan Control ☐ Non-herbicide methods ☐ Power equipment ☐ Herbicide applicator qualifications ☐ Herbicide transportation and safety plan ☐ Approved herbicides ☐ Approved herbicide adjuvants ☐ Approved herbicide carriers ☐ Herbicide mixing ☐ Approved herbicide application rates ☐ Approved herbicide application methods ☐ Minimize herbicide drift and leaching ☐ Required herbicide buffer distances
Post Construction Reporting: ☐ Action Completion Report ☐ Fish Salvage Report		

2. ACTION COMPLETION REPORT

The applicant shall submit this form to the Corps within 60 days of completing all work below ordinary high water (OHW). The Corps shall submit this form to NMFS at *slopes.nwr@noaa.gov* upon receipt from the applicant. If it is a Corps project, the Corps shall submit this form within 60 days of completing all work below OHW.

Actual Start and End Dates for the Completion of In-water Work:	***Start***:	***End***:
Actual Linear-feet of Riparian and/or Channel Modification:		
Actual Acreage of Herbicide Treatment		
Turbidity Monitoring/Sampling Completed	☐ Yes (include details below)	☐ No

Please include the following:

1. Photos of habitat conditions before, during, and after action completion.
2. A summary of the results of pollution and erosion control inspections, including any erosion control failure, contaminant release, and correction effort.
3. Records of turbidity monitoring (visual or by turbidimeter) including dates, times and location of monitoring. Include any exceedances and steps taken to reduce turbidity observed.

3. FISH SALVAGE REPORT

If applicable: The applicant shall submit a completed Fish Salvage Report and Fish Salvage Data Table (see below) to the Corps within 10 days of completing a capture and release as part of an action completed under SLOPES V Restoration. The Corps must submit the report to NMFS at *slopes.nwr@noaa.gov* upon receipt from the applicant. If it is a Corps project, the Corps shall submit this form to NMFS within 10 days of completing a capture and release event.

Date(s) of Fish Salvage Operation(s):	______________________
Supervisory Fish Biologist:	______________________
Address	______________________
Telephone Number	______________________

Describe methods that were used to isolate the work area and remove fish

Fish Salvage Data

Water Temperature:

Air Temperature:

Time of Day:

ESA-Listed Species	Number Handled		Number Injured		Number Killed	
	Juvenile	Adult	Juvenile	Adult	Juvenile	Adult
Lower Columbia River Chinook						
Upper Willamette River Chinook						
Upper Columbia River spring-run Chinook						
Snake River spring/summer run Chinook						
Snake River fall-run Chinook						
Chinook, unspecified						
Columbia River chum						
Lower Columbia River coho						
Oregon Coast coho						
Southern Oregon/Northern California Coasts coho						
Snake River sockeye						
Lower Columbia River steelhead						
Upper Willamette River steelhead						
Middle Columbia River steelhead						
Upper Columbia River steelhead						
Snake River Basin steelhead						
Steelhead, unspecified						
Southern green sturgeon						
Eulachon						