APPENDIX C

Biological Assessment

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Acronyms and Abbreviations

μg/L	micrograms per liter
BA	Biological Assessment
BMPs	Best Management Practices
cfs	Cubic feet per second
CWA	Clean Water Act
DPS	Distinct Population Segment
EA	Environmental Assessment
EFH	Essential Fish Habitat
EPA	U.S. Environmental Protection Agency
ESA	Endangered Species Act
ESU	Evolutionary Significant Unit(s)
FMP	Fishery Management Plan
GIS	Geographic Information System
IC	Impaired condition
LCFRB	Lower Columbia Fish Recovery Board
LVAP	Lower Vertical Adjustment Potential
LW	Large Wood
NEP	Nonessential experimental population
NOAA	National Oceanic and Atmospheric Administration
NPDES	National Pollutant Discharge Elimination System
NPF	Not properly functioning
NWPCC	Northwest Power and Conservation Council
ODEQ	Oregon Department of Environmental Quality
ODFW	Oregon Department of Fish and Wildlife
OHW	Ordinary High Water
PAH	Polycyclic Aromatic Hydrocarbons
PBES	Portland Bureau of Environmental Services
PCB	Polychlorinated Biphenyls
PCE	Primary constituent element
PFC	Properly functioning condition
RM	River Mile(s)
RRT	Restoration Review Team
TMDL	Total Maximum Daily Loads
USACE	U.S. Army Corps of Engineers
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey

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1. INTRODUCTION

The U.S. Army Corps of Engineers, Portland District (USACE) in partnership with the City of Portland and the Port of Portland as the non-federal sponsors have conducted a General Investigation Feasibility Study to evaluate ecosystem restoration needs and opportunities within the Lower Willamette River Basin in northwestern Oregon, Multnomah County. The purpose of the Feasibility Study was to evaluate significant ecosystem degradation problems in the basin and to recommend a series of feasible actions and projects that are supported by a local entity willing to provide the necessary items of local cooperation. The sponsors and the USACE initially identified over 50 sites in the Lower Willamette River and tributaries. This list of sites has since been reduced to five, including Kelley Point Park, Kenton Cove, BES Treatment Plant, Oaks Crossing, and Tryon Creek Highway 43 Culvert Replacement, which the City has identified as the critical sites on which to focus the restoration actions. It is these five sites which comprise the Lower Willamette Restoration Project and are referred to as the Project. This Project has been formulated to contribute to the identified restoration objectives of restoring fish and wildlife habitat and natural processes of the watershed.

The actions of the project need to be examined per Section 7(a)(2) of the ESA of 1973 (as amended) in order to "…ensure that any actions authorized, funded, and/or carried out by federal agencies are not likely to jeopardize the continued existence of any federally proposed or listed endangered species or threatened species, or result in the destruction or adverse modification of critical habitat of such species…". This Biological Assessment (BA) has been prepared to comply with this requirement, as well as the requirements for the Essential Fish Habitat (EFH) evaluation under the Magnuson-Stevens Fishery Conservation and Management Act.

This BA is intended to assess potential effects on proposed or listed ESA species under the jurisdiction of the National Marine Fisheries Service that may occur as a result of the project. Table 1-1 lists the species and critical habitat designations in Multnomah County, Oregon, which encompasses the Project action area.

Table 1-1. Species and Critical Habitat Designations Listed in Multnomah County

Species	Federal Status	Critical Habitat	State Status	Likely Present in the Action Area
Lower Columbia River coho salmon (*Oncorhynchus kisutch*)	Threatened June 28, 2005	Proposed January 14, 2013	Endangered	Present
Lower Columbia River Chinook salmon (*Oncorhynchus tshawytscha*)	Threatened June 28, 2005	Designated September 2, 2005	Not listed	Present
Upper Willamette River Chinook salmon (*Oncorhynchus tshawytscha*)	Threatened June 28, 2005	Designated September 2, 2005	Not listed	Present
Lower Columbia River steelhead (*Oncorhynchus mykiss*)	Threatened January 5, 2006	Designated September 2, 2005	Not listed	Present
Upper Willamette River steelhead (*Oncorhynchus mykiss*)	Threatened January 5, 2006	Designated September 2, 2005	Not listed	Present
Southern DPS of North American green sturgeon (*Acipenser medirostris*)	Threatened April 7, 2006	Designated October 9, 2009	Not listed	Unlikely

The purpose of this Project is to restore natural habitat functions at multiple sites along the Lower Willamette River and its tributaries. This Project emphasizes the opportunities to restore aquatic and riparian habitats.

1.1 Federal Action and authority

This BA assesses ecosystem restoration actions in the Lower Willamette River, led by the USACE along with its cost-sharing sponsor, the City of Portland.

This study is being conducted under the authority of House Resolution Docket 2687, adopted June 26, 2002, by the U.S. House of Representatives, Committee on Transportation and Infrastructure, and entitled *Lower Willamette River Watershed, Oregon*. The text of the resolution is as follows:

> *Resolved by the Committee on Transportation and Infrastructure of the United States House of Representatives, that the Secretary of the Army is requested to review the report of the Chief of Engineers on the Columbia and Lower Willamette Rivers below Vancouver, Washington and Portland, Oregon published as House Document Number 452, 87th Congress, 2nd Session, and other pertinent reports, to determine the feasibility of providing ecosystem restoration measures in the Lower Willamette River watershed from the Willamette Locks to [the] confluence of the Willamette River with the Columbia River through the development of a comprehensive restoration strategy development in close coordination with the City of Portland, Port of Portland, the State of Oregon, local governments and organizations, Tribal Nations and other Federal agencies.*

Although the environmental dredging component of the reconnaissance study will not be implemented, the City and the USACE have used this authority to prepare plans to restore habitat functions in the Lower Willamette River and two of its tributaries.

1.2 Consultation History

This BA initiates formal consultation with NMFS.

2. LOCATION AND SITE DESCRIPTION

The Lower Willamette River, which comprises the project area, is generally defined as the area downstream and north of Willamette Falls, and between river miles (RM) 0 and 20.5 (Figure 2-1). Key tributaries included in the Project are Columbia Slough and Tryon Creek.

The action area for the Project encompasses all areas to be affected directly or indirectly by the proposed federal action and not merely the immediate area involved in the action (50 CFR 402-02). The action area encompasses all areas that could be affected by any permanent or temporary impacts caused by project construction or by the presence of the projects themselves.

2.1 Project Area Location

The five project sites are located within three reaches (Figure 2-2) of the larger Lower Willamette River Basin including the mainstem Lower Willamette River, Columbia Slough, and Tryon Creek.

- **Lower Willamette Mainstem**. This reach stretches from RM 0 to Willamette Falls, located at RM 26. The two project sites on the mainstem Willamette River are located at RM 16.2 (Oaks Crossing/Sellwood Riverfront Park) and RM 0 (Kelley Point Park). The floodplain widens from north to south in this reach, but also becomes highly developed from south to north. The main exception to this is Kelley Point Park, which is relatively undeveloped and publically owned. Habitat is generally less disturbed and contamination issues are less severe in the south end of this reach, where the Oaks Crossing/Sellwood Riverfront Park project site is located. The primary areas of sediment contamination are found in Portland Inner Harbor, located downstream of the Oaks Crossing site.
- **Columbia Slough**. This reach extends along the Columbia Slough from its confluence with the Willamette River to Kenton Cove (RM 0 to RM 9.0). Most of the northern end of Columbia Slough is relatively undeveloped, although floodplains in most areas appear to have been filled or otherwise modified and the slough is typified by high, steep banks. Two project sites are located in this reach: BES (Bureau of Environmental Services) Plant and Kenton Cove, at RMs 5 and 7.
- **Tryon Creek**. This reach consists of Tryon Creek from its confluence with the Willamette River to Boones Ferry Road (RM 0 to RM 2.9). The Tryon Creek reach offers the most undeveloped area for restoration of any of reach in the project area. The Highway 43 Tryon Creek Culvert project site at RM 0.5 is critical to restoring fish passage to upstream spawning habitat.

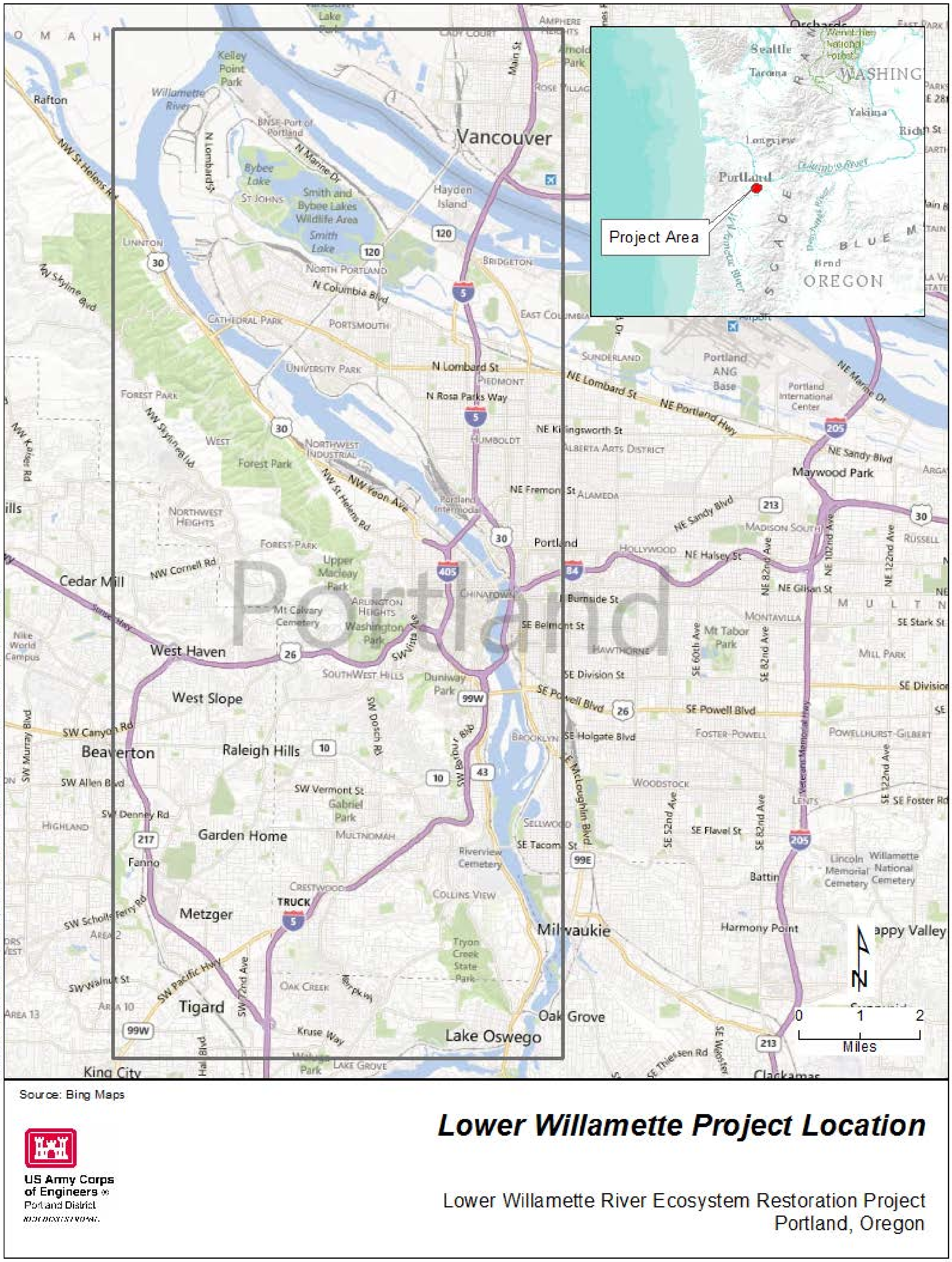

Figure 2-1. Location Map

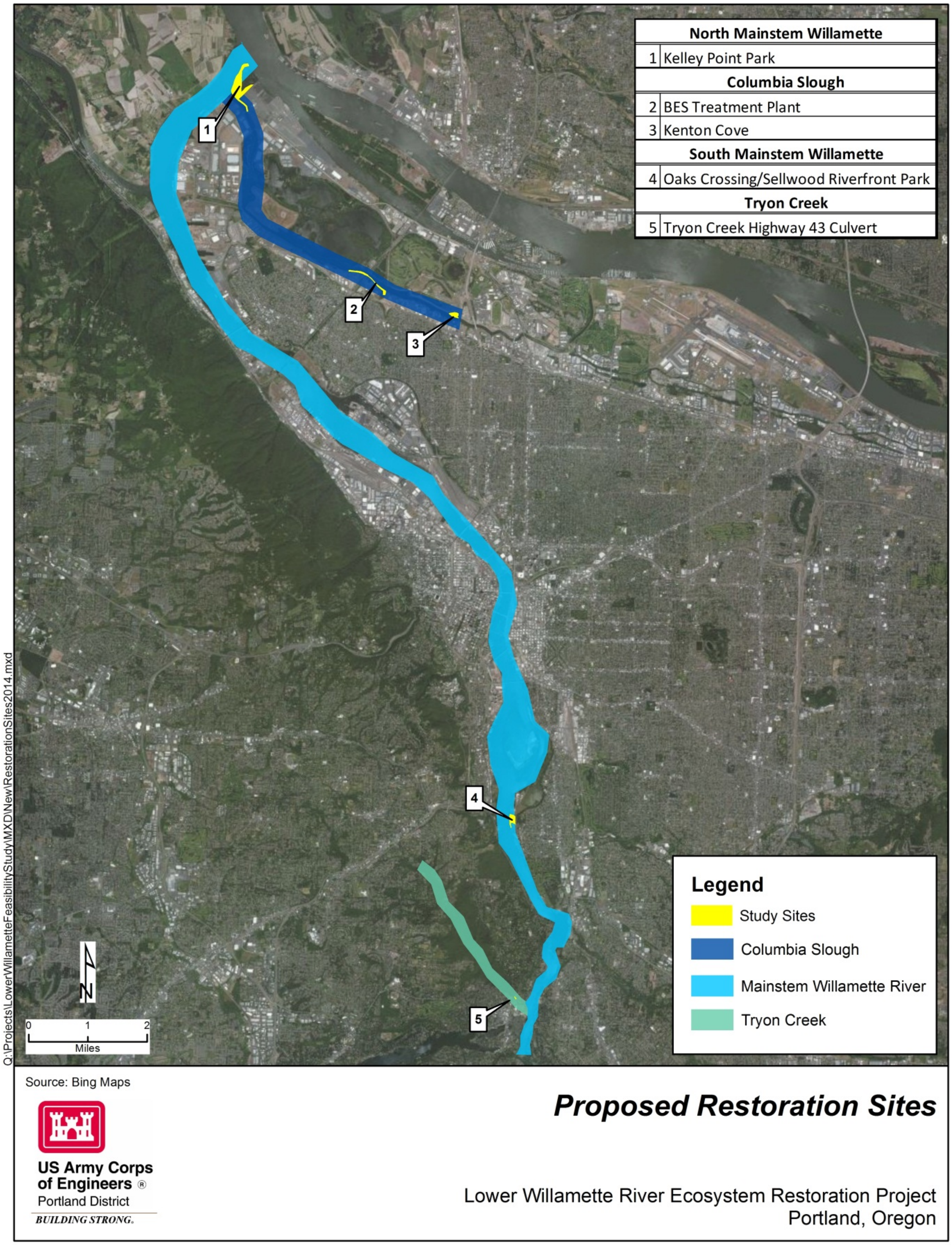

Figure 2-2. Site Specific Action Areas Map

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3. DESCRIPTION OF THE ACTION

The project that is the subject of this BA includes five restoration project sites: Kelley Point Park, BES Treatment Plant, Kenton Cove, Oaks Crossing, and Tryon Creek Highway 43 Culvert Replacement. Table 3-1 lists general information on each of the proposed restoration features in the project sites. A summary of the key restoration elements proposed at each site is provided in the discussion following.

Table 3-1. Proposed Restoration Sites and Locations [(1)]

General Location	Project Title General	Proposed Enhancement/Restoration Actions
Willamette Mainstem	Kelley Point Park	Remove invasive plants and plant native species; create off-channel habitat; slope banks to reconnect river and floodplain; add LW.
Columbia Slough	BES Plant	Excavate an alcove for high flow refugia and enhance a connection to off-channel habitat; add in-stream structure though the addition of boulders and LW; remove invasive plants and plant native species.
	Kenton Cove	Add LW and small amounts of fill to create small promontories for bank diversification and increased cover at edge of streambank.
Willamette Mainstem	Oaks Crossing	Excavate off-channel refuge habitat; add LW; remove invasive species and plant native trees and shrubs.
Tryon Creek	Tryon Highway 43 Culvert	Improve fish passage and channel conditions to improve access to upstream spawning habitat in Tryon Creek State Park.

1 Sites are identified and grouped by their general location, which is their associated waterbody.

3.1 Restoration Measures

Different combinations of restoration features are proposed at each site, depending on the problems to be addressed and the opportunities each site offers. These features, described below, include engineered and ecological solutions, and seek to minimize use of hard structure except where necessary (primarily to reconstruct or build a fish-passable culvert).

Large Wood and Boulder Placement: Large wood (LW) is a naturally occurring component of streams in the Lower Willamette River ecosystem. LW has been removed from streams for a variety of reasons including improved navigation, reduction of flow resistance, flood control, and perceived fish passage problems (Fischenich and Morrow 1999). Placement of LW is proposed as a restoration technique to enhance stream channel morphology and habitat forming functions such as pool creation, sediment and organic matter retention, and to increase habitat complexity and refugia (PBES 2005). Strategic placement of LW can promote channel scour or bar formation to create micro-habitats in off-channel areas, or can be used to protect restored bank features from the full force of the river’s current.

LW would be installed by excavating the streambank to allow trunks or stumps to be keyed into the bank for stability. Generally, one or two pieces of LW will be installed at each location, and vertical posts, boulders, and cables will be used to anchor the wood. After installation, the substrate around the LW will be recontoured to match previous or desired grade, and revegetated as needed. Boulders would be installed by excavating holes or trenches in the streambed with an excavator or backhoe, installing the boulders according to specifications, and backfilling the surrounding area with appropriate substrate.

Invasive Species Removal and Riparian Revegetation: Riparian areas shade streams, moderate stream temperatures, provide overhead cover and habitat for avian species, filter sediments and runoff, control streambank erosion, and provide a terrestrial source of organic matter and insects that support terrestrial and aquatic food webs (PBES 2005). Riparian plantings along river banks and floodplains also restore natural recruitment of LW to the system. Urbanization and development of riparian areas have reduced the natural function of riparian zones throughout the Lower Willamette Basin. Native vegetation will be planted in riparian zones to the edge of project boundary lines to reestablish the maximum riparian function possible.

The composition, age, and spatial structure of tree and shrub species are important indicators of the health of a riparian area. Properly functioning riparian ecosystems have the appropriate combination of mature and developing vegetation, species diversity, and levels of structure, all of which can be disturbed by the presence of invasive species. Invasive species often out-compete native species, reducing the productivity and function of riparian areas, altering wildlife habitat characteristics, and in some instances fundamentally changing soil characteristics and plant communities.

Invasive species removal projects are proposed in combination with riparian planting projects to more fully restore riparian function. This restoration measure would involve the active removal of non-native vegetation, including Himalayan blackberry, reed canary grass, yellow flag iris, holly, and English ivy from the riparian zone and floodplain. Removal could be done by mechanical means (plowing, disking, and mowing), hand removal (cutting), and/or spot applications of herbicides where the risk of contamination is limited. All areas temporarily disturbed during construction will be replanted by hand with native species, and appropriate erosion control including coir mats, straw, or jute netting will be installed to control movement of fine sediment particles into waterways.

In-stream and Channel Modifications: Steepened banks are often a product of bank stabilization and channelization activities, which cause channel incision, increased erosion and floodplain disconnection. Grading banks to gentler slopes is proposed to allow for restored hydrologic connections and to create shallow water habitat, reduce erosion, stabilize banks and to allow riparian and aquatic habitats to form more naturally.

Banks will be graded by use of a land or barge-mounted excavator. Excavated bank angles will vary depending on surrounding land uses and current bank angle. Areas above the ordinary high-water mark will be revegetated with native riparian species, and erosion control features including jute netting or coir mats will be installed. Spoils will be barge or truck hauled to an appropriate disposal facility. Areas below the OHW or below the water surface elevation will generally not be graded as part of this type of measure.

Off-Channel Habitat and Floodplain Reconnection: Connected floodplains attenuate flows, moderate normative flows, and contribute organic matter, substrate, and large wood to the stream system. Side channel and off-channel habitats are important feeding, resting, and rearing areas for aquatic species and by providing protected areas with lower flow velocities serve as key refugia during flood events. A study by the Oregon Department of Fish and Wildlife and the City of Portland conducted in the Lower Willamette River (Friesen 2005) found that all sampled off-channel habitats were used by juvenile salmonids for forage and refuge. The creation and reconnection of side channels, alcoves, and backwater habitats is proposed to provide this important habitat to aquatic species, and will serve a dual purpose by supporting floodwater attenuation.

Off-channel habitat creation and reconnection will primarily take the form of side channels and swales excavated in riparian areas. Excavation will involve heavy equipment including excavators, scrapers, backhoes, and dump trucks. Excavated areas will coincide with natural swales or other contours that will minimize the amount of materials to be excavated and fit with the landscape to the highest degree possible. Large trees will be avoided as much as possible, and work will occur in the dry except when removing the final amount of fill to allow inflow from the Willamette River or Columbia Slough, which will occur during the in-water work window. The banks of side channels will be contoured to resist erosion and revegetated above the ordinary high water elevation. LW and boulders will be installed as described above to create habitat diversity.

Fish Barrier Removal: Ill-placed or poorly designed culverts or other fish passage barriers affect the ability of salmonids to return to natal streams for spawning. As a result, culverts and impassable barriers can influence the temporal and spatial distribution of salmonids throughout a sub-basin. In Portland, Johnson Creek and Tryon Creek are the only two waterways that are open year-round to salmonids, although access into spawning areas of Tryon Creek is severely restricted by the culvert located where Tryon Creek passes under Highway 43.

3.2 Approved Actions and Design Criteria

These restoration measures align with the 18 project categories of aquatic restoration actions covered under the Programmatic Restoration Opinion for Joint Ecosystem Conservation by the Services (PROJECTS) program (NMFS 2013a). The PROJECTS Biological Opinion (BiOp) is a joint programmatic conference and biological opinion prepared by the National Marine Fisheries Service (NMFS) pursuant to section 7(a)(2) of the Endangered Species Action consultation on the effects of implementing aquatic restoration actions proposed to be funded or carried out by the U.S. Fish and Wildlife Service (USFWS) and the NOAA Restoration Center in the States of Oregon, Washington and Idaho. The PROJECTS approved actions that are applicable to the proposed Project are described below, along with the design criteria that are provided for each action.

Fish Passage Restoration: This type of action includes total removal, replacement, or resetting of culverts or bridges; stabilizing headcuts and other channel instabilities; removing, relocating, constructing, repairing, or maintaining fish ladders; and replacing, relocating, or constructing fish screens and irrigation diversions. The following design criteria pertain only to the Tryon Creek Hwy 43 Culvert replacement project:

a. Stream simulation culvert and bridge projects. All road-stream crossing structures shall adhere to the most recent version of NMFS fish passage criteria, which are as follows:

- Bed width will be greater than bankfull channel width, and of sufficient vertical clearance to allow ease of maintenance activities.
- Vertical clearance between the culvert bed and ceiling will be more than 6 feet to allow for debris removal.
- Slope will be equal to the slope of, and at elevations continuous with, the surrounding long-channel streambed profile Culvert will be open-bottomed, so footings will be keyed into the underlying bedrock.
- Culvert will be more than 150 feet, but a bridge is not possible at this location due to cost and transportation disruptions.
- Fill materials will match native substrate.
- Average water depth and velocities will simulate those in the surrounding stream channel.

NMFS engineering review, if required, shall occur at the conceptual, post-modeling, and final design phases, which is approximated by 30%, 60%, and 90% designs. All road-stream crossing structures shall simulate stream channel conditions per industry design standards found in any one of the following:

i. *Stream Simulation: An Ecological Approach to Providing Passage for Aquatic Organisms at Road-Stream Crossings* (USDA-Forest Service 2008).

ii. *Part XII Fish Passage Design and Implementation, Salmonid Stream Habitat Restoration Manual* (California Department of Fish and Game 2009) or the most recent version.

iii. *Water Crossings Design Guidelines* (Barnard *et al.* 2013) or the most recent version).

b. General road-stream crossing criteria

i. Span

1. Span is determined by the crossing width at the proposed streambed grade.
2. Single span structures will maintain a clear, unobstructed opening above the general scour elevation that is at least as wide as 1.5 times the active channel width.
3. Multi-span structures will maintain clear, unobstructed openings above the general scour elevation (except for piers or interior bents) that are at least as wide as 2.2 times the active channel width.
4. Entrenched streams: If a stream is entrenched (entrenchment ratio of less than 1.4), the crossing width will accommodate the floodprone width. Floodprone width is the channel width measured at twice the maximum bankfull depth (Rosgen 1996).
5. Minimum structure span is 6ft.

ii. Scour Prism

1. Designs shall maintain the general scour prism, as a clear, unobstructed opening (i.e., free of any fill, embankment, scour countermeasure, or structural material to include abutments, footings, and culvert inverts). No scour or stream stability countermeasure may be applied above the general scour elevation.
2. When bridge abutments are set back beyond the applicable criteria span they may be located above the general scour elevation.

iii. Embedment

1. All culvert footings and inverts shall be placed below the thalweg at a depth of 3 feet, or the Lower Vertical Adjustment Potential (LVAP) line, whichever is deeper.
   a. LVAP, as calculated in Stream Simulation: *An ecological approach to providing passage for aquatic organisms at road crossings* (USDA-Forest Service 2008).
2. In addition to embedment depth, embedment of closed bottom culverts shall be between 30% and 50% of the culvert rise.

v. NMFS fish passage review and approval. NMFS will review crossing structure designs if the span width is determined to be less than the criteria established above or if the design is inconsistent with criteria in *Anadromous Salmonid Passage Facility Design* (NMFS 2011a).

Large wood (LW), Boulder, and Gravel Placement: This type of action includes LW and boulder placement, and porous boulder step structures. The following design criteria pertain to all five proposed projects:

a. Large wood and boulder projects

i. Place LW and boulders in areas where they would naturally occur and in a manner that closely mimics natural accumulations for that particular stream type. For example, boulder placement may not be appropriate in low-gradient meadow streams.

ii. Structure types shall simulate disturbance events to the greatest degree possible and include, but are not limited to, log jams, debris flows, wind-throw, and tree breakage.

iii. No limits are to be placed on the size or shape of structures as long as such structures are within the range of natural variability of a given location and do not block fish passage.

iv. Projects can include grade control and streambank stabilization structures, while size and configuration of such structures will be commensurate with scale of project site and hydraulic forces.

v. The partial burial of LW and boulders is permitted and may constitute the dominant means of placement. This applies to all stream systems but more so for larger stream systems where use of adjacent riparian trees or channel features is not feasible or does not provide the full stability desired.

vi. LW includes whole conifer and hardwood trees, logs, and rootwads. LW size (diameter and length) should account for bankfull width and stream discharge rates. When available, trees with rootwads should be a minimum of 1.5 x bankfull channel width, while logs without rootwads should be a minimum of 2.0 x bankfull widths.

vii. Structures may partially or completely span stream channels or be positioned along stream banks.

viii. Stabilizing or key pieces of LW will be intact, hard, with little decay, and if possible have root wads (untrimmed) to provide functional refugia habitat for fish. Consider orienting key pieces such that the hydraulic forces upon the LW increase stability.

ix. Anchoring LW — 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 or rock) to increase the mass of the structure to resist movement
4. Use of large boulders as anchor points for the LW
5. Pin LW with rebar to large rock to increase its weight. For streams that are entrenched (Rosgen F, G, A, and potentially B) or for other streams with very low width to depth ratios (less than 12) an additional 60% ballast weight may be necessary due to greater flow depths and higher velocities.
6. Anchoring LW by cable is not allowed under this opinion.

b. Porous boulder step structures and vanes (Tryon Creek Highway 43 site only)

i. Full channel spanning boulder structures are to be installed only in highly uniform, incised, bedrock-dominated channels to enhance or provide fish habitat in stream reaches where log placements are not practicable due to channel conditions (not feasible to place logs of sufficient length, bedrock dominated channels, deeply incised channels, artificially constrained reaches, etc.), where damage to infrastructure on public or private lands is of concern, or where private landowners will not allow log placements due to concerns about damage to their streambanks or property.

ii. Install boulder structures low in relation to channel dimensions so that they are completely overtopped during channel-forming flow events (approximately a 1.0 to 1.5-year flow event).

iii. Boulder step structures are to be placed diagonally across the channel or in more traditional upstream pointing "V" or "U" configurations with the apex oriented upstream.

iv. Boulder step structures are to be constructed to allow upstream and downstream passage of all native fish species and life stages that occur in the stream. Plunges shall be kept less than 6 inches in height.

v. The use of gabions, cable, or other means to prevent the movement of individual boulders in a boulder step structure is not allowed.

vi. Rock for boulder step structures shall be durable and of suitable quality to assure long-term stability in the climate in which it is to be used. Rock sizing depends on the size of the stream, maximum depth of flow, planform, entrenchment, and ice and debris loading.

vii. The project designer or an inspector experienced in these structures should be present during installation.

viii. Full spanning boulder step structure placement should be coupled with measures to improve habitat complexity and protection of riparian areas to provide long-term inputs of LW.

Off- and Side-Channel Habitat Restoration: These actions will be implemented to reconnect historic side channels with floodplains by removing off-channel fill and plugs. Furthermore, new side-channels and alcoves can be constructed in geomorphic settings that will accommodate such features. The following design criteria pertain to all sites except for the Tryon Creek Highway 43 Culvert site.

a. NMFS fish passage review and approval. When a proposed side channel will contain greater than 20% of the bankfull flow, the action will be reviewed by the restoration review team (RRT) and reviewed and approved by NMFS for consistency with NMFS (2011a) *Anadromous Salmonid Passage Facility Design* criteria.

b. Data requirements. Data requirements and analysis for off- and side-channel habitat restoration include evidence of historical channel location, such as land use surveys, historical photographs, topographic maps, remote sensing information, or personal observation.

c. Allowable excavation. Off- and side-channel improvements can include minor excavation (less than or equal to 10% of volume) of naturally accumulated sediment within historical channels, *i.e.,* based on the OHW level as the elevation datum. The calculation of the 10% excavation volume does not include manually placed fill, such as dikes, berms, or earthen plugs. There is no limit as to the amount of excavation of anthropogenic fill within historical side channels as long as such channels can be clearly identified through field or aerial photographs. Excavation depth will not exceed the maximum thalweg depth in the main channel. 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.

Streambank Restoration: This type of action includes alluvium placement, LW placement, roughened toe, woody plantings, herbaceous cover in areas where the native vegetation does not include trees or shrubs, bank reshaping and slope grading, coir logs, deformable soil reinforcement, ELJs, floodplain flow spreaders, and floodplain roughness. The following design criteria pertain to all five proposed projects.

- NMFS will review LW placement projects that would occupy greater than 25% of the bankfull cross section area.
- Structure shall simulate disturbance events to the greatest degree possible and include, but not be limited to, log jams, debris flows, wind-throw, and tree breakage.
- Structures may partially or completely span stream channels or be positioned along stream banks.

- Where structures partially or completely span the stream channel LW should be comprised of whole conifer and hardwood trees, logs, and rootwads. LW size (diameter and length) should account for bankfull width and stream discharge rates.

- Structures will incorporate a diverse size (diameter and length) distribution of rootwad or non-rootwad, trimmed or untrimmed, whole trees, logs, snags, slash, *etc*.

- For individual logs that are completely exposed, or embedded less than half their length, logs with rootwads should be a minimum of 1.5 times bankfull channel width, while logs without rootwads should be a minimum of 2.0 times bankfull width.

- Consider orienting key pieces such that the hydraulic forces upon the LW increase stability.

- If LW mechanical anchoring is required, a variety of methods may be used. These include large angular rock, buttressing the wood between adjacent trees, or the use of manila, sisal or other biodegradable ropes for lashing connections. If hydraulic conditions warrant use of structural connections, rebar pinning or bolted connections may be used. Use of cable is not covered by this opinion.

- When a hole in the channel bed caused by local scour will be filled with rock to prevent damage to a culvert, road, or bridge foundation, the amount of rock will be limited to the minimum necessary to protect the integrity of the structure.

- When a footing, facing, head wall, or other protection will be constructed with rock to prevent scouring or down-cutting of, or fill slope erosion or failure at, an existing culvert or bridge, the amount of rock used will be limited to the minimum necessary to protect the integrity of the structure. Whenever feasible, include soil and woody vegetation as a covering and throughout the structure.

- Use a diverse assemblage of vegetation species native to the action area or region, including trees, shrubs, and herbaceous species. Vegetation, such as willow, sedge and rush mats, may be gathered from abandoned floodplains, stream channels, *etc.*

- Do not apply surface fertilizer within 50 feet of any stream channel.

- Install fencing as necessary to prevent access to revegetated sites by livestock or unauthorized persons.

- Conduct post-construction monitoring and treatment or removal of invasive plants until native plant species are well established.

Wetland Restoration: This type of action restores degraded wetlands by (a) excavation and removal of fill materials; (b) contouring to reestablish more natural topography; (c) setting back existing dikes, berms, and levees; (d) reconnecting or recreating historical tidal and fluvial channels; (e) planting native wetland species; or (f) a combination of the above methods. The following design criteria pertain only to the Oaks Crossing project:

a. Include applicable General Construction Measures for specific types of actions as applicable (e.g., Off- and Side-Channel Habitat Restoration, above) to ensure that all adverse effects to fish and their designated critical habitats are within the range of effects considered in the PROJECTS BiOp.

3.3 Project Descriptions

This section provides details on specific actions that would occur at each restoration site. In all cases, heavy equipment such as excavators and haul trucks would be used during construction; all in-water work will be confined to the designated work window; and in-water work areas will be isolated with coffer dams so that construction will be performed "in the dry" to reduce turbidity and adverse effects to fish and wildlife. Photos of each site are shown in Section 4, and conceptual plans showing project features are shown in Appendix A.

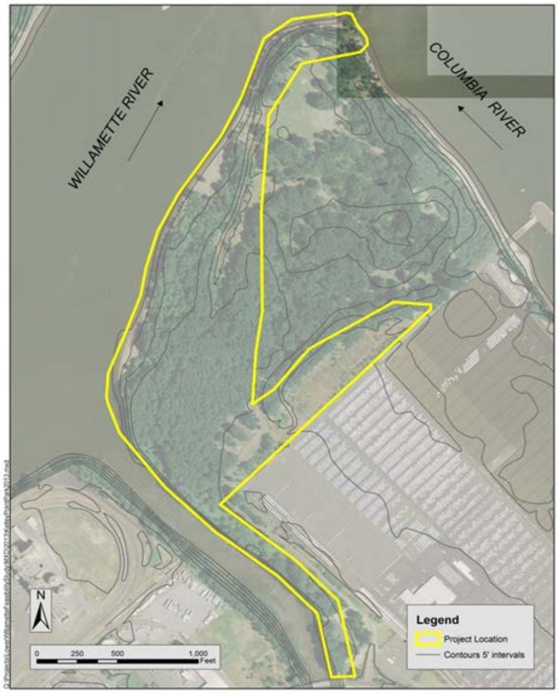

Figure 3-1. Kelly Point Park Project Site

Kelley Point Park (Restoration Action Types: Large wood (LW), Boulder, and Gravel Placement; Off- and Side-Channel Habitat Restoration; Streambank Restoration). The proposed actions at this 48-acre site will be to excavate two off-channel backwater areas totaling approximately 5,000 feet in length and 10 feet wide to an elevation approximately 6 inches below the normal winter flow water surface elevation; remove invasive plants and revegetate with native riparian species over approximately 16.9 acres; regrade steep banks for floodplain enhancement along 5,000 linear feet of the Willamette River and Columbia Slough, and place LW as needed to enhance habitat complexity. Trails throughout the park would be adjusted to allow for restoration as needed, and up to three crossing structures would be installed. To reduce the amount of fill to be removed, rather than excavating large areas of floodplain, meandering channels would be cut along existing swales to allow for off-channel refugia. An estimated 197,000 cubic yards (cy) of material will be excavated and hauled off-site either by barge or truck.

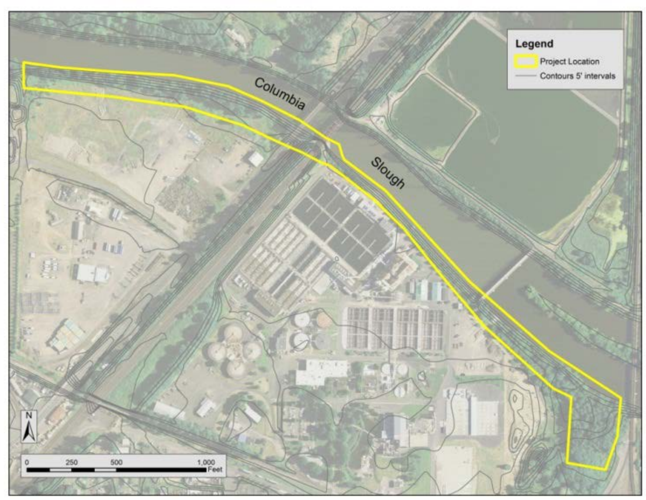

Figure 3-2. BES Plant Project Site

BES Plant (Restoration Action Types: Large wood (LW), Boulder, and Gravel Placement; Off- and Side-Channel Habitat Restoration; Streambank Restoration).

The intent of this project is to excavate a connection to a floodplain backwater/swale area to allow more frequent inundation and enhance the riparian zone along Columbia Slough. Habitat quality is moderate to good, but opportunities to improve and expand riparian wetland and backwater habitats exist in several parts of the project site. Off-channel rearing and high-water refugia would be enhanced by excavating a connection from Columbia Slough to the low swale at the southeast end of the site and by excavating an alcove at the base of the slope near the northwest end of the site. Steepened banks would be laid back along approximately 400 linear feet of Columbia Slough by excavating and hauling approximately 13,000 cy of soil; LW would be added along the banks to increase habitat complexity; several large boulders would be placed in the backwater area for reptile and amphibian habitat; and invasive species removal and riparian revegetation would occur on approximately 0.7 acres.

Kenton Cove (Restoration Action Types: LW, Boulder, and Gravel Placement; Streambank Restoration). Most of this 3.2 acre site is surrounded by a highly maintained levee, with a natural riparian floodplain zone along Columbia Slough. The dominant species include black cottonwood, Himalayan blackberry, and reed canarygrass. The intent of this project is to enhance this backwater cove with LW, remove invasive species, and revegetate with native trees and shrubs. Because the edges of the cove are very uniform and offer very little habitat complexity, it is recommended to create small habitat islands with clean fill and woody debris, with the wood as the centerpiece of the habitat island. An estimated 1600 cy of gravel and topsoil will be imported and hauled by truck for the creation of the habitat islands. LW would be installed as appropriate and invasive species removal and revegetation with native species would occur over approximately 3.2 acres.

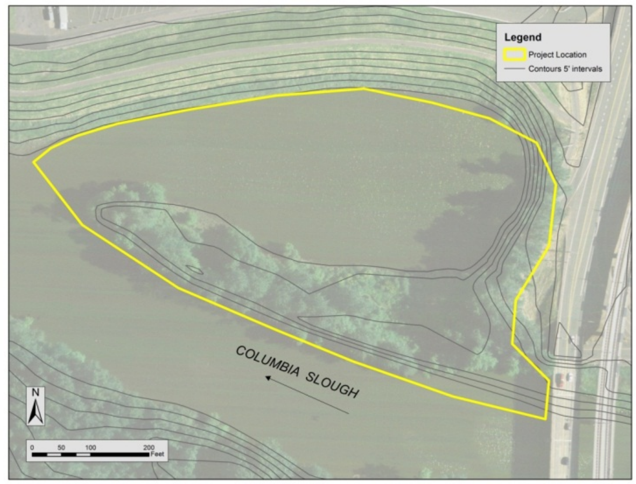

Figure 3-3. Kenton Cove Project Site

Oaks Crossing/Sellwood Riverfront Park (Restoration Action Types: LW, Boulder, and Gravel Placement; Off- and Side-Channel Habitat Restoration: Wetland Restoration). The intent of this project is to restore salmonid habitat in the floodplain of this 9.97 acre site by connecting off-channel habitat to the river, adding LW, removing invasive species, and revegetating with native wetland and riparian species. Habitat at this site consists of gallery forest lined with native and invasive species. Shallow water habitat would be enhanced by addition of LW as needed to enhance habitat. To create

Figure 3-4. Oaks Crossing/Sellwood Riverfront Park Project Site.

approximately 1,200 linear feet of side channels and backwater habitat, an estimated 9,000 cy of material will be excavated and hauled either by barge or truck. The bottom elevations of the side channels would correspond to an elevation approximately 6 inches below the water surface elevation under normal winter flows. Invasive species would be removed and wetland or riparian vegetation would be planted over approximately 7.2 acres.

Highway 43 Tryon Creek Culvert (Restoration Action Type: Fish Passage Restoration). The intent of this project is to replace the culvert under Highway 43 and the Portland and Northern rail line with a fish passable culvert. The new open-bottom arch culvert would simulate the natural stream dimensions, allowing for sediment and debris to pass through and provide fish unhindered passage beneath the roadway and railroad line. Implementation of this project would allow unhindered fish passage into the Tryon Creek State Natural Area, where fish habitat has been restored recently. Replacing this culvert would require excavation of up to 21,000 cy of overburden from above the culvert; demolition and removal of the entire 400 foot culvert; removal of approximately 1,200 cy of bedrock; installation of a 28-foot wide, open bottom arch culvert; installation of headwalls and wingwalls at both ends of the culvert; installation of rock weirs in the streambed for velocity control; backfill with 17,800 cy of overburden; and riparian revegetation over approximately 2.5 acres. Temporary dewatering may be needed during some of the work in the streambed. All work in the streambed and bank areas would occur during the in-water work window.

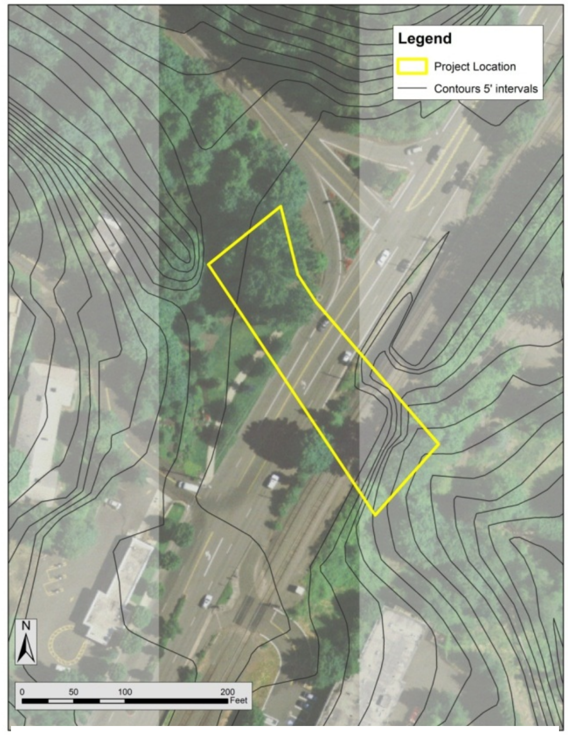

Figure 3-5. Highway 43 Tryon Creek Culvert Project Site.

A drawing of the proposed culvert appears below. This culvert has been designed to be consistent with design criteria from the PROJECTS BiOp (NMFS 2013) and recommendations in *Anadromous Salmonid Passage Facility Design* (NMFS 2008).

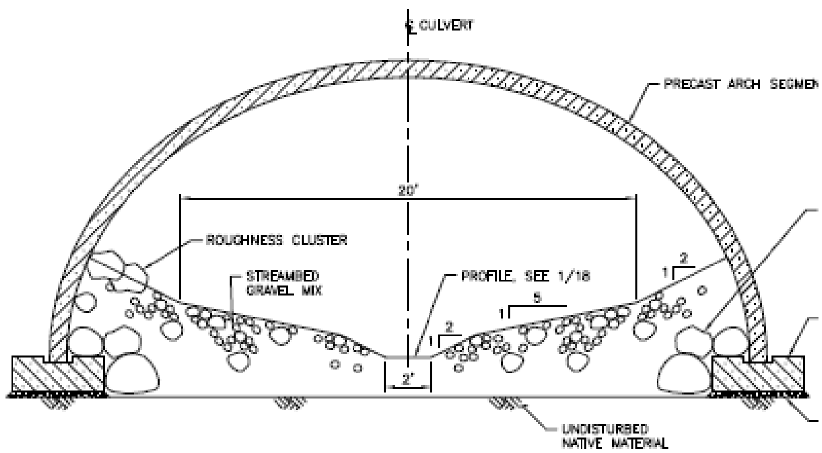

Figure 3-6. Cross Section of Proposed Tryon Creek Highway 43 Culvert

4. DESCRIPTION OF ACTION AREA AND PROJECT SITES

4.1 Existing Conditions

The Lower Willamette River ecosystem has changed markedly during the last 150 years as a result of floodplain fill, installation of revetments, and development of the watershed (Hulse et al. 2002). Changes to the ecosystem have been evident in the dramatic declines in riparian and floodplain areas, wetlands, and fish populations. Fish distribution throughout the Lower Willamette River watershed is shown in Figure 4-1.

4.1.1 Lower Willamette River

The Lower Willamette River is a tidally influenced freshwater estuary that is significantly influenced by Pacific Ocean tidal fluctuations transmitted upstream in the Columbia River. When the water surface level of the Columbia River exceeds that of the Lower Willamette River, water from the Columbia River enters the Willamette River and the net flow direction of the Willamette River is negative (upstream). This condition occurs when Portland Harbor stages are less than 12 feet NGVD29 (National Geodetic Vertical Datum) and is most pronounced when harbor stages are less than 5 feet NGVD29; the latter stages commonly occur in late summer and early fall (USACE 2009). Tidal influences in the Lower Willamette River extending to the Morrison Bridge typically fluctuate between 0 to 3 feet mimicking the mixed semi-diurnal ocean tide patterns (two unequal high tides and two unequal low tides daily) (Limno-Tech 1997).

Hydrology in the Lower Willamette River is driven by upstream reservoir regulation of both the Willamette and Columbia Rivers, natural stream flows, climatic patterns, and tidal effects. The average annual daily discharge recorded at USGS Gage No. 14211720, Willamette River at Portland (Morrison Bridge) for water years 1973 to 2011 is 33,160 cubic feet per second (cfs). A maximum discharge of 420,000 cfs was recorded on February 9, 1996, and a minimum discharge of 4,200 cfs was recorded on July 10, 1978 (USGS 2012a). Peak flows after heavy rains can swell from 200,000 to 400,000 cfs (Hulse *et al*. 2002). Very high flows correspond to the spring freshet and large storm events, and generally last between 1 and 2 weeks. Normal winter flows are generally attained in October and last until approximately late April, depending on the timing of early snowmelt. During this time, salmonids are typically in need of rearing and refuge habitat to avoid the high flows before they begin their out migration to the ocean.

Hydrologic processes in the Lower Willamette River have changed in response to construction of upstream dams, irrigation diversions, and navigation dredging below Willamette Falls. Winter flood flows have been reduced and summer low flows have increased (PBES 2005). Wetland losses, diking and bank hardening, vegetation removal, impervious surfaces and regional changes in hydrology have altered the temporal and spatial patterns of groundwater inflows and in general reduced levels of overland flows and groundwater input, although there is little quantitative information to assess the specific nature of these changes.

There are dozens of federal, state, local, and private dams and reservoirs in the greater Willamette River Basin with a collective storage capacity of over 2.7 million acre-feet (Hulse *et al*. 2002). Most notable of the federal projects is the Willamette River Basin Project, which consists of 13 dams built by USACE beginning in the 1960s for downstream flood reduction and hydroelectric power generation, in addition to various bank protection structures for flood control and hydropower production (Willamette Partnership 2004).

Quality habitat for key life stages of salmonids is limited in the Lower Willamette River. Key habitat types and features such as off-channel habitat, shallow water habitat, channel and bank complexity and large woody debris are insufficient to support the migratory and rearing life stages of the focal species. Changes in the abundance and distribution of gravels and LW have reduced suitable spawning areas and rearing habitat (NPCC 2004). Altered flow regimes and water temperature patterns due to upstream dam releases have reduced the availability and quality of off-channel habitat including backwater sloughs, floodplain ponds, and other slow-moving side-channel habitat.

Across the Lower Willamette River reach, the only mapped wetland is a freshwater forested/shrub wetland at the southern end of Kelly Point Park. Although no other wetland has been identified in the remainder of this reach, two riverine aquatic habitats are present. These include riverine tidal unconsolidated shore regularly flooded and riverine tidal unconsolidated shore seasonal tidal. Both may host fringe riparian wetlands. Reconnaissance-level surveys at the Oaks Crossing/Sellwood Riverfront Park site indicate that freshwater forested/shrub wetland occurs there. A mature black cottonwood riparian forest is found close to the bank of the Willamette River at this site.

Because of the level of pollution in Lower Willamette River sediments, the Portland Harbor from downtown Portland to the confluence with the Columbia River was added to the federal Superfund cleanup list in December 2000. Pollutants generated throughout the Willamette River Basin, including industrial discharges, toxic pollutants carried by stormwater, and other sources, have contributed to highly elevated levels of DDT, PCBs, polycyclic aromatic hydrocarbons (PAHs) and heavy metals in Lower Willamette River sediment.

Fish sampling has been conducted at sites within the Lower Willamette and Lower Columbia Rivers to assess if fish may be at risk for toxic effects of DDT contamination. The results of this study concluded that although some bioaccumulation of DDT was detected, the resulting levels were below the threshold concentration for injury from DDT. Although it is likely that some bioaccumulation is inevitable if individuals remain in areas of known high levels of contamination for prolonged durations, testing of fish tissue to date has shown that levels are below established thresholds. Although this effect may be magnified if fish linger in restored areas for rearing, testing did not indicate that levels of toxins would rise above threshold.

Diverse and extensive habitat types are found throughout the Lower Willamette River as a result of its location at the juncture of two major river systems (PBES 2006). Habitat types present in the lower river segment include bottomland forest, scrub/shrub, and grassland. Important wildlife linkages provided by this segment offer wintering and breeding habitat for waterfowl, shorebirds, and neotropical migrants along the Pacific Flyway (Aldolfson Associates 2000). The presence of waterfowl and shorebirds in this tidally influenced area is unique to the project area. Bottomland forests and wetlands offer wintering and/or breeding habitat for waterfowl, shorebirds, and neotropical migrants. Kelley Point Park and Smith and Bybee Lakes provide critical breeding and nesting habitat for declining populations of neotropical birds.

Riparian forests, also called gallery or bottomland forests, grew abundantly on the floodplains of the Willamette River and its tributaries. These forests included a diverse mosaic of brushy thickets, marshes, and ash openings, maintained through annual inundation by floods. Approximately 20 percent of riparian vegetation present in 1851 remains, much of it now only one to two tree lengths in width. Vegetation of bottomland and wetland forests consisted of black cottonwood *(Populus trichocarpa)*, Oregon ash *(Fraxinus latifolia)*, and willow *(Salix* sp.*)* with associated understory assemblages (Portland Bureau of Planning and Sustainability 2009).

4.1.2 Tryon Creek

Tryon Creek is a 5-mile long, perennial tributary to the Willamette River, with headwaters in the West Hills of Portland (west of Interstate 5).The historic hydrology of Tryon Creek is typical of a low to moderate gradient headwater streams, with steep landscape slopes that have been modified by the effects of development and urbanization. The annual hydrograph for Tryon Creek reflects a climatic precipitation pattern, with higher flows and frequent storm flow events during the wet period from approximately October through May, followed by lower flows during the summer dry period (June through September) (PBES 2005). Although there are no quantified historic data to compare hydrologic changes in the last century in the Tryon Creek watershed, it can be inferred from similar streams in the Pacific Northwest that the climatic precipitation pattern has likely not changed significantly with development, but that daily and monthly stream flow events and runoff volumes have changed due to development.

The average annual daily discharge recorded at USGS Gage No. 14211315 (Tryon Creek near Lake Oswego) for water years 2002 to 2011 is 8.72 cfs. A maximum discharge of 1,210 cfs was recorded on December 9, 2010, and a minimum discharge of 0.09 cfs was recorded on September 4, 5, and 12, 2002 (USGS 2012b). No contaminated sediments were identified in or near Tryon Creek during a database search. The headwaters of the creek are highly developed, and stormwater may bring pollutants associated with urban runoff. The only stormwater or sewage structure identified as occurring at any of the restoration sites included in this study is a sewage pipeline that runs parallel to the Highway 43 Tryon Creek culvert.

No wetlands have been mapped at the Highway 43 Tryon Creek Culvert site. However, NWI maps would generally not identify wetlands in an area such as Tryon Creek that is covered by a riparian canopy, so these data are inconclusive. Reconnaissance-level surveys have identified areas that have strong wetland indicators at this site, including fringing fresh emergent wetlands and riparian wetlands.

Culverts on Tryon Creek at Boones Ferry Road, Highway 43, and on Arnold Creek at Arnold Creek Road partially or completely block fish passage into the upper reaches of these streams. Boones Ferry Road comprises the upstream extent of the study area, and the Arnold Creek culvert is found further upstream, outside of the study area.

Relatively extensive wildlife habitat is found between Highway 43 and Boones Ferry Road. Much of this area is undeveloped and part of the Tryon Creek State Natural Area. Above Boones Ferry Road, the watershed is more highly developed and wildlife habitat quality is lower.

4.1.3 Columbia Slough

Hydrology within the Columbia Slough watershed has also changed from historic conditions. Levee construction and reinforcement; filling of lakes and wetland complexes with dredge materials; draining of wetlands and other adjacent low-lying areas; and heavy industrial, commercial, residential, and agricultural development have all occurred within and around the slough (PBES 2005). The result has been disconnection of the slough from its floodplain and only seasonal connection to the Columbia River. These activities have left Columbia Slough with complex and highly managed hydrologic features that affect flows directly above the confluence of the Lower Willamette River with the Columbia River.

Average annual daily discharge and stage (water elevation) have been recorded at USGS Gage No. 14211820 (Columbia Slough at Portland) for water years 1990 to 2009, although these data have not been recorded continuously. A maximum water elevation of 27.26 cfs was observed on February 9, 1996 (USGS 2012b), which corresponds to record flooding throughout the region.

The travel corridors along Columbia Slough are important for dispersion of mammalian species such as deer, coyote, fox, and beaver, as well as reptiles and amphibians (Adolfson Associates 2000).

Although not a designated wetland, Columbia Slough is composed of two types of riverine systems, both of which have the potential to host additional wetlands. The Columbia Slough sites contain freshwater emergent wetlands and freshwater forested/shrub wetlands; most soils in the area are hydric. A very small part of the BES treatment plant has a forest/shrub wetland at the west tip of the property. Kenton Cove has no mapped wetlands, but likely has narrow fringing freshwater emergent wetland at the toe of the banks.

Several obstructions to fish access in the subbasin also affect native fish. Access to the middle and upper Columbia Slough is prevented by the Multnomah County Drainage District dike and pumping system. It is likely that fish could access the upper slough area during high spring runoff in the Columbia (PBES 2006). Columbia Slough at the location of the project sites is fully accessible to fish moving upstream from the confluence of the slough with the Willamette River.

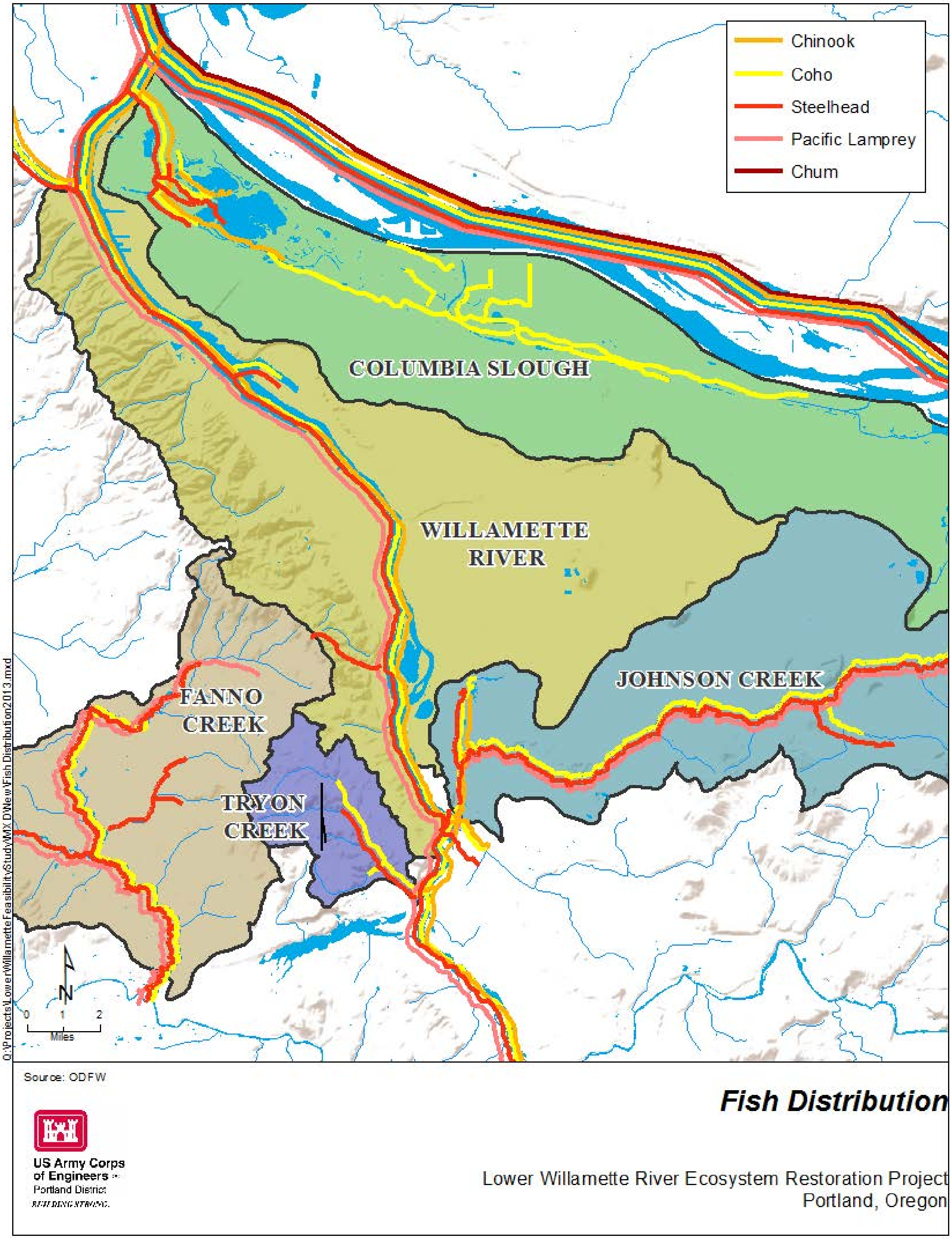

Figure 4-1. Salmonid distribution in study area

4.2 Site Descriptions

The final list of sites included in this study collectively provide spawning, forage, rearing, and escape habitat for some or all of the listed anadromous species mentioned in this BA. Sites were selected to be consistent with the City of Portland's priority habitat areas and watershed restoration objectives. This section contains a general description of baseline conditions at each of the five sites shown in Figure 2-2. Components of the recommended restoration plans for each site are shown in the figures in Appendix A.

4.2.1 Kelley Point Park

Habitat value in Kelley Point Park is currently moderate. The dominant vegetation includes large grassy areas, with an Oregon ash and cottonwood riparian zone that is on average 50 feet wide. Blackberry is dominant in multiple locations. The shoreline along Kelley Point is of good quality, with shallow-water habitat and moderately sloping banks with some LW present (Figure 4-2). Banks are steepest at the confluence of the Willamette and Columbia Rivers, and along the banks of the Columbia Slough. Aquatic habitat includes a sandy shoreline with a steep drop-off and little to no shoreline or aquatic vegetation to provide cover.

Figure 4-2. Kelley Point Park Banks along the Willamette River

4.2.2 BES Treatment Plant

The BES Treatment Plant site consists of a City-owned bike trail and park, and the left bank of the Columbia Slough. Dominant vegetation includes black cottonwood, ninebark *(Physocarpus capitatus)*, Himalayan blackberry (*Rubus armeniacus*), English ivy (*Hedera helix*), and reed canarygrass *(Phalaris arundinaceae)*. The shoreline appears to be naturally vertical and is about 8 feet high. Aquatic habitat is limited due to the steep banks and little to no cover. A small swale area (<1 ac) at the east end of the site is connected to the slough infrequently through a culvert (Figure 4-3).

Figure 4-3. Backwater swale at BES Treatment Plan

4.2.3 Kenton Cove

Currently, most of the Kenton Cove site is surrounded by a highly maintained levee with a natural riparian floodplain zone along Columbia Slough. Although Kenton Cove has a direct, consistent connection with the Columbia Slough, aquatic habitat is lacking with little to no vegetative cover, offering little benefit to aquatic species. The riparian zone includes dominant species such as black cottonwood, Himalayan blackberry, and reed canarygrass (Figure 4-4).

Figure 4-4. Kenton Cove

4.2.4 Oaks Crossing

The Oaks Crossing site consists of a low riparian zone lined with native and invasive species. The site is within a multi-use park setting. Dominant species in the riparian zone include black cottonwood, willows, cedars, Himalayan blackberry, English ivy, and reed canarygrass (Figure 4-5). There is a powerline tower on the site that sits within a small existing wetland. The shoreline consists of gradual sandy slope with little to no vegetative cover.

The site's close proximity to Oaks Bottom Wildlife Refuge increases the value for habitat improvement on this adjacent property for wildlife and aquatic species. Although there is no hydrologic connection between these two sites and they are separated by a road and the SAM TRANS rail line, migration of amphibians and waterfowl is likely to occur between the two areas.

Figure 4-5. Banks of Oaks Crossing along the Willamette River

4.2.5 Tryon Creek - Highway 43 Culvert Replacement

This site includes a culvert complex that acts as a fish passage barrier under most conditions. The length of the existing culvert under Highway 43 and the train line is approximately 400 feet. The culvert is approximately a 6-foot concrete box (Figure 4-6). Weirs downstream of the culvert and baffles within the culvert were installed in an attempt to facilitate immediate fish passage until a long-term solution can be found. Upstream of this culvert is ~2.7 miles of high quality unhindered spawning and rearing habitat up to the Boones Ferry Road crossing. The Boones Ferry Road crossing is a barrier to upstream fish passage for which a passable replacement culvert is under design by the City of Portland. The estimated bankfull width of the stream is 30 feet.

Figure 4-6. Highway 43 Culvert on Tryon Creek (facing upstream)

5. CONSERVATION MEASURES

The Project would comply with relevant conservation construction measures and best management practices listed below.

5.1 General Construction Conservation Measures

- **Site Contamination Assessment:** An HTRW assessment of available records has been conducted for the project sites to ensure that the proposed project will not release contaminants to aquatic habitat. This assessment, which included a search of relevant databases and a field reconnaissance survey, concluded that there are no HTRW sites within ¼ mile of any of the proposed restoration sites.

- **Site Layout and Flagging Sensitive Areas:** Before construction begins flagging of entry and exit points, staging areas, and sensitive resources will occur in order to avoid disturbance during construction.

- **Staging Storage and Stockpile Areas:** Staging area and storage areas will be designated to store materials, fuel, and equipment. Equipment will be staged at least 150 from any natural water body or wetland to avoid contamination or sedimentation of water bodies. However since the project sites may occur in confined areas, this may not be feasible. If the staging area(s) will be located within 150 feet of the river or the wetlands, they will be fenced and fully contained to prevent the runoff of sediment or pollutant laden stormwater into the river or wetlands.

- **Erosion Controls:** Site planning and site erosion control measures will be installed prior to construction to prevent erosion and sediment discharge. Temporary erosion controls measures including fiber wattles, site fences, jute matting, wood fiber mulch, or geotextiles will be installed, as appropriate, before any significant alteration of the site occurs. Additional sediment barriers will be stored on site if needed.

- **Hazardous Material Spill Prevention Control:** An erosion and pollution control plan will be prepared for each individual project site and carried out, commensurate with the scope of the action that includes the following information: (a) the name, phone number, and address of the person responsible for accomplishing the plan; (b) best management practices to confine vegetation and soil disturbance to the minimum area, and minimum length of time, as necessary to complete the action, and otherwise prevent or minimize erosion associated with the action; (c) best management practices to confine, remove, and dispose of construction waste, including debris, discharge water, concrete, cement, grout, washout facility, petroleum product, or other hazardous materials generated, used, or stored on-site; (d) procedures to contain and control a spill of any hazardous material generated, used or stored on-site, including notification of proper authorities; and (e) steps to cease work under high flows, except for efforts to avoid or minimize resource damage.

- **Equipment, Vehicles, and Power Tools:** Equipment will be selected to minimize adverse effects on the environment. Vehicles and equipment will be inspected daily for fluid leaks before leaving the staging area when operating within 50 feet of any stream, waterbody, or wetland and the equipment will be steam cleaned before operation below the ordinary high water or as necessary to remain grease free and prevent invasive species contamination. Biodegradable lubricants and fuels will be used as available.

- **Temporary Access Roads:** Temporary access roads will not be built on steep slopes, where grade, soil, or other features suggest a likelihood of excessive erosion or failure. For the most part, existing access roads are present, and only limited additional grading or placement of gravel/rock for access would be required to facilitate construction.

- **Dust Abatement:** Dust abatement measures will be commensurate with soil type, equipment use, wind conditions, and the effects of other erosion control measures; work will be sequenced to reduce the exposure of bare soil to wind erosion; spill containment supplies will be maintained on site; petroleum-based products will not be used for dust abatement.

- **Temporary Stream Crossings:** No stream crossings will occur at active spawning sites, when holding adult listed fish are present or holding, or when eggs or alevins are in the gravel; temporary crossings will not be placed in areas that may increase the risk of channel re-routing or avulsion, or in potential spawning habitat, *e.g.*, pools and pool tailouts. The number of temporary stream crossings will be minimized, and existing stream crossings will be used whenever reasonable; temporary bridges and culverts will be installed to allow for equipment and vehicle crossing over perennial streams during construction. Whenever possible, vehicles and machinery will cross streams at right angles to the main channel or equipment and vehicles will 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. All temporary stream crossings will be obliterated as soon as they are no longer needed, and any damage to affected stream banks or channel will be fully restored following project implementation.

- **Surface Water Withdrawal and Construction Discharge Water:** Surface water will only be diverted to meet construction needs if developed sources are unavailable or inadequate. Diversions will not exceed 10% of the available flow and will have a juvenile fish exclusion device that is consistent with NMFS's criteria. Screens will be installed, operated, and maintained to meet NMFS fish screen criteria. All construction discharge water will be treated 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.

- **Fish Passage**: Fish passage will be provided for adult or juvenile fish present in the action area during construction, or fish will be salvaged and removed if waters are diverted. All reconnection channels and passageways will meet NMFS fish passage criteria described in Section 4.

- **In-water Work Period:** All work below the ordinary high water line will occur during the designated ODFW in-water work periods for the Lower Willamette River and tributaries, as appropriate (see Table 5-1). These in-water work periods are generally listed in the Oregon Guidelines for Timing of In-water Work to Protect Fish and Wildlife Resources (ODFW 2008, or most recent version), but are then more specifically determined by coordination with ODFW staff. Coordination with ODFW and NMFS will happen accordingly for this project.

Table 5-1. Listed In-water Work Periods for the Lower Willamette and Tributaries

Waterbody	Work Window
Tryon Creek	July 15 to September 30
Mainstem Willamette	July 1 to October 31
Columbia Slough	June 15 to September 15

Source: ODFW 2009

- **Fisheries, Hydrology, Geomorphology, Wildlife, Botany, and Cultural Surveys in Support of Aquatic Restoration:** A monitoring and adaptive management plan to track the success of the restoration features will be developed.

- **Work Area Isolation:** Any work within the wetted channel will be isolated from the Lower Willamette River and its tributaries by installation of coffer dams and other measures, as appropriate. A work area isolation and fish salvage plan will be prepared for each site for approval by ODFW and NMFS and carried out with a scientific collection permit. Fish and wildlife will be salvaged and removed from the work area. Any pumps used outside of isolated areas will be screened per ODFW requirements. Any groundwater present in the excavation area will be pumped and treated via infiltration or other methods (such as Baker tanks or silt bags) prior to discharge back to either the river or wetlands.

- **Fish Capture and Release:** Any fish that may be trapped within the isolated work area will be captured and released using a trap, seine, electrofishing, or other methods as prudent to minimize the risk of injury, then released at a safe release site. A scientific collection permit will be obtained to conduct this work, with approval of the fish salvage plan from NMFS and ODFW. Capture and release will be supervised by a fishery biologist experienced with work area isolation and competent to ensure the safe handling of fish. If electrofishing is used, the NMFS electrofishing guidelines will be followed (NMFS 2000).

- **Invasive and non-native plant control**: Invasive and non-native plant control will use manual, mechanical, or hydro-mechanical methods as a priority. Herbicide use will be used secondarily and will follow all NMFS approved herbicide label instructions and application will occur by or supervised by a licensed applicator

- **Site Restoration**: Any temporary access routes constructed will be removed in their entirety and the locations will be restored via mulching and hydroseeding and then planting of native shrub and tree species. Any fill placed in wetlands for temporary construction purposes will be removed and the area will be fully restored. Any large wood, native vegetation, topsoil and native channel material displaced by construction will be stockpiled for reuse on-site during restoration, as feasible. When construction is complete, all disturbed areas will be restored as necessary to renew ecosystem processes. Fencing will be installed as necessary to prevent damage to newly revegetated sites by unauthorized persons.

- **Planting or Installing Vegetation:** Disturbed areas will be planted and seeded before or at the beginning of the first growing season after construction. A diverse mix of native species adapted to the site conditions will be used for all revegetation efforts. Non-native or invasive species will not be included. Existing non-native or invasive species will be controlled as feasible on the site to promote native vegetation growth and dominance.

6. BIOLOGY AND DISTRIBUTION OF LISTED SPECIES

Of those species listed in Table 6-1, the only known ESA-listed species present in the project area are the fishes. It is assumed, given the best scientific information available, that the necessary habitat requirements for all other species listed in Table 1-1 are not present in the action area and individuals are therefore absent from the project sites. Otherwise, there are no listed plants, amphibians, reptiles, or mammals known to occur or that have the potential to occur in the proposed action areas.

The yellow-billed cuckoo *(Coccyzus americanus)* was proposed for listing as *threatened* under the ESA on 3 October 2013 (FR 78 61622). Although this species is considered a riparian obligate species, the large, extensive riparian forests they prefer are inter-mixed with an urban landscape. It is assumed that very few birds are present in the region, and if any birds are present they would occupy extensive riparian forests outside of the action area; therefore the yellow-billed cuckoo is not expected to be present in the action area. The proposed restoration actions described above will not impact the gallery forests preferred by cuckoos, as most construction work is intended to restore aquatic habitats and the associated floodplain. No large trees or forested areas will be removed or damaged during construction. For these reasons, the Corps has determined the proposed action will have ***no effect*** to yellow-billed cuckoos and this species is not evaluated further in this assessment.

Table 6-1. ESA Status of Key Species Found in the Project Area

Species	Scientific Name	ESU	ESA Listing Status
Coho salmon	*Oncorhynchus kisutch*	Lower Columbia / Southwest Washington	Threatened
Chinook salmon	*Oncorhynchus tshawytscha*	Lower Columbia	Threatened
		Upper Columbia Spring-run	Endangered
		Upper Willamette	Threatened
		Snake Spring/ Summer-run	Threatened
		Snake Fall-run	Threatened
Steelhead	*Oncorhynchus mykiss*	Lower Columbia	Threatened
		Middle Columbia	Threatened
		Upper Columbia	Threatened
		Upper Willamette	Threatened
		Snake	Threatened
Chum salmon	*Oncorhynchus keta*	Columbia	Threatened
North American green sturgeon	*Acipenser medirostris*	Southern DPS	Threatened

Source: NMFS 2014.

The species carried forward for further analysis in this assessment include seven listed fish species that have the potential to be present in the action area and have a federal listing status of threatened. A total of 15 ESUs composed of these seven different species may use or migrate through watercourses in the project area. These species include Lower Columbia River coho salmon ESU (*Oncorhynchus kisutch*), Lower Columbia River Chinook salmon ESU (*O. tshawytscha*), Upper Willamette River Chinook salmon ESU (*O. tshawytscha*), Upper Willamette River steelhead DPS (*O. mykiss*), Lower Columbia River steelhead DPS (*O. mykiss*), and the Southern DPS of North American green sturgeon (*Acipenser medirostris*). Only one species, the Lower Columbia River coho salmon, also has a state listing status of endangered. The Clackamas population of Chum salmon (*O. keta*) was not included in this evaluation as it is likely extirpated from the Willamette River (NMFS 2004).

6.1 Lower Columbia River Coho Salmon ESU, Threatened

The Lower Columbia River coho salmon ESU was listed as threatened on June 28, 2005 (70FR37160); critical habitat has been proposed on January 14, 2013 (78FR2726). The ESU includes all naturally spawned populations of coho salmon in the Columbia River and its tributaries in Washington and Oregon, from the mouth of the Columbia up to and including the Big White Salmon and Hood Rivers, as well as the Willamette River to Willamette Falls, Oregon, and 25 artificial propagation programs (NMFS 2005a). Information presented in this discussion came primarily from the Federal Register designating the listing status of the Lower Columbia River coho salmon ESU (NMFS 2005a) and the 5-Year Review of Lower Columbia River Salmon (NMFS 2011).

Coho salmon is a widespread species of Pacific salmon, with production in most major river basins around the Pacific Rim from central California to Korea and northern Hokkaido, Japan (Laufle et al. 1986). The Lower Columbia River ESU includes all naturally spawned populations of coho salmon in the Columbia River and its tributaries in Washington and Oregon, from the mouth of the Columbia up to and including the Big White Salmon and Hood Rivers, and includes the Willamette River to Willamette Falls, Oregon, as well as twenty-five artificial propagation programs (NMFS 2011). The following ESU description was taken from the Lower Columbia Fish Recovery Board's (LCFRB's) technical framework (2004). Coho salmon runs in the Columbia River, and to some extent the Willamette River, show considerable temporal variability in river entry and spawn timing. Coho salmon begin to return to the Columbia River in August and continue through December/January, peaking in September/October. This variability resembles the pattern of river entry in other river systems, such as the Chehalis in southwest Washington, the Skagit in northern Washington, and the Klamath in southern Oregon (Leidy and Leidy 1984; Washington Department of Fisheries 1993).

The timing of coho salmon spawning can also reflect water temperature changes in a particular river system. Lister et al. (1981) found that spawn timing of coho salmon in tributaries of the Cowichan River (British Columbia) was strongly correlated to tributary water temperature; coho salmon spawning in warmer tributaries spawned later than those spawning in colder tributaries. Such factors make determining and comparing when coho salmon will enter a river or spawn difficult because of the temperature variability across and within basins (NMFS 2005a). Other environmental factors influence coho salmon spawning as well. Adult coho salmon returning to spawn need adequate flows and water quality, and unimpeded passage to their natal grounds. They also need deep pools with vegetative cover and in-stream structures such as root wads for resting and shelter from predators.

After emergence, coho salmon fry move to shallow, low velocity rearing areas, primarily along the stream edges and in side channels. They congregate in quiet backwaters, side channels, and small creeks, especially in shady areas with overhanging branches (Gribanov 1948). All coho salmon juveniles remain in their natal river for a full year after leaving the gravel.

Most juvenile coho salmon migrate seaward as smolts in late spring, typically during their second year. Factors that tend to affect the time of migration include: the size of the fish, flow conditions, water temperature, dissolved oxygen levels, day length, and the availability of food (Shapovalov and Taft 1954). The size of coho salmon smolts is fairly consistent over the species' geographic range; a fork length of 3.9 inches (100 mm) appears to be the threshold for smoltification (Gribanov 1948). Generally, the timing of outmigration is earlier in the southern coho salmon populations compared to northern populations.

Coho salmon use estuaries primarily to adjust physiologically to salt water. Most research indicates that, upon entering the ocean, coho salmon remain in nearshore environments over the continental shelf for a couple of months before they disperse on more seaward migrations; this holds true from California to Alaska (Shapovalov and Taft 1954; Milne 1964; Godfrey 1965). This pattern may help coho salmon avoid pelagic predators and reduce feeding competition with immature salmon that are older by a year or more.

Coho salmon typically spend 18 months in the ocean before returning to freshwater. Thus, many returning coho salmon are 3 years old and have spent 18 months in freshwater and 18 months in salt water. Jacks, however, return earlier at age 2. These sexually mature males return to freshwater to spawn after only 5 to 7 months in the ocean.

The latest status review of Lower Columbia coho salmon concludes that the ESU is not meeting recovery criteria and 21 out of 24 historical populations are at very high risk of extinction with the remaining three at high to moderate risk of extinction (NMFS 2011c). The Lower Columbia River ESU is primarily limited by habitat degradation, but past over-harvest and the natural spawning of stray hatchery coho were also identified as contributing to the decline of the ESU.

6.1.1 Utilization of the Action Area

Historically the Lower Willamette River subbasin has provided the third most important spawning grounds for coho salmon throughout the entire Lower Columbia Basin. Coho are believed to be native only to the watershed below Willamette Falls, most notably the Clackamas River, Johnson Creek, Tryon Creek, and tributaries of Multnomah Channel (PBES 2006). The Lower Willamette River and its tributaries up to Willamette Falls include critical spawning and rearing habitat for coho. Coho typically spawn in small, low-gradient areas of the Lower Willamette River tributaries. Juveniles rear up to a year in side channels, backwater pools, and beaver ponds before emigrating seaward. Coho are in low abundance within the Lower Willamette basin. Mostly fish utilize the mainstem as a corridor for adult returns to tributaries such as the Clackamas River and for out-migration of juveniles (NMFS 2011c). Recently, coho have been collected in Tryon Creek between the confluence with the Willamette River and the Highway 43 culvert (PBES 2012). Additionally, juvenile coho have been identified in the Columbia Slough during winter months (ODFW 2009).

Adults may spawn in the tributary streams within the project area from September through December. Eggs are present in the redds until hatching, when the fry emerge. Juveniles will rear in backwater and refuge areas wherever present in the action area.

6.1.2 Critical Habitat

Critical habitat was proposed for the Lower Columbia River coho salmon ESU on January 14, 2013 and includes the mainstem Willamette River, Tryon Creek, and Columbia Slough in the action area.

Within the proposed rule for critical habitat, physical and biological requirements were defined for coho salmon based on their natural history and habitat needs. These requirements are defined in terms of a concept called primary constituent elements (PCEs), which are physical or biological features that have been identified as essential for their conservation. These PCEs include:

PCE 1: Freshwater spawning sites with water quantity and quality conditions and substrate supporting spawning, incubation and larval development;

PCE 2: Freshwater rearing sites with:

> (i) Water quantity and floodplain connectivity to form and maintain physical habitat conditions and support juvenile growth and mobility;
>
> (ii) Water quality and forage supporting juvenile development; and
>
> (iii) Natural cover such as shade, submerged and overhanging large wood, log jams and beaver dams, aquatic vegetation, large rocks and boulders, side channels, and undercut banks.

PCE 3: Freshwater migration corridors free of obstruction and excessive predation with water quantity and quality conditions and natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, side channels, and undercut banks supporting juvenile and adult mobility and survival;

PCE 4: Estuarine areas free of obstruction and excessive predation with:

> (i) Water quality, water quantity, and salinity conditions supporting juvenile and adult physiological transitions between fresh- and saltwater;
>
> (ii) Natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, side channels; and

(iii) Juvenile and adult forage, including aquatic invertebrates and fishes, supporting growth and maturation.

PCE 5: Nearshore marine areas free of obstruction and excessive predation with:

(i) Water quality and quantity conditions and forage, including aquatic invertebrates and fishes, supporting growth and maturation; and

(ii) Natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, and side channels.

PCE 6: Offshore marine areas with water quality conditions and forage, including aquatic invertebrates and fishes, supporting growth and maturation.

Status of Critical Habitat in the Action Area Freshwater habitats in the action area contain only a subset of the identified physical or biological features for coho salmon: PCEs 1 to 3 are present in the action area. The environmental baseline of the action area has been assessed by rating each PCE condition as "properly functioning (PFC)," "impaired (IC)," or "not properly functioning (NPF)." A summary of each PCE element follows in Table 6-2, along with a justification for the status of each PCE element in the action area. The effects that the project may have on the environmental baseline of each PCE element are analyzed in the following section (Section 7).

Table 6-2. Environmental Baseline Summary of Relevant Chinook Critical Habitat PCEs in the Action Area

PCE	Function	Description of Existing Conditions	Cause of Degradation from PFC
Chinook salmon			
1. Freshwater spawning sites	IC	The mainstem Willamette River has been largely impacted by upriver dams and dredging has reducing the amount of braiding and side channels that may have supported spawning; Tryon Creek has partial barriers limiting passage into potential spawning sites.	Habitat loss and impaired access to spawning sites from mainstem dams, impassible culverts, land use, and dredging.
2. Freshwater rearing sites	IC	The mainstem Willamette River has been largely impacted by upriver dams and dredging reducing the amount of braiding, side channels and off-channel rearing habitat area.	Habitat loss and degradation from mainstem dams, land use, and dredging. Contaminated sediments from industrial and urban development further degrade overall habitat quality.
3. Freshwater migration corridors	IC	Water temperatures and water quality have been altered due to changes in the hydrograph and effects of urbanization and fish passage barriers partially block access on Tryon Creek.	Mainstem dams, impassible culverts, urbanization, contaminants, stormwater, and land use.

6.2 Lower Columbia River ESU and Upper Willamette River ESU Chinook Salmon, Threatened

Both the Lower Columbia River Chinook salmon ESU and Upper Willamette River Chinook salmon ESU (*Oncorhynchus tshawytscha*) were listed as threatened on March 24, 1999 (64FR14329) with the threatened status reaffirmed on June 28, 2005 (70FR37160); critical habitat for these ESUs was designated on September 2, 2005 (70FR52630). Draft Interim Regional Recovery Plans have been prepared for both ESUs (NMFS 2005b and NMFS 2010a, respectively). The Lower Columbia River Chinook ESU includes all naturally spawned populations of Chinook salmon from 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, and includes the Willamette River to Willamette Falls, Oregon, exclusive of spring-run Chinook salmon in the Clackamas River (64FR14208) (NMFS 2005a). The Upper Willamette River Chinook salmon ESU includes all naturally spawned populations of spring-run Chinook salmon in the Clackamas River and in the Willamette River, and its tributaries above Willamette Falls, Oregon, as well as seven artificial propagation programs (64FR14208) (NMFS 2005a). Information presented in this discussion came primarily from the Federal Register designating the listing status of the Lower Columbia River Chinook salmon ESU and Upper Willamette River Chinook salmon ESU (NMFS 2005a), the 5-Year Review of Lower Columbia River Salmon (NMFS 2011c), the 5-Year Review of Upper Willamette River Salmon (NMFS 2012), and the Draft Interim Regional Recovery Plans whenever applicable (NMFS 2005b, 2010a).

Chinook salmon, also known by the common names king, spring, quinault, and tyee salmon, historically ranged from the Ventura River in California to Point Hope, Alaska in North America (Healey 1991). Additionally, Chinook salmon have been reported in the Mackenzie River area of northern Canada (McPhail and Lindsey 1970). Factors implicated in the decline of the species include dams, logging, agriculture, water withdrawal, mining, and urbanization, all of which contribute to habitat loss and degradation. Overfishing and the wide use of hatcheries and other forms of artificial propagation are also factors (Myers et al. 1998; West Coast Salmon Biological Review Team 2003). In addition, sources suggest that the "inadequacy of existing regulatory mechanisms" is a general reason for overall decline in abundance of Chinook salmon (Oregon Natural Resources Council 1995).

Chinook salmon are the largest of the salmon species in body size and exhibit one of the most diverse and complex life history strategies. Two generalized freshwater life-history types were initially described by Gilbert (1912): "stream-type" Chinook salmon reside in freshwater for a year or more following emergence, whereas "ocean-type" Chinook salmon migrate to the ocean within their first year. Healey (1991) has promoted the use of broader definitions for "ocean-type" and "stream-type" to describe two distinct races of Chinook salmon. This racial approach incorporates life history traits, geographic distribution, and genetic differentiation and provides a valuable frame of reference for comparisons of Chinook salmon populations.

Chinook salmon populations can be characterized by their time of freshwater entry as spring, summer, or fall runs (NMFS 2005a, 2005b, 2010). Spring Chinook salmon tend to enter freshwater, migrate far upriver, where they hold and become sexually mature before spawning in the late summer and early autumn (NMFS 2005a, 2005b, 2010). Fall Chinook salmon enter freshwater in a more advanced stage of sexual maturity, move rapidly to their spawning areas on the mainstem or lower tributaries of their natal rivers, and spawn within a few days or weeks of freshwater entry (Fulton 1970; Healey 1991). Summer Chinook salmon are intermediate between spring and fall runs, spawning in large and medium-sized tributaries, and not showing the extensive delay in maturation exhibited by spring Chinook salmon (Fulton 1970). The Lower Columbia River Chinook ESU includes both fall and spring runs while the Upper Willamette River Chinook ESU is a spring run population (NMFS 1999).

Chinook salmon require clean, cool water and clean gravel to spawn. Females deposit their eggs in the gravel bottom in areas of relatively swift water; eggs hatch approximately 6 to 12 weeks later. Chinook prefer to spawn in the mainstem of large tributaries (NMFS 2005a, 2005b, 2010). For maximum survival of eggs and larvae, water temperatures must range between 57°F. Optimum rearing habitat for Chinook consists of pools and wetland areas with woody debris and overhanging vegetation. Chinook salmon typically spend 2 to 4 years maturing in the ocean before returning to their native streams to spawn. All adult Chinook salmon die after spawning (NMFS 2005a, 2005b, 2010).

The latest status reviews of Lower Columbia River and Upper Willamette River Chinook salmon show mixed recovery results (NMFS 2011c and NMFS 2012). The Lower Columbia River populations showed increases in abundance during the early 2000s but declines back to the 2000 level in subsequent years. Nearly all spring Chinook salmon populations are cut off from access to essential spawning habitat by tributary hydroelectric dams. The Sandy spring Chinook salmon population, which is not affected by a tributary dam, is considered at moderate risk. All other spring Chinook salmon populations are considered at very high risk or extirpated or nearly so. Of the 32 historical populations in this ESU, 28 are considered at very high risk and only two populations are considered viable. Additionally, the Upper Willamette River ESU of Chinook salmon is also not meeting recovery criteria and not considered viable. The Clackamas and McKenzie populations were found to be at moderate to low risk of extinction for abundance and productivity; the remaining five are in the very high risk category.

6.2.1 Utilization of the Action Area

Upper Willamette River ESU spring Chinook are an early-run population supported in such tributaries as the Clackamas, Molalla, Calapooia, Santiam, McKenzie, and Middle Fork Willamette Rivers. Lower Columbia River ESU fall Chinook did not historically ascend Willamette Falls, but rather spawned and reared in the reaches of the Lower Willamette River and its tributaries (including the Clackamas River). The Lower Willamette River continues to provide critical spawning and rearing habitat for Willamette Basin Chinook. Recently, Chinook have been collected in Tryon Creek between the confluence with the Willamette River and the Highway 43 culvert (PBES 2012). Additionally, juvenile Chinook have been identified in the Columbia Slough primarily during their outmigration in the spring, but have also been observed in the summer and winter months (ODFW 2009).

6.2.2 Critical Habitat

Critical habitat for Lower Columbia River Chinook is designated in the mainstem Willamette River in the action area, the mouth of Tryon Creek, and Columbia Slough. Critical rearing and migration corridor habitat for Upper Willamette Chinook includes the mainstem Willamette River in the action area.

Within the final rule for critical habitat, physical and biological requirements were defined for Chinook salmon based on their natural history and habitat needs. These requirements are defined in terms of a concept called primary constituent elements (PCEs), which are physical or biological features that have been identified as essential for their conservation. These PCEs include:

PCE 1: Freshwater spawning sites with water quantity and quality conditions and substrate supporting spawning, incubation and larval development;

PCE 2: Freshwater rearing sites with:

> (i) Water quantity and floodplain connectivity to form and maintain physical habitat conditions and support juvenile growth and mobility;
>
> (ii) Water quality and forage supporting juvenile development; and
>
> (iii) Natural cover such as shade, submerged and overhanging large wood, log jams and beaver dams, aquatic vegetation, large rocks and boulders, side channels, and undercut banks.

PCE 3: Freshwater migration corridors free of obstruction and excessive predation with water quantity and quality conditions and natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, side channels, and undercut banks supporting juvenile and adult mobility and survival;

PCE 4: Estuarine areas free of obstruction and excessive predation with:

> (i) Water quality, water quantity, and salinity conditions supporting juvenile and adult physiological transitions between fresh- and saltwater;
>
> (ii) Natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, side channels; and
>
> (iii) Juvenile and adult forage, including aquatic invertebrates and fishes, supporting growth and maturation.

PCE 5: Nearshore marine areas free of obstruction and excessive predation with:

> (i) Water quality and quantity conditions and forage, including aquatic invertebrates and fishes, supporting growth and maturation; and
>
> (ii) Natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, and side channels.

PCE 6: Offshore marine areas with water quality conditions and forage, including aquatic invertebrates and fishes, supporting growth and maturation.

Status of Critical Habitat in the Action AreaFreshwater habitats in the action area contain only a subset of the identified physical or biological features for Chinook salmon: PCEs 1 to 3 are present in the action area. The environmental baseline of the action area has been assessed by rating each PCE condition as "properly functioning (PFC)," "impaired (IC)," or "not properly functioning (NPF)." A summary of each PCE element follows in Table 6-3, along with a justification for the status of each PCE element in the action area. The effects that the project may have on the environmental baseline of each PCE element are analyzed in the following section (Section 7).

Table 6-3. Environmental Baseline Summary of Relevant Chinook Critical Habitat PCEs in the Action Area

PCE	Function	Description of Existing Conditions	Cause of Degradation from PFC
Chinook salmon			
1. Freshwater spawning sites	IC	The mainstem Willamette River has been largely impacted by upriver dams and dredging has reducing the amount of braiding and side channels that may have supported spawning; Tryon Creek has partial barriers limiting passage into potential spawning sites.	Habitat loss and impaired access to spawning sites from mainstem dams, impassible culverts, land use, and dredging.
2. Freshwater rearing sites	IC	The mainstem Willamette River has been largely impacted by upriver dams and dredging reducing the amount of braiding, side channels and off-channel rearing habitat area.	Habitat loss and degradation from mainstem dams, land use, and dredging. Contaminated sediments from industrial and urban development further degrade overall habitat quality.
3. Freshwater migration corridors	IC	Water temperatures and water quality have been altered due to changes in the hydrograph and effects of urbanization and fish passage barriers partially block access on Tryon Creek.	Mainstem dams, impassible culverts, urbanization, contaminated sediments, navigation structures, and land use.

6.3 Lower Columbia River DPS and Upper Willamette River DPS Steelhead, Threatened

The Lower Columbia River steelhead and Upper Willamette River steelhead (*Oncorhynchus mykiss*) populations were listed as a threatened species on March 19, 1998 (63FR13347) and the threatened status was reaffirmed on January 5, 2006 (71FR834); critical habitat for these DPSs was designated on September 2, 2005 (70FR52630). Draft Interim Regional Recovery Plans have been prepared for both DPSs (NMFS 2010b and NMFS 2005b, respectively).The Upper Willamette River steelhead ESU includes all naturally spawned populations of winter-run steelhead in the Willamette River, Oregon, and its tributaries upstream from Willamette Falls to the Calapooia River, inclusive. The Lower Columbia River steelhead includes all naturally spawned populations of steelhead (and their progeny) in streams and tributaries to the Columbia River between the Cowlitz and Wind Rivers, Washington, inclusive, and the Willamette and Hood Rivers, Oregon, inclusive. Excluded are steelhead in the Upper Willamette River Basin above Willamette Falls, Oregon, and from the Little and Big White Salmon Rivers, Washington (NMFS 2006a). Information presented in this discussion came primarily from the Federal Register designating the listing status of the Lower Columbia River Steelhead DPS and Upper Willamette River

Steelhead DPS (NMFS 2006a), and the 5-Year Review of Lower Columbia River Salmon (NMFS 2011c).

Steelhead in North America are distributed from northwestern Mexico to the Kuskokwim River in Alaska (NMFS 2006a). Steelhead exhibit more complex life history traits than other Pacific salmonid species. Some forms of *O. mykiss* are anadromous while others, called rainbow or redband trout, are resident forms that remain permanently in freshwater. Anadromous steelhead usually reside in freshwater for 2 years but have been reported to stay as long as 7 years before moving to the ocean. Steelhead typically reside in marine waters for 1 or 3 years before returning to their natal stream to spawn at 4 or 5 years of age. Some Oregon and California populations include “half-pounders” that migrate from the ocean to freshwater and return to the ocean without spawning (NMFS 2006a).

Steelhead can be divided into two basic run types based on the level of sexual maturity at the time of river entry and the duration of the spawning migration (Burgner et al. 1992). The stream-maturing type (inland), or summer steelhead, enters freshwater in a sexually immature condition and requires several months in freshwater to mature and spawn. The ocean-maturing type (coastal), or winter steelhead, enters freshwater with well-developed gonads and spawns shortly after river entry (NMFS 2005b, 2006, 2010b). Variations in migration timing exist between populations. Both summer and winter steelhead occur in British Columbia, Washington, and Oregon; Idaho has only summer steelhead, and California is thought to have only winter steelhead (Busby et al. 1996). In the Pacific Northwest, summer steelhead enter freshwater between May and October, and winter steelhead enter freshwater between November and April. The Upper Willamette River steelhead is a winter run population while the Lower Columbia River steelhead has both winter and summer runs.

Steelhead are iteroparous, or capable of spawning more than once before death. Repeat spawning by steelhead probably ranges from 10 to 20 percent of the spawning population annually. Steelhead spawn in cool, clear streams with suitable gravel size, depth, and current velocity. Intermittent streams may also be used for spawning (NMFS 2005b, 2006, 2010b). Steelhead enter streams and arrive at spawning grounds weeks or even months before they spawn, when they are vulnerable to disturbance and predation. Cover in the form of overhanging vegetation, undercut banks, submerged vegetation, submerged objects such as logs and rocks, floating debris, deep water, turbulence, and turbidity is required to reduce disturbance and predation of spawning steelhead. Summer steelhead usually spawn farther upstream than winter steelhead (Behnke 1992). Summer steelhead juveniles typically rear in freshwater from 1 to 4 years before migrating to the ocean. Winter steelhead generally smolt after 2 years in freshwater (Busby et al. 1996).

Based on catch data, juvenile steelhead tend to migrate offshore during their first summer rather than migrating near the coast as do salmon. During fall and winter, juveniles move southward and eastward (Hartt and Dell 1986). Available fin-mark and coded-wire tag data suggest that winter steelhead tend to migrate farther offshore but not as far north into the Gulf of Alaska as summer steelhead (Burgner et al. 1992) and that southern Oregon and California populations are south-migrating rather than north-migrating (Nicholas and Hankin 1988). Ocean distribution data for specific ESUs is limited. Maturing Columbia River steelhead are found off the coast of northern British Columbia and west into the north Pacific Ocean (Myers et al. 1998). At the time adults are entering freshwater, tagging data indicate that immature Columbia River steelhead are out in the mid-north Pacific Ocean.

6.3.1 *Utilization of the Action Area*

In the Lower Willamette River, populations below Willamette Falls are part of the Lower Columbia River ESU. These anadromous steelhead spawn and rear in both east and west side tributaries, notably, the Clackamas River, Johnson Creek, and Tryon Creek, with restricted rearing in the Columbia slough. Upstream of Willamette Falls, steelhead are part of the Upper Willamette River ESU. These steelhead predominately populate eastside tributaries and the Tualatin River to the west. The Lower Willamette River is an important rearing and migratory corridor for this population. Recently, steelhead have been collected in Tryon Creek between the confluence with the Willamette River and the Highway 43 culvert (PBES 2012).

6.3.2 *Critical Habitat*

Critical habitat for Lower Columbia River steelhead is located in the mainstem Willamette River in the action area, Johnson Creek, Tryon Creek, Columbia Slough, and Smith and Bybee Lakes. Critical rearing and migration corridor habitat for Upper Willamette steelhead includes the mainstem Willamette River in the action area.

Within the final rule for critical habitat, physical and biological requirements were defined for steelhead based on their natural history and habitat needs. The PCEs for Lower Columbia River steelhead have been identified as essential for their conservation, are listed below:

PCE 1: Freshwater spawning sites with water quantity and quality conditions and substrate supporting spawning, incubation and larval development;

PCE 2: Freshwater rearing sites with:

> (i) Water quantity and floodplain connectivity to form and maintain physical habitat conditions and support juvenile growth and mobility;
>
> (ii) Water quality and forage supporting juvenile development; and
>
> (iii) Natural cover such as shade, submerged and overhanging large wood, log jams and beaver dams, aquatic vegetation, large rocks and boulders, side channels, and undercut banks.

PCE 3: Freshwater migration corridors free of obstruction and excessive predation with water quantity and quality conditions and natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, side channels, and undercut banks supporting juvenile and adult mobility and survival;

PCE 4: Estuarine areas free of obstruction and excessive predation with:

> (i) Water quality, water quantity, and salinity conditions supporting juvenile and adult physiological transitions between fresh- and saltwater;

(ii) Natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, side channels; and

(iii) Juvenile and adult forage, including aquatic invertebrates and fishes, supporting growth and maturation.

PCE 5: Nearshore marine areas free of obstruction and excessive predation with:

(i) Water quality and quantity conditions and forage, including aquatic invertebrates and fishes, supporting growth and maturation; and

(ii) Natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, and side channels.

PCE 6: Offshore marine areas with water quality conditions and forage, including aquatic invertebrates and fishes, supporting growth and maturation.

Status of Critical Habitat in the Action Area Freshwater habitats in the action area contain only a subset of the identified physical or biological features for steelhead: PCEs 1 to 3. The environmental baseline of the action area has been assessed by rating each PCE condition as PFC, IC, or NPF. A summary of each PCE element follows in Table 6-4, along with a justification for the status of each PCE element in the action area. The effects that the project may have on the environmental baseline of each PCE element are analyzed in the following section (7).

Table 6-4. Environmental Baseline Summary of Relevant Steelhead Critical Habitat PCEs in the Action Area

PCE	Function	Description of Existing Conditions	Cause of Degradation from PFC
Freshwater spawning sites	IC	The mainstem Willamette River has been largely impacted by upriver dams and dredging has reduced the amount of braiding and side channels that may have supported spawning; Tryon Creek has partial barriers limiting passage into potential spawning sites.	Mainstem dams, land use, and dredging.
Freshwater rearing sites	IC	The mainstem Willamette River has been largely impacted by upriver dams and dredging has reduced the amount of braiding, side channels and off-channel rearing habitat area.	Mainstem dams, land use, and dredging.
Freshwater migration corridors	IC	Water temperatures and water quality have been altered due to changes in the hydrograph and effects of urbanization and fish passage barriers partially block access on Tryon Creek.	Mainstem dams, contaminants, stormwater, urbanization and land use.

6.4 Southern DPS of North American Green Sturgeon, Threatened

The Southern DPS of North American green sturgeon (*Acipenser medirostris*) was listed as threatened on October 9, 2009 (50CFR223); no critical habitat has been designated for this species (50CFR226). No recovery plan has been drafted for the Southern DPS of North American green sturgeon to date. The DPS includes all coastal U.S. marine waters within 60 fathoms depth from Monterey Bay, California (including Monterey Bay), north to Cape Flattery, Washington, including the Strait of Juan de Fuca, Washington, to its U.S. boundary; the Sacramento River, lower Feather River, and lower Yuba River in California; the Sacramento-San Joaquin Delta and Suisun, San Pablo, and San Francisco bays in California; the Lower Columbia River estuary (upstream to Bonneville Dam); and certain coastal bays and estuaries in California (Humboldt Bay), Oregon (Coos Bay, Winchester Bay, Yaquina Bay, and Nehalem Bay), and Washington (Willapa Bay and Grays Harbor) (NMFS 2006b). Information presented in this discussion came primarily from the Federal Register designating the listing status of the Southern DPS of North American green sturgeon (NMFS 2006b).

Green sturgeon are long-lived, slow-growing fish and the most marine-oriented of the sturgeon species. Mature males range from 4.5 to 6.5 feet (1.4 to 2 m) in fork length and do not mature until they are at least 15 years old, while mature females range from 5 to 7 feet (1.6 to 2.2 m) fork length and do not mature until they are at least 17 years old (VanEenennaam 2002). Maximum ages of adult green sturgeon are likely 60 to 70 years (Moyle 2002). This species is found along the west coast of Mexico, the United States, and Canada (NMFS 2006b).

Green sturgeon are believed to spend the majority of their lives in nearshore oceanic waters, bays, and estuaries. Early life-history stages reside in freshwater, with adults returning to freshwater to spawn when they are more than 15 years old and more than 4 feet (1.3 m) long. Spawning is believed to occur every 2 to 5 years (Moyle 2002). Adults typically migrate into freshwater beginning in late February; spawning occurs from March to July, with peak activity from April to June (Moyle et al. 1995). Females produce 60,000 to 140,000 eggs (Moyle et al. 1992). Juvenile green sturgeon spend 1 to 4 years in fresh and estuarine waters before dispersal to saltwater (Beamesderfer and Webb 2002). They disperse widely in the ocean after their out-migration from freshwater (Moyle et al. 1992).

The only feeding data available on adult green sturgeon has shown them to eat benthic invertebrates including shrimp, mollusks, amphipods, and even small fish (Moyle et al. 1992).

Green sturgeon utilize both freshwater and saltwater habitat (NMFS 2006b). Green sturgeon spawn in deep pools or "holes" in large, turbulent, freshwater river mainstems (Moyle et al. 1992). Specific spawning habitat preferences are unclear, but eggs likely are broadcast over large cobble substrates, with a range of clean sand to bedrock substrates also used (Moyle et al. 1995). It is likely that cold, clean water is important for proper embryonic development. Adults occupy oceanic waters, bays, and estuaries when not spawning. Green sturgeon are known to forage in estuaries and bays ranging from San Francisco Bay to British Columbia (NMFS 2006b).

A principal factor in the decline of the Southern DPS is the reduction of the spawning area to a limited section of the Sacramento River (NMFS 2006b). This remains a threat due to increased risk of extirpation due to catastrophic events. Insufficient freshwater flow rates in spawning areas, contaminants (e.g., pesticides), bycatch of green sturgeon in fisheries, potential poaching (e.g., for caviar), entrainment by water projects, influence of exotic species, small population size, impassable barriers, and elevated water temperatures likely pose a threat to this species (NMFS 2006b). It is not likely that green sturgeon spawn in the action area.

6.4.1 Utilization of the Action Area

Southern DPS green sturgeon occur in Oregon in nearshore marine area, bays, estuaries, and the deep, low elevation, riverine mainstem of coastal rivers. Southern green sturgeon only spawn in the Sacramento River system (NMFS 2013b). There is no evidence that green sturgeon spawning occurs within the Willamette or Columbia Rivers (NMFS 2006b). Green sturgeon mainly use deep waters of the mainstem Columbia, well outside of the shallow water and tributary habitats of the proposed action area. For these reasons, it is highly unlikely that any sturgeon would be present at the project sites or in the action area.

6.4.2 Critical Habitat

Critical habitat for the Southern DPS of North American green sturgeon is not designated in the Lower Willamette River or the Lower Columbia River within the project vicinity. Critical habitat in the Lower Columbia River Estuary extends only up the Columbia River to River Mile 46.

7. EFFECTS OF THE PROPOSED ACTION

7.1 Effects on Species

This project is intended to have long-term beneficial effects on listed species and their critical habitats and help contribute towards the recovery of these species. However, there are also likely to be temporary adverse effects associated with the construction of the project. The effects of the Project have been evaluated on the listed fish species with respect to life stage, as relevant. Beneficial effects are expected for all life stages as a result of each restoration action improving habitat conditions. However, during construction adverse effects to all life stages could occur. These potential adverse effects would be avoided or minimized as restoration actions will not be undertaken at sites occupied by spawning adult fish or where ocupied redds are present and construction will be deferred until the time of year when the fewest fish are present. The in-water work windows for Tryon Creek, the Columbia Slough, and the Mainstem Willamette have been determined by ODFW (2008) and are listed in Table 7-1.

Table 7-1. In-water Work Periods for the Lower Willamette and Tributaries

Waterbody	Work Window
Tryon Creek	July 15 to September 30
Mainstem Willamette	July 1 to October 31
Columbia Slough	June 15 to September 15

Source: ODFW 2008

The types of effects associated with construction of the various habitat features are described generally in the following paragraph, and more specifically for each type of restoration action in the following section.

Construction will have direct physical effects on the environment including vegetation clearing, development of access roads, construction staging areas, and materials storage areas; water diversion and pumping, excavation, fill, and grading; followed by site restoration such as placement of wood, revegetation, placement of topsoil and other substrates and other actions to restore habitats and ecosystem processes. These construction activities can disrupt or reduce the natural vegetative and fluvial processes at a project site, such as the recruitment of large wood, riparian shading, sediment and nutrient deposition, and groundwater recharge (NMFS 2013a). During wet weather, cleared areas can erode and suspend sediments in runoff and also potentially increase the volume and frequency of runoff. This can elevate turbidity in receiving waterbodies and adversely affect spawning gravels and other habitats (i.e. by filling in pools) as well as increasing volumes into streams during runoff events. The erosion of topsoil can reduce the upland fertility. In-water work can also resuspend sediments or generate turbidity that can be transported downstream. Heavy equipment can compact soils and reduce suitability for plant growth and reduce infiltration. The use of heavy equipment also creates a risk of spills of fuels, lubricants and other contaminants. A spill into a waterbody would likely cause short-term lethal toxicity to fish and invertebrates in the vicinity.

However, these effects are likely to be short-term at any one site (few months). Turbidity from in-water excavation and installation of large wood is likely to abate very quickly (few hours). Other effects may persist for longer until riparian and floodplain vegetation is fully reestablished.

7.1.1 Large Wood and Boulder Placement

Installation of LW and boulders would require disruption of the riparian area and excavation of stream beds and banks to allow these materials to be keyed into the substrate, or for installation of anchoring materials including wooden posts and cables.

Beneficial effects from installing LW and boulders would include increased stream habitat complexity, reestablished natural hydraulic processes, increased overhead cover, increased prey and food-web dynamics, and sediment retention. Large wood and boulders in a stream will trap gravel above the structure, creating pools, increasing the connection with the floodplain vegetation. As a result of these benefits, an increase in habitat functions is expected.

Potential adverse effects of this action may include minor damage to riparian soil and vegetation and minor disturbance of streambanks and channel substrate. Potential short term unavoidable construction related effects including harassment or actual mortality through contact with in-water construction equipment or materials may occur. Temporary effects to suitable habitat and water quality are likely to result from in-water work resulting in increased turbidity and suspended sediments and sediment deposition. Effects to species from these actions may include the temporary displacement of individual fish. If the streambed is dewatered during construction, fish passage will be temporarily restricted.

To the degree possible, installation of LW would occur in the dry, and installation of boulders and LW in the active channel would occur during the in-water work window. Additionally, fill placement would occur when creating small habitat islands in Kenton Cove. The island creation would be isolated by silt curtains or coffer dams, and fish would be removed from the area prior to construction. Effects from installing these types of features would be similar to effects from off-channel habitat creation and in-stream channel modifications.

If fish are present in the work area, flowing water will be isolated and fish captured and relocated to an appropriate location in an effort to minimize possible mortality. Juveniles would likely experience increased levels of stress and injury during handling, which could be exacerbated by poor water quality (increased temperatures, low dissolved oxygen saturation), prolonged periods of holding between capture and release, and any debris that may accumulate in the traps. The appropriate conservation measures and handling techniques will be employed to ensure that most of the stress resulting from handling and transport is short-lived and minor.

7.1.2 *Invasive Species Removal and Riparian Revegetation*

Riparian restoration would consist primarily of mechanical removal of invasive species and revegetating with native species by hand and with light machinery. The intent of this action would be to restore native riparian functions.

Beneficial effects of this action would be the reestablishment of native riparian forests and plant communities, increase overhead cover, and provide a long-term source of instream wood, reduce fine sediment supply, increase shade, nutrient input, and moderate microclimate effects.

This work would occur above the ordinary high water mark and in the dry, so adverse effects to listed anadromous species would be limited to noise from construction equipment, temporary increases in input of fine sediment from soils disturbed during construction, and disturbance from human presence in the revegetation area. These effects are expected to be very limited and temporary, and will not contribute to adversely affecting anadromous fish.

7.1.3 In-Stream and Channel Modifications

The intent of this action is to reduce artificially increased channel height and steepness. Increased streambank heights may result in increased bank erosion, disconnection from the floodplain, and may be responsible for a significant portion of sediment loads in streams.

Beneficial effects include improving aquatic and riparian habitat diversity and complexity, reconnect stream channels to floodplains, reduce bed and bank erosion, increase hyporheic exchange, and moderate flow disturbance. Grading banks to gentler slopes is proposed to allow for restored hydrologic connections and create shallow water habitat, reduce erosion, stabilize banks and to allow riparian and aquatic habitats to form more naturally.

Although most of this work would occur in the dry, potential direct construction effects include harassment or direct mortality through contact with construction equipment during in-water work, stress related to fish displacement, handling, or removal, increased suspended sediment and deposition, blocked migration, disrupted or disturbed behavior, and temporary displacement from bank areas that may be dewatered during construction. Potential adverse effects to suitable habitat and critical habitat include temporary loss of riparian vegetation and temporary loss or imbalance of nutrients and food supply.

In-water work associated with channel modifications will occur during the in-water work window, when fish are least likely to be present. Given the low potential for listed salmonids to access the construction areas at this time, and because fish will have ample room either in the Willamette River or Columbia Slough to avoid the construction areas and any associated turbidity plume, these effects are considered to be unlikely to result in mortality.

During construction, biologists will be on-site to observe if any fish are present. If fish are present in the work area, flowing water will be isolated and fish captured and relocated to an appropriate location in an effort to minimize possible mortality. Juveniles would likely experience increased levels of stress and injury during handling, which could be exacerbated by poor water quality (increased temperatures, low dissolved oxygen saturation), prolonged periods of holding between capture and release, and any debris that may accumulate in the traps. The appropriate conservation measures and handling techniques will be employed to ensure that most of the stress resulting from handling and transport is short-lived and minor.

7.1.4 Off-Channel Habitat and Floodplain Reconnection

The intent of creating off-channel habitat and floodplain reconnections is to increase habitat diversity, provide rearing habitat for juvenile salmonids, and refuge habitat for fish during high flows. Off-channel habitat creation and floodplain reconnection would involve excavation of fill to create side channels and backwater habitat, and installation of woody debris and boulder to enhance habitat.

The main beneficial effects of this action would be to provide high water refuge and winter and summer rearing habitat for fish. Additional benefits include increased habitat complexity, long-term nutrient storage and food web production, and increased sediment storage.

This work would occur in the dry, with the exception of final excavation which would occur to allow the river to access the excavated channels and backwater areas. However the amount of excavation and earthwork required could be substantial. Resulting potential adverse effects of the action include a loss of riparian vegetation and temporary loss or imbalance of nutrients and food supply Potential adverse effects resulting from construction actions include harassment or actual mortality through contact with in-water construction equipment or materials. Temporary effects to suitable habitat and water quality are likely to result from in-water work, resulting in increased turbidity and suspended sediments and sediment deposition. Effects to species from these actions may include the temporary displacement of individual fish.

During the final phase of construction when side channels are connected to the main channel, a fish biologist will be present to identify if fish are present in the work area. If fish are observed, flowing water will be isolated and fish captured and relocated to an appropriate location in an effort to minimize possible mortality. Juveniles would likely experience increased levels of stress and injury during handling, which could be exacerbated by poor water quality (increased temperatures, low dissolved oxygen saturation), prolonged periods of holding between capture and release, and any debris that may accumulate in the traps. The appropriate conservation measures and handling techniques will be employed to ensure that most of the stress resulting from handling and transport is short-lived and minor.

7.1.5 Fish Barrier Removal

Replacing the culvert at the Tryon Creek Highway 43 site will include removal of overburden above the culvert; excavation of the culvert; replacement with a new culvert; replacement of the overburden; recontouring of affected stretches of streambed and bank; and revegetation of affected riparian areas. The intent of this action is to restore and improve juvenile and adult fish passage where it has been partially or completely eliminated by past actions.

The main beneficial effect to listed salmonid species from culvert replacement expected over the long-term is increased access to historic spawning grounds in Tryon Creek, restoring the spatial and temporal connectivity of the creek and permitting fish to access upstream areas essential for spawning and rearing. Enhanced access to almost three miles of tributary habitat will significantly increase the amount of such habitat in the Lower Willamette River watershed. In addition, the natural bedload movements will be restored in the lower portion of Tryon Creek.

Potential adverse effects resulting from construction actions include harassment or actual mortality through contact with in-water construction equipment or materials. Temporary effects to suitable habitat and water quality are likely to result from in-water work, resulting in increased turbidity and suspended sediments and sediment deposition. Effects to species from these actions may include the temporary displacement of individual fish. If the streambed is dewatered during construction, fish passage will be temporarily restricted.

In-stream work associated with culvert replacement will occur in the late summer during the in-water work window, which coincides with low flow and highest water temperatures in Tryon Creek. Given the low potential for listed salmonids to access the construction area at this time, and because the construction area is located in close proximity to the Willamette River, it is considered unlikely that construction would force listed salmonids into unsuitable habitats or cause migration delays.

If fish are present in the work area, flowing water will be isolated and fish captured and relocated to an appropriate location in an effort to minimize possible mortality. Juveniles would likely experience increased levels of stress and injury during handling, which could be exacerbated by poor water quality (increased temperatures, low dissolved oxygen saturation), prolonged periods of holding between capture and release, and any debris that may accumulate in the traps. The appropriate conservation measures and handling techniques will be employed to ensure that most of the stress resulting from handling and transport is short-lived and minor.

7.1.6 Wetland Restoration

Wetland restoration is likely to result in effects similar to those of off- and side-channel reconnection, described above.

7.2 Effects of the Action on PCEs of Relevance in the Action Area

The project is likely to have the following effects on the PCEs of relevance in the action area (Table 7-2).

Table 7-2. Summary of the Proposed Condition of the PCEs in the Action Area

PCE	Function	Proposed Condition Description	Explanation
Lower Columbia River Coho, Lower Columbia River and Upper Willamette River Chinook ESU, and Lower Columbia River and Upper Willamette River Steelhead			
1. Freshwater Spawning Sites	Improve IC	In Tryon Creek, fish passage will be improved providing passage into spawning areas; bar and off-channel habitat gravels recruitment will provide additional spawning habitat.	Tributary spawning areas will be opened up by removing fish passage barriers. Gravel recruitment and sorting are likely to occur with the installation of LW.
2. Freshwater Rearing Sites	Improve IC	Rearing habitats will be substantially increased, both in-channel and in off-channel areas. Water temperatures will improve via restoration of a vegetative canopy, but will still remain elevated. The quantity of wood, log jams, and riparian vegetation will increase.	The dams will still control peak flows and release flows with high temperatures in the mainstem; however, the proposed action will restore and connect off-channel and riparian habitats as well as install large wood in-stream and in floodplain areas to provide habitat structure and cover.
3. Freshwater Migration Corridors	Improve IC	The migration corridors will continue to have high water temperatures and water quality issues. However, juveniles will experience a substantial increase in the quantity of available off-channel rearing habitats during outmigration. In Tryon Creek, a passage barrier will be removed and in-stream habitat will have enhanced vegetative cover and pools.	Dams and urbanization have modified the temperature regime and water quality in the mainstem. Riparian areas will be restored in the tributaries and off-channel habitat areas and quantities of large wood will be added to the system. Off-channel habitats will be connected and restored.

PFC - Properly Functioning Condition
IC – Impaired Condition

7.3 Cumulative Effects

Cumulative effects under ESA are defined as “those effects of future state or private activities, not involving Federal activities, that are reasonably certain to occur within the action area of the Federal action subject to consultation” (50 CFR 402.02). As discussed above, significant cumulative effects have already occurred in the northern Willamette River Valley, which have caused or contributed to the decline of the above species. No specific additional projects in the restoration areas are anticipated at this time, although continued industrial, commercial, and residential development will likely occur in the action area as the population of the region grows.

The City of Portland, watershed councils, municipalities, counties, the State of Oregon, and other entities are likely to continue to undertake restoration measures to improve habitats for listed species in the Lower Willamette subbasin. These effects will result in improvements to fish population abundance, productivity, and spatial structure and result in some improvement to the condition of critical habitat PCEs. When considered together, these cumulative effects are likely to have a balancing effect on listed species and their critical habitats.

As the population grows, new residential and industrial growth will likely occur in the urban areas. Concurrently, increased growth will increase the pressure to expand the urban growth boundary, which will result in the expansion of development into rural and semi-rural areas of the subbasin. Increased development of tributary watersheds could increase peak flows and increase water quality issues, further degrading habitat. Water quality will be affected by additional point and non-point (stormwater) water quality impact sources. Although TMDLs have already been developed for the subbasin to address the worst water quality problems and it is likely that there will be improvements in water quality as a result, water quality standards may not ultimately be achieved.

The combined expected development and population growth would likely reduce the availability and quality of habitats for listed species and also contribute to adverse effects on the hydrologic regime and water quality. This would result in the continued degradation of the PCEs of critical habitats, indirectly impacting individuals.

The City of Portland’s River Plan/North Reach includes a compensatory mitigation program to account for protecting the environmental resources of the North Reach of the Willamette River. Development along this reach of the Lower Willamette River will require the mitigation of impacts to habitat so that natural ecosystem functions are not reduced or lost. Overall, this program will at least balance the needs for economic development with the protection of natural resources.

The remediation and clean-up of the Portland Harbor Superfund site will also improve the condition of sediment and water quality in the Lower Willamette River through the removal of contamination sources. The Record of Decision document and related clean-up activities are expected to begin in 2014 after the EPA agrees upon a Proposed Plan. However, clean-up has already begun at some early-action areas that were deemed to possibly become a threat to people or the environment before the long-term cleanup is completed (EPA 2012).

Overall, the project will incrementally restore habitats that are rare in the project area. Parameters that will be incrementally improved as a result of this project include water temperature, off-channel habitat, in-stream habitat, and riparian habitat. This project will not inhibit or preclude future restoration projects that could restore habitats and natural processes to the basin. This project will incrementally contribute to the improved function of adjacent habitats in order to ultimately achieve properly functioning conditions and recover listed species.

7.4 Inter-related and inter-dependent effects

7.4.1 Willamette River Projects Biological Opinion

This project is not intended to help fulfill the requirements of any existing Biological Opinions. However, on an incidental basis, some of the actions described herein are consistent with recommendations for anadromous species recovery as specified in the Willamette River Projects Biological Opinion (NMFS and USFWS 2008). This document spelled out recommendations for restoration of habitat features, including substrate quality, water temperature regulation, and fish passage and migration. Although the project described in this BA will not likely have a significant effect on the quality of substrate or temperature in the Willamette River, it will be consistent with the Willamette BiOp recommendations by increasing opportunities for fish passage into upstream spawning habitat and supporting upstream and downstream migration by providing for increased foraging habitat and refugia from predation and high flows.

7.4.2 Willamette Floodplain Restoration General Investigation

The project proposed in this BA is consistent with restoration actions that are recommended for implementation as part of the Willamette Floodplain Restoration Study (WFRS). The WFRS project would restore floodplain habitat for various fish species, including the Upper Willamette River Chinook salmon, a species that would benefit from the increased foraging habitat and refugia offered by this project.

7.4.3 Portland Harbor Superfund Site

Although consultation has not been implemented for most remediation projects that would be implemented as part of the Portland Harbor CERCLA project, numerous entities responsible for remediation will also need to restore aquatic and riparian habitat to cover Natural Resource Damage Assessment (NRDA) obligations. These projects will occur in the same reach of the Lower Willamette River as the project described in this BA, leading to an overall lift in the quality of habitat in this reach.

7.5 Effects Determination

7.5.1 Lower Columbia River Coho, Threatened

The project *may affect, is likely to adversely affect* Lower Columbia River coho salmon. The project *may affect, but is not likely to adversely affect* Lower Columbia River coho salmon critical habitat. Immediate and temporary effects may occur during construction of the project, although in-water work is to be conducted only during the designated in-water work window. Benefits to the species as a direct result of the project are expected, including improved fish passage; improved spawning, rearing, and refuge habitats; and improved water quality and riparian habitats.

7.5.2 Lower Columbia River and Upper Willamette River Chinook, Threatened

The project *may affect, is likely to adversely affect* Lower Columbia River and Upper Willamette River Chinook salmon. The project *may affect, but is not likely to adversely affect* Lower Columbia River and Upper Willamette River Chinook salmon critical habitat. Immediate and temporary effects may occur during construction of the project, although in-water work is to be conducted only during the designated in-water work window. Benefits to the species as a direct result of the project are expected, including improved fish passage; improved rearing and refuge habitats; and improved water quality and riparian habitats.

7.5.3 Lower Columbia River and Upper Willamette River Steelhead, Threatened

The Project *may affect, is likely to adversely affect* Lower Columbia River and Upper Willamette River steelhead. The project *may affect, but is not likely to adversely affect* Lower Columbia River and Upper Willamette River steelhead critical habitat. Immediate and temporary effects may occur during construction of the project, although in-water work is to be conducted only during the designated in-water work window. Benefits to the species as a direct result of the project are expected, including improved fish passage; improved spawning, rearing, and refuge habitats; and improved water quality and riparian habitats.

7.5.4 Southern DPS of North American Green Sturgeon, Threatened

The Project will have *no effect* on the Southern DPS of North American green sturgeon. Southern DPS green sturgeon occur in Oregon in nearshore marine area, bays, estuaries, and the deep, low elevation, riverine mainstem of coastal rivers. The Southern DPS of green sturgeon only spawn in the Sacramento River system and there is no evidence that green sturgeon spawning occurs within the Willamette or Columbia Rivers (NMFS 2006b, NMFS 2013b). Therefore, the proposed action will have no effect on green sturgeon spawning. Green sturgeon mainly use deep waters of the mainstem Columbia and are not likely to experience the effects of the proposed action, as the actions will be confined primarily to shallow water habitats that are not frequented by southern green sturgeon. Therefore there are no expected effects (beneficial or adverse) on the Southern DPS of North American green sturgeon.

8. CLIMATE CHANGE CONSIDERATIONS

Ongoing climate change will likely affect listed species in the Pacific Northwest. The Independent Scientific Advisory Board (2007) identified potential effects of climate change in the Columbia River Basin. Changes in precipitation and temperatures are likely throughout the basin, which would affect hydrology and habitats for salmonid rearing and migration. In the Willamette Basin, it is likely that there will be an increasing proportion of rainfall versus snowpack, which could lead to less water available for storage in reservoirs and less water available during the summer and fall months when temperatures are high and flows are naturally diminished. Water temperatures are likely to increase during low flow periods due to lesser proportions of snowmelt runoff and lesser quantities of water. More intense rain storms may also occur, which would cause more intense runoff and associated flooding from development and urbanization. The potential increases in water temperatures could cause issues with pre-spawning mortality, egg incubation, and rearing for salmonids. More intense runoff and flooding events could cause scour of redds/eggs and flush juvenile salmonids downstream.

The project may help reduce some of the potential adverse effects of climate change by restoring riparian and floodplain vegetation to provide more shade and thermal refugia. The project will also conserve and restore off-channel connections that will provide refuge and rearing habitats and increase filtration of pollutants, as well as attenuate flows and help recharge groundwater sources.

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9. CONCLUSIONS

Table 9-1 summarizes the effect determinations made for each of the species potentially occurring in the project vicinity.

Table 9-1. Determination of Effects Summary Table

Species	**ESA Status**	**Effect Determination**	**Critical Habitat Determination**
Coho salmon (*Oncorhynchus kisutch*); Lower Columbia River ESU	Threatened	May affect, likely to adversely affect	May affect, not likely to adversely affect
Chinook salmon (*Oncorhynchus tshawytscha*); Lower Columbia River ESU	Threatened	May affect, likely to adversely affect	May affect, not likely to adversely affect
Chinook salmon (*Oncorhynchus tshawytscha*); Upper Willamette River ESU	Threatened	May affect, likely to adversely affect	May affect, not likely to adversely affect
Steelhead (*Oncorhynchus mykiss*); Lower Columbia River DPS	Threatened	May affect, likely to adversely affect	May affect, not likely to adversely affect
Steelhead (*Oncorhynchus mykiss*); Upper Willamette River DPS	Threatened	May affect, likely to adversely affect	May affect, not likely to adversely affect
North American green sturgeon (*Acipenser medirostris*); Southern DPS	Threatened	No effect	N/A

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10. ESSENTIAL FISH HABITAT

10.1 Background

The Sustainable Fisheries Act of 1996 (Public Law 104-297) amended the Magnuson-Stevens Fishery Conservation and Management Act (now called the Magnuson-Stevens Act) to require federal agencies to consult with NOAA Fisheries on activities that may adversely affect EFH. The EFH guidelines (50 CFR §600.05-600.930) outline the process for federal agencies, NOAA Fisheries, and the Fishery Management Councils to satisfy the EFH consultation requirement under Section 305(b(2)-(4)) of the Magnuson-Stevens Act. As part of the EFH consultation process, the guidelines require federal action agencies to prepare a written EFH Assessment describing the effects of that action on EFH (50 CFR §600.920(e)(1)). This document has been prepared to satisfy that requirement.

EFH is defined as "those waters and substrates necessary to fish for spawning, breeding, feeding, or growth to maturity" (16 U.S.C §1802(10). For the purpose of interpreting this definition of EFH: "*waters* include aquatic areas (marine waters, intertidal habitats, and freshwater streams) and their associated physical, chemical, and biological properties that are used by fish and may include aquatic areas historically used by fish where appropriate; *substrate* includes sediment, hard bottom, structures underlying the waters, and associated biological communities; *necessary* means the habitat required to support a sustainable fishery and the managed species' contribution to a healthy ecosystem; and *spawning, breeding, feeding, or growth to maturity* covers a species' full life cycle (50 CFR §600.10); *Adverse effect* is defined as any impact that reduces quality and/or quantity of EFH, and may include direct (*e.g.*, contamination or physical disruption), indirect (*e.g.*, loss of prey or reduction in species fecundity), site-specific or habitat-wide impacts, including individual, cumulative, or synergistic consequences of actions" (50 CFR §600.810). The Magnuson-Stevens Act promotes the protection of these habitats through review, assessment, and mitigation of activities that may adversely affect these habitats.

The EFH mandate applies to all species managed under a Fishery Management Plan (FMP). In Washington, Oregon, and California, there are three FMPs covering groundfish, coastal pelagic species, and Pacific salmon. Federal agencies must consider the impact of a proposed action on all three types of EFH. This project is located in the freshwater Willamette River and its tributaries, therefore only the Pacific salmon EFH is applicable in this assessment.

Pacific salmon EFH for the Pacific Coast Salmon FMP includes all streams, lakes, ponds, wetlands, and other water bodies currently and historically utilized by Pacific salmon within Washington, Oregon, Idaho, and California within the USGS HUC. Excluded from the FMP are some areas upstream of certain impassable man-made barriers (e.g., dams as identified by the Pacific Fishery Management Council in Appendix A of Amendment 14 to the Pacific Coast Salmon Plan), and longstanding, naturally-impassable barriers (e.g., natural waterfalls in existence for several hundred years) (Pacific Fishery Management Council [PFMC] 2000).

Based on the available life history information, freshwater EFH for Pacific salmon consists of four major components: (1) spawning and incubation, (2) juvenile rearing, (3) juvenile migration corridors, and (4) adult migration corridors and adult holding habitat (Roni et al. 1999). Important features of essential habitat for spawning, rearing, and migration include adequate: (1) substrate composition; (2) water quality (dissolved oxygen, nutrients, temperature, etc.); (3) water quantity, depth, and velocity; (4) channel gradient and stability; (5) food availability; (6) cover and habitat complexity (e.g., large woody debris, pools, channel complexity, aquatic vegetation, etc.); (7) space (habitat area); (8) access and passage; and (9) floodplain and habitat complexity. Potential threats to these habitat features and life history components include: (1) direct (hydrologic modifications); (2) indirect (loss of prey or reduction of species diversity); (3) site-specific; or (4) habitat-wide impacts that are chemical, biological, and physical in nature and may result in individual, cumulative, or synergistic consequences (Wilbur and Pentony 1999).

10.2 Identification of EFH in the Project Action Area

The Lower Willamette River is located in the U.S. Geological Survey hydrologic unit (HUC) 17090012 and is designated as EFH for Chinook and coho salmon. Steelhead and the Southern DPS of North American green sturgeon are not managed by the Pacific Fishery Management Council, so EFH is not designated for these species (PFMC 2000). The project area contains essential fish habitat, including potential habitat for spawning, rearing/breeding, feeding, and growth to maturity.

10.3 Potential Adverse Effects of the Project on EFH

The definition of “adverse effect” is “any impact that reduces quality and/or quantity of EFH, including direct (e.g., contamination or physical disruption), indirect (e.g., loss of prey or reduction in species fecundity), site-specific or habitat-wide impacts, including individual, cumulative, or synergistic consequences of actions” (50 CFR §600.810). The significance of small-scale projects lies in the cumulative and synergistic effects resulting from a large number of these activities occurring in a single watershed or at the same time.

Upon project completion, features of fish habitat will be improved or restored including water quality, habitat access, habitat elements, channel dynamics, and watershed conditions. Based on these factors, this project will improve the quality and quantity of spawning, rearing, migration, and holding EFH in the project area.

The effects of the project action have already been discussed in the ESA effects analysis on Chinook and coho salmon and their critical habitats and collectively these would apply to EFH. Construction activities of the project will have temporary and localized impacts on fish habitat. Turbidity may increase during the in-water portion of the work; however, it is likely to be localized and on a small scale. The conservation measures proposed in this BA will avoid and minimize any temporary adverse effects from project construction on EFH; no long term adverse effects to EFH are expected to result from the action.

The proposed action will restore EFH components for juvenile rearing, adult holding, migration, and adult spawning habitat by reconnecting off-channel habitats, installing LW, and removing fish passage barriers.

11. MATRIX OF PATHWAYS AND INDICATORS

Table 11-1 summarizes the likely effects of the project using the matrix of pathways and indicators (NMFS 1996). This matrix assists with evaluating the effects of the Project on anadromous salmonid habitat, lists six major habitat elements (pathways), measurable indicators associated with habitat function, and a comparison of the functional rating for the environmental baseline with the effects of the action.

Table 11-1. Checklist for Documenting Environmental Baseline and Effects of Proposed Action on Relevant Indicators

Pathways	Indicators	Environmental Baseline			Effects of the Action		
		Properly Functioning	At Risk	Not Properly Functioning	Restore	Maintain	Degrade
Water Quality	Temperature			X		X	
	Sediment			X	X		
	Chemical Contamination/ Nutrients			X		X	
Habitat Access	Physical Barriers			X	X		
Habitat Elements	Substrate[3]			X	X		
	Large Woody Debris		X		X		
	Pool Frequency		X		X		
	Pool Quality		X		X		
	Off-channel Habitat			X	X		
	Refugia			X	X		
Channel Condition & Dynamics	Width/Depth Ratio		X			X	
	Streambank Condition		X		X		
	Floodplain Connectivity			X	X		
Flow/ Hydrology:	Peak/Base Flows			X		X	
	Increase in Drainage Network			X		X	
Watershed Conditions	Road Density & Location			X		X	
	Disturbance History			X		X	
	Riparian Reserves			X	X		

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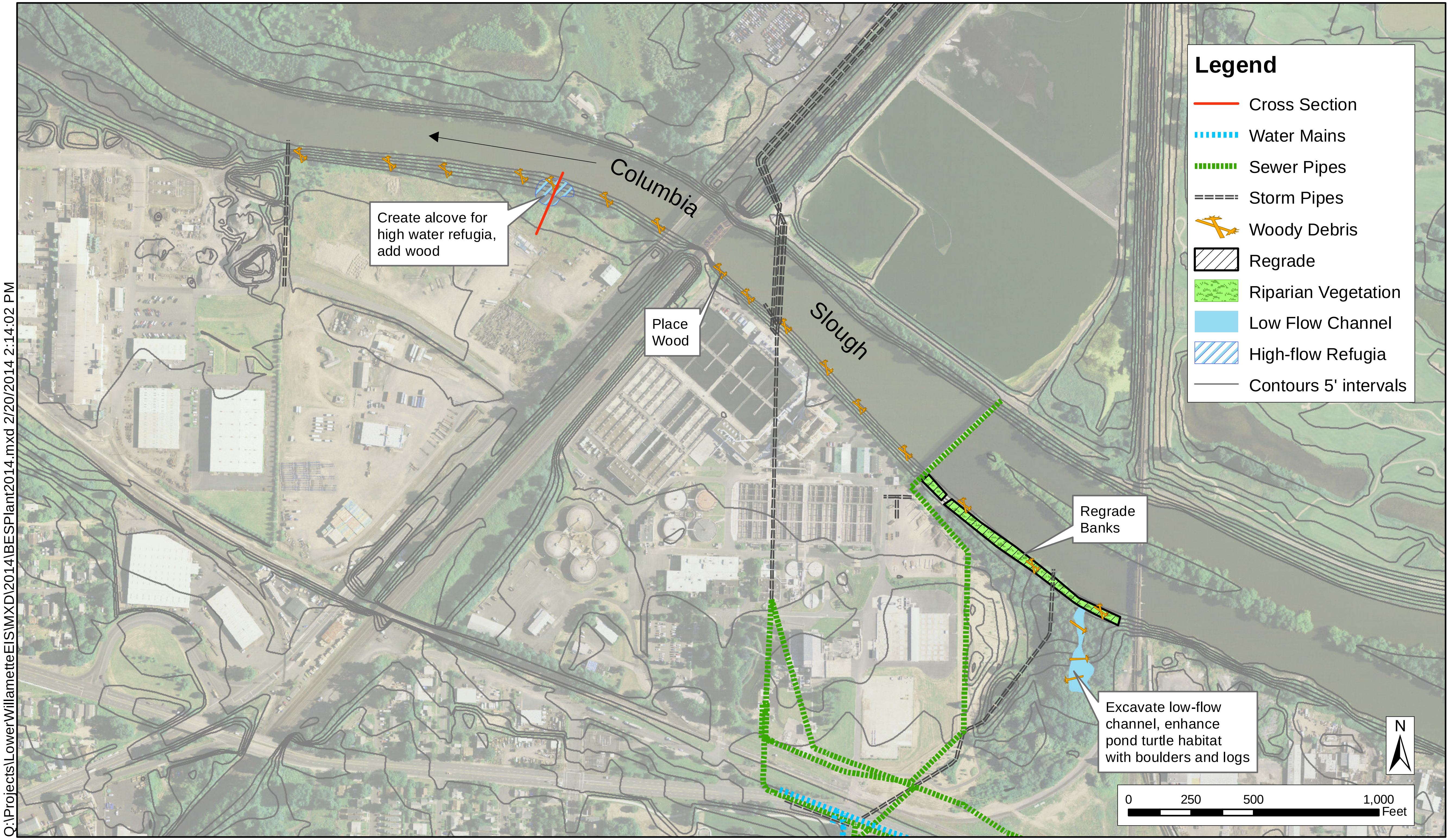
Appendix A – Conceptual Restoration Plans

BES Plant

Lower Willamette Ecosystem Restoration Project

Conceptual Restoration Plan



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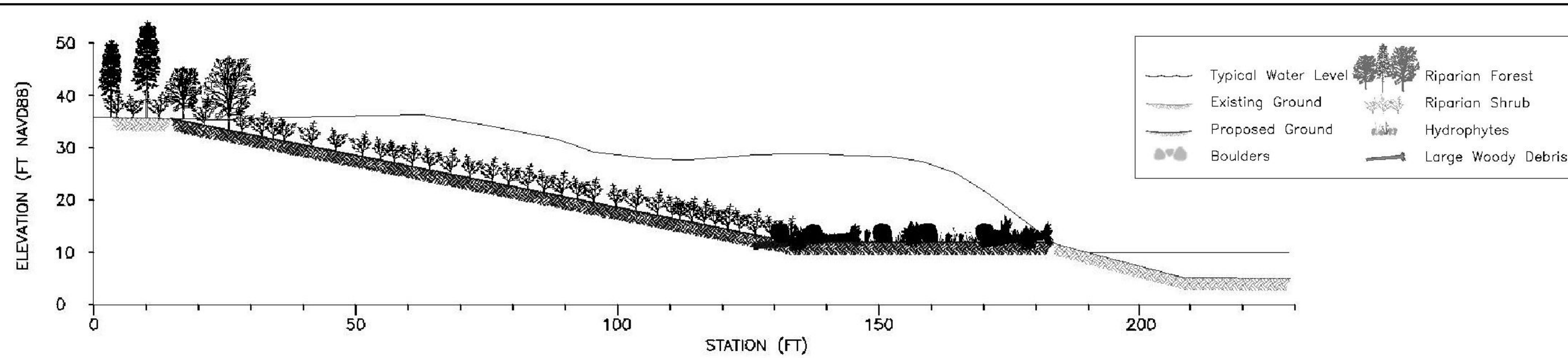

US Army Corps of Engineers®
Portland District
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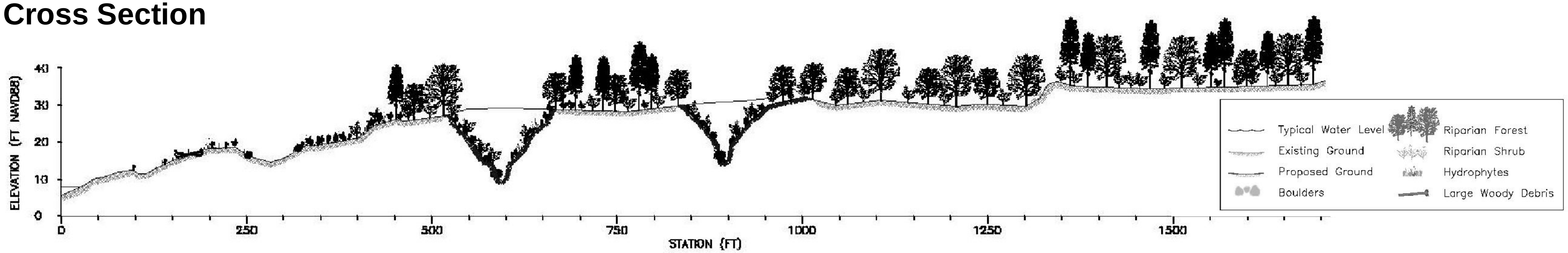
Kelley Point Park

Lower Willamette Ecosystem Restoration Project

Conceptual Restoration Plan

Cross Section



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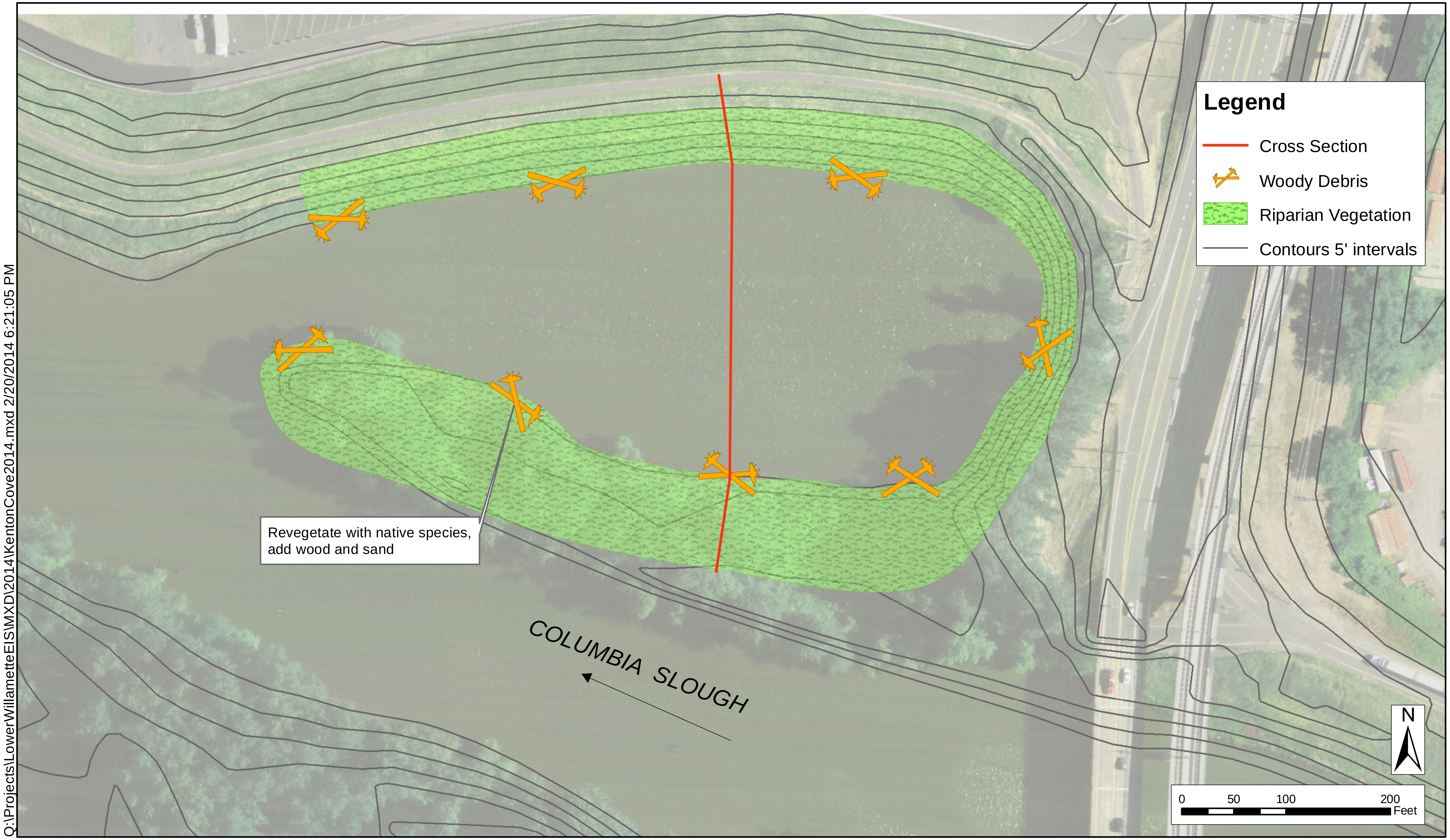
Kenton Cove

Lower Willamette Ecosystem Restoration Project

Conceptual Restoration Plan



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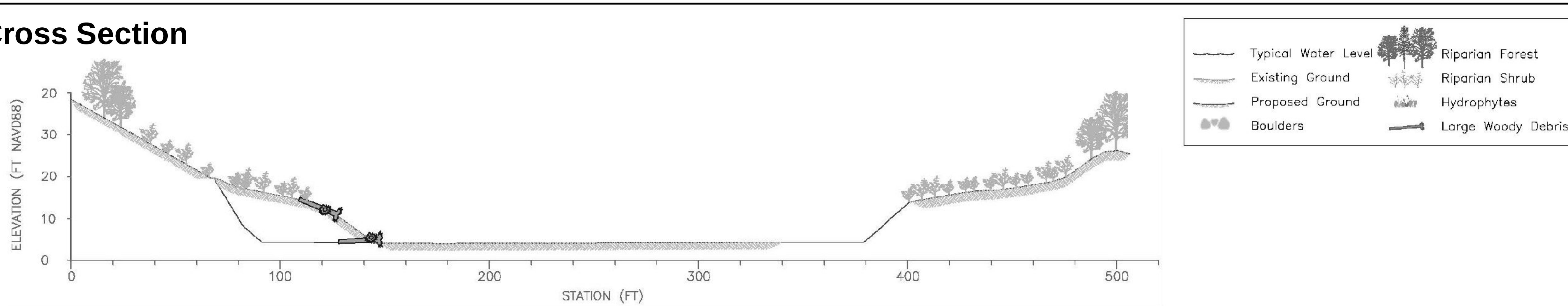

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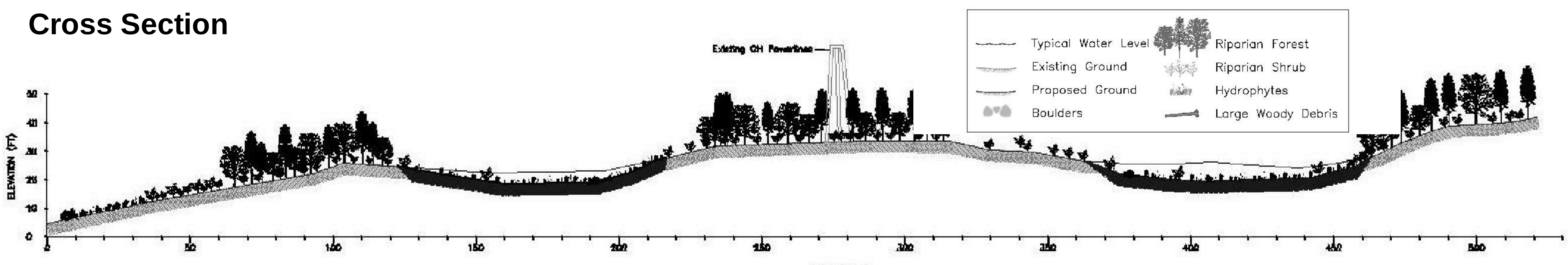
Oaks Crossing/ Sellwood Riverfront Park

Lower Willamette Ecosystem Restoration Project

Conceptual Restoration Plan

Cross Section



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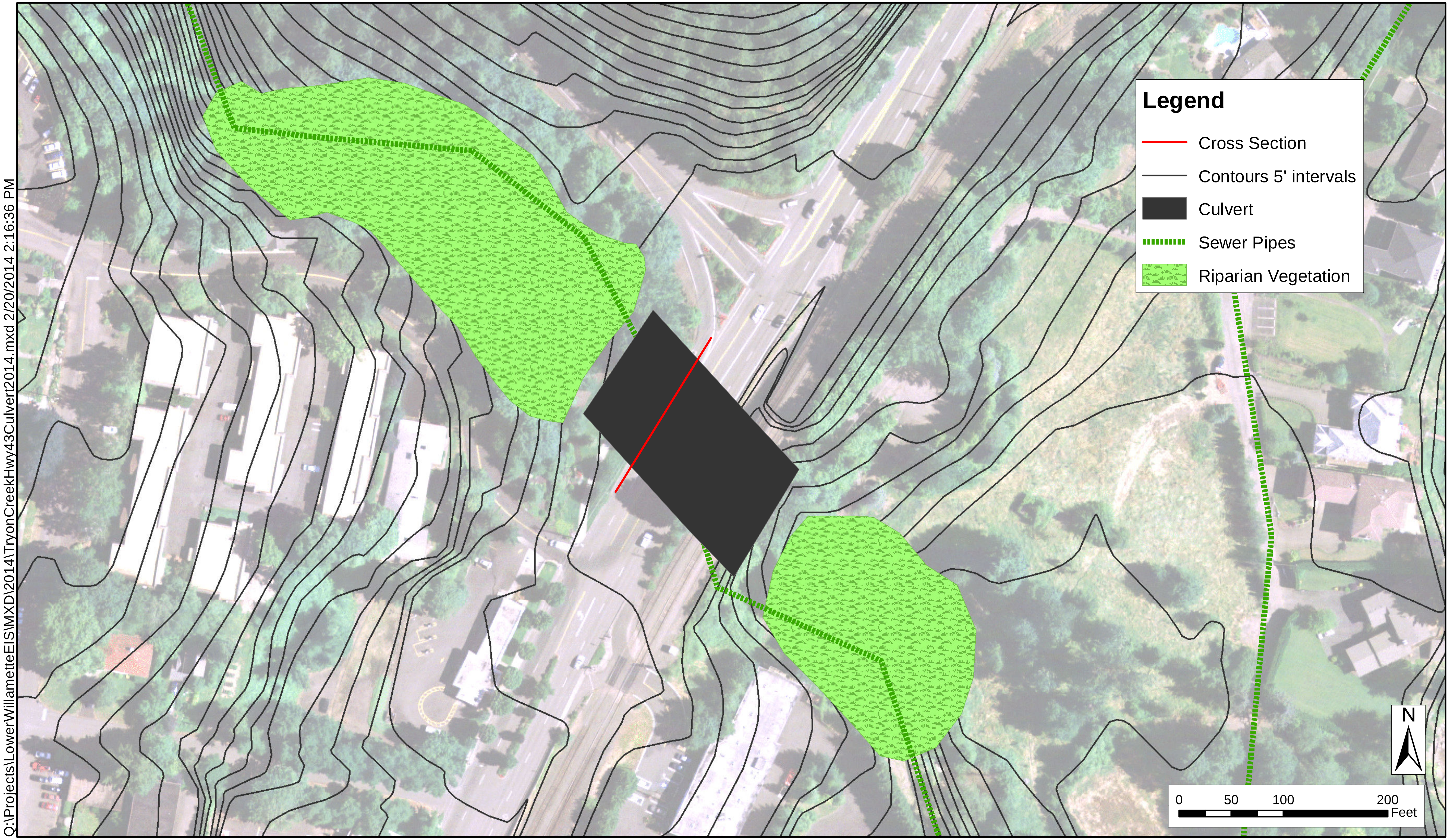
Tryon Creek Highway 43 Culvert

Lower Willamette Ecosystem Restoration Project
Conceptual Restoration Plan



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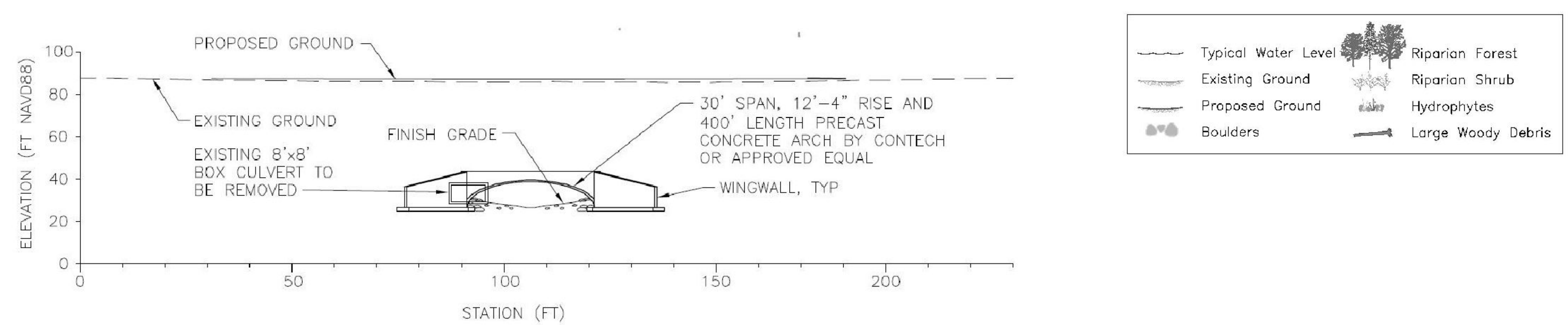

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Appendix B – Biological Opinion and Incidental Take Statement

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
West Coast Region
1201 NE Lloyd Boulevard, Suite 1100
Portland, OR 97232

Refer to NMFS No:
WCR-2014-633

May 23, 2014

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 Biological and Conference Opinion and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Consultation for the Lower Willamette River Ecosystem Restoration General Investigation on the Willamette River, the Columbia Slough, and Tryon Creek (HUC 17090012), Multnomah and Clackamas Counties, Oregon

Dear Ms. Casey:

The enclosed document contains a biological and conference 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 a proposal by the Portland District of the U.S. Army Corps of Engineers to authorize actions under the Lower Willamette River Ecosystem Restoration General Investigation under the authority of House Resolution Docket 2687, adopted June 26, 2002, by the U.S. House of Representatives, Committee on Transportation and Infrastructure, and entitled *Lower Willamette River Watershed, Oregon*. In this opinion, NMFS concludes that the proposed action is not likely to jeopardize the continued existence of Lower Columbia River (LCR) Chinook salmon (*Oncorhynchus tshawytscha*), Upper Willamette River (UWR) Chinook salmon, LCR coho salmon (*O. kisutch*), LCR steelhead (*O. mykiss*), or UWR steelhead or result in the destruction or adverse modification of their designated or proposed (for LCR coho salmon) critical habitats.

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

This document also includes the results of our analysis of the action's likely effects on essential fish habitat (EFH) pursuant to section 305(b) of the Magnuson-Stevens Fishery Conservation and Management Act (MSA), and includes two conservation recommendations to avoid, minimize, or otherwise offset potential adverse effects on EFH. One of these conservation recommendations is identical to 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 Federal action agency must explain why the recommendations will not be followed, including the scientific justification for any disagreements over the effects of the action and the recommendations. In response to increased oversight of overall EFH program effectiveness by the Office of Management and Budget, NMFS established a quarterly reporting requirement to determine how many conservation recommendations are provided as part of each EFH 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.

Please direct questions regarding this opinion to Genevieve Angle in the Willamette Branch of the Oregon/Washington Coastal Area Office, at 503-231-2223.

Sincerely,

Keith Kirkendall

for William W. Stelle, Jr.
Regional Administrator

Endangered Species Act (ESA) Section 7(a)(2) Biological and Conference Opinion and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat (EFH) Consultation

Lower Willamette River Ecosystem Restoration General Investigation
on the Willamette River, the Columbia Slough, and Tryon Creek (HUC 17090012),
Multnomah and Clackamas Counties, Oregon

NMFS Consultation Number: WCR-2014-633

Action Agency: U.S. Army Corps of Engineers

Affected Species and Determinations:

ESA-Listed Species	Status	Is Action Likely to Adversely Affect Species or Critical Habitat?	Is Action Likely To Jeopardize the Species?	Is Action Likely To Destroy or Adversely Modify Critical Habitat?
Lower Columbia River Chinook Salmon (*Oncorhynchus tshawytscha*)	Threatened	Yes	No	No
Upper Willamette River Chinook Salmon (*O. tshawytscha*)	Threatened	Yes	No	No
Lower Columbia River Coho Salmon (*O. kisutch*)	Threatened	Yes	No	No*
Lower Columbia River Steelhead (*O. mykiss*)	Threatened	Yes	No	No
Upper Willamette River Steelhead (*O. mykiss*)	Threatened	Yes	No	No

*Critical habitat is proposed for LCR coho salmon.

Fishery Management Plan That Describes EFH in the Project Area	Does Action Have an Adverse Effect on EFH?	Are EFH Conservation Recommendations Provided?
Pacific Coast Salmon	Yes	Yes

Consultation Conducted By: National Marine Fisheries Service, Northwest Region

Issued By:

for William W. Stelle, Jr.
Regional Administrator

Date: May 23, 2014

TABLE OF CONTENTS

LIST OF ACRONYMS

BA	Biological Assessment
BMP	Best Management Practice
CFR	Code of Federal Regulations
CHART	Critical Habitat Analytical Review Team
DPS	Distinct Population Segment
EFH	Essential Fish Habitat
ESA	Endangered Species Act
ESU	Evolutionarily Significant Unit
FR	Federal Register
HUC	Hydraulic Unit Code
LCR	Lower Columbia River
LW	Large Wood
MSA	Magnuson Stevens Act
NMFS	National Marine Fisheries Service
OHW	Ordinary High Water
PCE	Primary constituent element
RM	River Mile
RPM	Reasonable and prudent measure
TRT	Technical Review Team
U.S.C.	United States Code
UWR	Upper Willamette River
VSP	Viable Salmonid Population
WLC	Willamette-Lower Columbia

1. INTRODUCTION

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

1.1 Background

The National Marine Fisheries Service (NMFS) prepared the 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 on the proposed action, 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 the Data Quality Act (44 U.S.C. 3504(d)(1) *et seq*.) and they underwent pre-dissemination review.

1.2 Consultation History

The NMFS received a letter from the U.S. Army Corps of Engineers (Corps) on April 1, 2014, requesting formal consultation on the effects of authorizing actions under the Lower Willamette River Ecosystem Restoration General Investigation under the authority of House Resolution Docket 2687, adopted June 26, 2002, by the U.S. House of Representatives, Committee on Transportation and Infrastructure, and entitled *Lower Willamette River Watershed, Oregon*. The restoration actions would take place on the east bank of the Lower Willamette River at river mile (RM) 0 and 16.2, in the Columbia Slough at RM 7.5 and 9, and in Tryon Creek at RM 0.5, in Multnomah County and Clackamas County, Oregon. Along with the letter requesting formal consultation, we received a biological assessment for the proposed action, as well as project drawings, maps, and photographs. The City of Portland and the Port of Portland are the local sponsors for the actions covered under this General Investigation, and for the purposes of this opinion, we refer to them as the "applicant." Consultation was initiated on April 1, 2014. This opinion is based on the information provided in the documents described above.

The Corps determined that the proposed action is likely to adversely affect Lower Columbia River (LCR) Chinook salmon (*Oncorhynchus tshawytscha*), Upper Willamette River (UWR) Chinook salmon, LCR coho salmon (*O. kisutch*), LCR steelhead (*O. mykiss*), and UWR steelhead. The Corps also determined that designated or proposed critical habitat for the species listed above and EFH for Chinook and coho salmon may be adversely affected by the proposed action.

A complete record of this consultation is on file in Portland, Oregon.

1.3 Proposed Action

"Action" means all activities or programs of any kind authorized, funded, or carried out, in whole or in part, by Federal agencies. Interrelated actions are those that are part of a larger action and depend on the larger action for their justification. Interdependent actions are those that have no independent utility apart from the action under consideration. No interrelated or interdependent actions were identified for the proposed action.

The Corps proposes to authorize five restoration projects. These projects are located at Kelley Point Park (Willamette RM 0), the Bureau of Environmental Services (BES) Treatment Plant (Columbia Slough RM 7.5), Kenton Cove (Columbia Slough RM 9), Oaks Crossing (Willamette RM 16.2), and the Tryon Creek Highway 43 Culvert (Tryon Creek RM 0.5). A summary of the key restoration elements proposed at each site is provided below.
Different combinations of restoration features are proposed at each site, depending on the problems to be addressed and the opportunities each site offers.

Large Wood and Boulder Placement: Large wood (LW) will be installed by excavating the streambank to allow trunks or stumps to be keyed into the bank for stability. Generally, one or two pieces of LW will be installed at each location. After installation, the substrate around the LW will be recontoured to match previous or desired grade, and revegetated as needed. Boulders will be installed by excavating holes or trenches in the streambed with an excavator or backhoe, installing the boulders according to specifications, and backfilling the surrounding area with appropriate substrate.

Invasive Species Removal and Riparian Revegetation: Native vegetation will be planted in riparian zones to the edge of project boundaries. Invasive species removal is proposed in combination with riparian planting. This will involve the active removal of non-native vegetation, including Himalayan blackberry, reed canary grass, yellow flag iris, holly, and English ivy from the riparian zone and floodplain. Removal will be done by mechanical means (plowing, disking, and mowing), hand removal (cutting), and/or spot applications of herbicides where the risk of contamination is limited. All areas temporarily disturbed during construction will be replanted by hand with native species, and appropriate erosion control including coir mats, straw, or jute netting will be installed to control movement of fine sediment particles into waterways.

In-stream and Channel Modifications: Grading banks to gentler slopes is proposed to allow for restored hydrologic connections and to create shallow water habitat, reduce erosion, stabilize banks and to allow riparian and aquatic habitats to form more naturally. Banks will be graded by use of a land or barge-mounted excavator. Excavated bank angles will vary depending on surrounding land uses and current bank angle. Areas above the ordinary high-water mark will be revegetated with native riparian species, and erosion control features including jute netting or coir mats will be installed. Spoils will be hauled by barge or truck to an appropriate disposal facility. Areas below ordinary high water or below the water surface elevation will generally not be graded as part of this type of measure.

Off-Channel Habitat and Floodplain Reconnection: Off-channel habitat creation and floodplain reconnection will primarily take the form of side channels and swales excavated in riparian areas. Excavation will involve heavy equipment including excavators, scrapers, backhoes, and dump trucks. Excavated areas will coincide with natural swales or other contours that will minimize the amount of materials to be excavated and fit with the landscape to the highest degree possible. Large trees will be avoided as much as possible, and work will occur in the dry except when removing the final amount of fill to allow inflow from the Willamette River or Columbia Slough, which will occur during the in-water work window. The banks of side channels will be contoured to resist erosion and revegetated above the ordinary high water elevation. LW and boulders will be installed as described above to create habitat diversity.

Fish Barrier Removal: Access into spawning areas of Tryon Creek is severely restricted by the culvert located where Tryon Creek passes under Highway 43. This culvert is proposed for replacement. The new culvert will allow access to spawning areas upstream of the culvert.

These restoration measures align with the 18 project categories of aquatic restoration actions covered under the Programmatic Restoration Opinion for Joint Ecosystem Conservation by the Services (PROJECTS) (NMFS No.: NWR-2013-10221). The PROJECTS Biological Opinion is a joint programmatic conference and biological opinion prepared by the National Marine Fisheries Service (NMFS) pursuant to section 7(a)(2) of the Endangered Species Act on the effects of implementing aquatic restoration actions proposed to be funded or carried out by the U.S. Fish and Wildlife Service (USFWS) and the NOAA Restoration Center in the States of Oregon, Washington and Idaho. The PROJECTS approved actions that are applicable to the proposed projects are described below, along with the design criteria that are provided for each action. The Corps proposes to adhere to these design criteria for the proposed restoration actions discussed above. This allows us to conduct an expedited review of these actions because we have already carried out a detailed analysis of these types of actions with the proposed design criteria.

1) Fish Passage Restoration: This type of action includes total removal, replacement, or resetting of culverts or bridges; stabilizing headcuts and other channel instabilities; removing, relocating, constructing, repairing, or maintaining fish ladders; and replacing, relocating, or constructing fish screens and irrigation diversions. The following design criteria pertain only to the Tryon Creek Highway 43 culvert replacement project:

a. Stream simulation culvert and bridge projects. All road-stream crossing structures shall adhere to the most recent version of NMFS fish passage criteria, which are as follows:

- Bed width will be greater than bankfull channel width, and of sufficient vertical clearance to allow ease of maintenance activities.
- Vertical clearance between the culvert bed and ceiling will be more than 6 feet to allow for debris removal.
- Slope will be equal to the slope of, and at elevations continuous with, the surrounding long-channel streambed profile. Culvert will be open-bottomed so footings will be keyed into the underlying bedrock.
- Culvert will be more than 150 feet, but a bridge is not possible at this location due to cost and transportation disruptions.
- Fill materials will match native substrate.

- Average water depth and velocities will simulate those in the surrounding stream channel.

The proposed road-stream crossing structures shall simulate stream channel conditions per industry design standards found in any one of the following:

i. *Stream Simulation: An Ecological Approach to Providing Passage for Aquatic Organisms at Road-Stream Crossings* (USDA-Forest Service 2008).

ii. Part XII Fish Passage Design and Implementation, Salmonid Stream Habitat Restoration Manual (California Department of Fish and Game 2009) or the most recent version.

iii. Water Crossings Design Guidelines (Barnard *et al.* 2013) or the most recent version.

b. General road-stream crossing criteria

i. Span

1. Span is determined by the crossing width at the proposed streambed grade.
2. Single span structures will maintain a clear, unobstructed opening above the general scour elevation that is at least as wide as 1.5 times the active channel width.
3. Multi-span structures will maintain clear, unobstructed openings above the general scour elevation (except for piers or interior bents) that are at least as wide as 2.2 times the active channel width.
4. Entrenched streams: If a stream is entrenched (entrenchment ratio of less than 1.4), the crossing width will accommodate the floodprone width. Floodprone width is the channel width measured at twice the maximum bankfull depth (Rosgen 1996).
5. Minimum structure span is 6ft.

ii. Scour Prism

1. Designs shall maintain the general scour prism as a clear, unobstructed opening (i.e., free of any fill, embankment, scour countermeasure, or structural material to include abutments, footings, and culvert inverts). No scour or stream stability countermeasure may be applied above the general scour elevation.

iii. Embedment

1. All culvert footings and inverts shall be placed below the thalweg at a depth of 3 feet, or the Lower Vertical Adjustment Potential (LVAP) line, whichever is deeper.
   a. LVAP, as calculated in Stream Simulation: An ecological approach to providing passage for aquatic organisms at road crossings (USDA-Forest Service 2008).
2. In addition to embedment depth, embedment of closed bottom culverts shall be between 30% and 50% of the culvert rise.

iv. NMFS fish passage review and approval. NMFS will review crossing structure designs if the span width is determined to be less than the criteria established above or if the design is inconsistent with criteria in *Anadromous Salmonid Passage Facility Design* (NMFS 2011c).

2) Large wood (LW), Boulder, and Gravel Placement: This type of action includes LW and boulder placement, and porous boulder step structures. The following design criteria pertain to all five proposed projects:

a. Large wood and boulder projects

i. Place LW and boulders in areas where they would naturally occur and in a manner that closely mimics natural accumulations for that particular stream type. For example, boulder placement may not be appropriate in low-gradient meadow streams.

ii. Structure types shall simulate disturbance events to the greatest degree possible and include, but are not limited to, log jams, debris flows, wind-throw, and tree breakage.

iii. No limits are to be placed on the size or shape of structures as long as such structures are within the range of natural variability of a given location and do not block fish passage.

iv. Projects can include grade control and streambank stabilization structures, while size and configuration of such structures will be commensurate with scale of project site and hydraulic forces.

v. The partial burial of LW and boulders is permitted and may constitute the dominant means of placement. This applies to all stream systems but more so for larger stream systems where use of adjacent riparian trees or channel features is not feasible or does not provide the full stability desired.

vi. LW includes whole conifer and hardwood trees, logs, and rootwads. LW size (diameter and length) should account for bankfull width and stream discharge rates. When available, trees with rootwads should be a minimum of 1.5 x bankfull channel width, while logs without rootwads should be a minimum of 2.0 x bankfull widths.

vii. Structures may partially or completely span stream channels or be positioned along stream banks.

viii. Stabilizing or key pieces of LW will be intact, hard, with little decay, and if possible have root wads (untrimmed) to provide functional refugia habitat for fish. Consider orienting key pieces such that the hydraulic forces upon the LW increase stability.

ix. Anchoring LW — 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 or rock) to increase the mass of the structure to resist movement
4. Use of large boulders as anchor points for the LW
5. Pin LW with rebar to large rock to increase its weight. For streams that are entrenched (Rosgen F, G, A, and potentially B) or for other streams with very low width to depth ratios (less than 12) an additional 60% ballast weight may be necessary due to greater flow depths and higher velocities.
6. Anchoring LW by cable is not allowed under this opinion.

b. Porous boulder step structures and vanes (Tryon Creek Highway 43 site only)

i. Full channel spanning boulder structures are to be installed only in highly uniform, incised, bedrock-dominated channels to enhance or provide fish habitat in stream reaches where log placements are not practicable due to channel conditions (not feasible to place logs of sufficient length, bedrock dominated channels, deeply incised channels, artificially constrained reaches, etc.), where damage to infrastructure on public or private lands is of concern, or where private landowners will not allow log placements due to concerns about damage to their streambanks or property.

ii. Install boulder structures low in relation to channel dimensions so that they are completely overtopped during channel-forming flow events (approximately a 1.0 to 1.5-year flow event).

iii. Boulder step structures are to be placed diagonally across the channel or in more traditional upstream pointing "V" or "U" configurations with the apex oriented upstream.

iv. Boulder step structures are to be constructed to allow upstream and downstream passage of all native fish species and life stages that occur in the stream. Plunges shall be kept less than 6 inches in height.

v. The use of gabions, cable, or other means to prevent the movement of individual boulders in a boulder step structure is not allowed.

vi. Rock for boulder step structures shall be durable and of suitable quality to assure long-term stability in the climate in which it is to be used. Rock sizing depends on the size of the stream, maximum depth of flow, planform, entrenchment, and ice and debris loading.

vii. The project designer or an inspector experienced in these structures should be present during installation.

viii. Full spanning boulder step structure placement should be coupled with measures to improve habitat complexity and protection of riparian areas to provide long-term inputs of LW.

3) Off- and Side-Channel Habitat Restoration: These actions will be implemented to reconnect historic side channels with floodplains by removing off-channel fill and plugs. Furthermore, new side-channels and alcoves can be constructed in geomorphic settings that will accommodate such features. The following design criteria pertain to all sites except for the Tryon Creek Highway 43 Culvert site.

a. **Data requirements.** Data requirements and analysis for off- and side-channel habitat restoration include evidence of historical channel location, such as land use surveys, historical photographs, topographic maps, remote sensing information, or personal observation.

b. **Allowable excavation.** Off- and side-channel improvements can include minor excavation (less than or equal to 10% of volume) of naturally accumulated sediment within historical channels, *i.e.*, based on the OHW level as the elevation datum. The calculation of the 10% excavation volume does not include manually placed fill, such as dikes, berms, or earthen plugs. There is no limit as to the amount of excavation of anthropogenic fill within historical side channels as long as such channels can be clearly identified through field or aerial photographs. Excavation depth will not exceed the maximum thalweg depth in the main channel. 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.

4) Streambank Restoration: This type of action includes alluvium placement, LW placement, roughened toe, woody plantings, herbaceous cover in areas where the native vegetation does not include trees or shrubs, bank reshaping and slope grading, coir logs, deformable soil reinforcement, engineered log jams (ELJs), floodplain flow spreaders, and floodplain roughness. The following design criteria pertain to all five proposed projects.

- Structure shall simulate disturbance events to the greatest degree possible and include, but not be limited to, log jams, debris flows, wind-throw, and tree breakage.
- Structures may partially or completely span stream channels or be positioned along stream banks.
- Where structures partially or completely span the stream channel LW should be comprised of whole conifer and hardwood trees, logs, and rootwads. LW size (diameter and length) should account for bankfull width and stream discharge rates.
- Structures will incorporate a diverse size (diameter and length) distribution of rootwad or non-rootwad, trimmed or untrimmed, whole trees, logs, snags, slash, *etc.*
- For individual logs that are completely exposed, or embedded less than half their length, logs with rootwads should be a minimum of 1.5 times bankfull channel width, while logs without rootwads should be a minimum of 2.0 times bankfull width.
- Consider orienting key pieces such that the hydraulic forces upon the LW increase stability.
- If LW mechanical anchoring is required, a variety of methods may be used. These include large angular rock, buttressing the wood between adjacent trees, or the use of manila, sisal or other biodegradable ropes for lashing connections. If hydraulic conditions warrant use of structural connections, rebar pinning or bolted connections may be used. Use of cable is not covered by this opinion.
- When a hole in the channel bed caused by local scour will be filled with rock to prevent damage to a culvert, road, or bridge foundation, the amount of rock will be limited to the minimum necessary to protect the integrity of the structure.
- When a footing, facing, head wall, or other protection will be constructed with rock to prevent scouring or down-cutting of, or fill slope erosion or failure at, an existing culvert or bridge, the amount of rock used will be limited to the minimum necessary to protect the integrity of the structure. Whenever feasible, include soil and woody vegetation as a covering and throughout the structure.
- Use a diverse assemblage of vegetation species native to the action area or region, including trees, shrubs, and herbaceous species. Vegetation, such as willow, sedge and rush mats, may be gathered from abandoned floodplains, stream channels, *etc.*
- Do not apply surface fertilizer within 50 feet of any stream channel.
- Install fencing as necessary to prevent access to revegetated sites by livestock or unauthorized persons.
- Conduct post-construction monitoring and treatment or removal of invasive plants until native plant species are well established.

5) Wetland Restoration: This type of action restores degraded wetlands by (a) excavation and removal of fill materials; (b) contouring to reestablish more natural topography; (c) setting back existing dikes, berms, and levees; (d) reconnecting or recreating historical tidal and fluvial channels; (e) planting native wetland species; or (f) a combination of the above methods. The following design criteria pertain only to the Oaks Crossing project:

a. **Include applicable General Construction Measures** for specific types of actions as applicable (e.g., Off- and Side-Channel Habitat Restoration, above) to ensure that all adverse effects to fish and their designated critical habitats are within the range of effects considered in the PROJECTS BiOp.

The section below provides details on specific actions that would occur at each restoration site. In all cases, heavy equipment such as excavators and haul trucks would be used during construction; all in-water work will be confined to the designated work window; and in-water work areas will be isolated with coffer dams so that construction will be performed “in the dry” to reduce turbidity and adverse effects to fish and wildlife.

Kelley Point Park (Restoration Action Types: Large wood (LW), Boulder, and Gravel Placement; Off- and Side-Channel Habitat Restoration; Streambank Restoration). The proposed actions at this 16-acre site will be to excavate two off-channel backwater areas totaling approximately 5,000 feet in length and 10 feet wide to an elevation approximately 6 inches below the normal winter flow water surface elevation; remove invasive plants and revegetate with native riparian species over approximately 11 acres; regrade steep banks for floodplain enhancement along 5,000 linear feet of the Willamette River and Columbia Slough, and place LW as needed to enhance habitat complexity. Trails throughout the park will be adjusted to allow for restoration as needed, and up to three crossing structures will be installed. To reduce the amount of fill to be removed, rather than excavating large areas of floodplain, meandering channels will be cut along existing swales to allow for off-channel refugia. An estimated 197,000 cubic yards (cy) of material will be excavated and hauled off-site either by barge or truck.

BES Plant (Restoration Action Types: Large wood (LW), Boulder, and Gravel Placement; Off- and Side-Channel Habitat Restoration; Streambank Restoration). The intent of this project is to excavate a connection to a floodplain backwater/swale area to allow more frequent inundation and enhance the riparian zone along Columbia Slough. Habitat quality is moderate to good, but opportunities to improve and expand riparian wetland and backwater habitats exist in several parts of the project site. Off-channel rearing and high-water refugia will be enhanced by excavating a connection from Columbia Slough to the low swale at the southeast end of the site and by excavating an alcove at the base of the slope near the northwest end of the site. Steepened banks will be laid back along approximately 400 linear feet of the Columbia Slough by excavating and hauling approximately 13,000 cy of soil; LW will be added along the banks to increase habitat complexity; several large boulders will be placed in the backwater area for reptile and amphibian habitat; and invasive species removal and riparian revegetation will occur on approximately 0.7 acres.

Kenton Cove (Restoration Action Types: LW, Boulder, and Gravel Placement; Streambank Restoration). Most of this 3.2 acre site is surrounded by a highly maintained levee, with a natural riparian floodplain zone along the Columbia Slough. The dominant species include black cottonwood, Himalayan blackberry, and reed canarygrass. The intent of this project is to enhance this backwater cove with LW, remove invasive species, and revegetate with native trees and shrubs. Because the edges of the cove are very uniform and offer very little habitat complexity, small habitat islands with clean fill and woody debris will be created, with the wood as the centerpiece of the habitat island. An estimated 1600 cy of gravel and topsoil will be imported and hauled by truck for the creation of the habitat islands. LW will be installed as appropriate and invasive species removal and revegetation with native species will occur over approximately 3.2 acres.

Oaks Crossing/Sellwood Riverfront Park (Restoration Action Types: LW, Boulder, and Gravel Placement; Off- and Side-Channel Habitat Restoration; Wetland Restoration). The intent of this project is to restore salmonid habitat in the floodplain of this 7.2 acre site by connecting off-channel habitat to the river, adding LW, removing invasive species, and revegetating with native wetland and riparian species. Habitat at this site consists of gallery forest lined with native and invasive species. Shallow water habitat will be enhanced by addition of LW as needed. To create approximately 1,200 linear feet of side channels and backwater habitat, an estimated 9,000 cy of material will be excavated and hauled either by barge or truck. The bottom elevations of the side channels will correspond to an elevation approximately 6 inches below the water surface elevation under normal winter flows. Invasive species will be removed and wetland or riparian vegetation will be planted over approximately 7.2 acres.

Highway 43 Tryon Creek Culvert (Restoration Action Type: Fish Passage Restoration). The intent of this project is to replace the culvert under Highway 43 and the Portland and Northern rail line with a fish passable culvert. The new open-bottom arch culvert will simulate the natural stream dimensions, allowing for sediment and debris to pass through and provide fish unhindered passage beneath the roadway and railroad line. Implementation of this project will allow unhindered fish passage into the Tryon Creek State Natural Area, where fish habitat has been restored recently. Replacing this culvert will require excavation of up to 21,000 cy of overburden from above the culvert; demolition and removal of the entire 400 foot culvert; removal of approximately 1,200 cy of bedrock; installation of a 28-foot wide, open bottom arch culvert; installation of headwalls and wingwalls at both ends of the culvert; installation of rock weirs in the streambed for velocity control; backfill with 17,800 cy of overburden; and riparian revegetation over approximately 2.5 acres. Temporary dewatering may be needed during some of the work in the streambed. All work in the streambed and bank areas will occur during the in-water work window.

This culvert has been designed to be consistent with design criteria from the PROJECTS BiOp (NMFS 2013a) and recommendations in *Anadromous Salmonid Passage Facility Design* (NMFS 2008).

The applicant has proposed the following conservation measures to minimize the effects of the proposed action:

- **Site Contamination Assessment:** An assessment of available records has been conducted for the project sites to ensure that the proposed project will not release contaminants to aquatic habitat. This assessment, which included a search of relevant databases and a field reconnaissance survey, concluded that there are no hazardous, toxic or radioactive waste sites within ¼ mile of any of the proposed restoration sites.
- **Site Layout and Flagging Sensitive Areas:** Before construction begins, flagging of entry and exit points, staging areas, and sensitive resources will occur in order to avoid disturbance during construction.

- **Staging, Storage and Stockpile Areas:** Staging areas and storage areas will be designated to store materials, fuel, and equipment. Equipment will be staged at least 150 feet from any natural water body or wetland when possible to avoid contamination or sedimentation of water bodies. However since the project sites may occur in confined areas, this may not be feasible. If the staging area(s) will be located within 150 feet of the river or the wetlands, they will be fenced and fully contained to prevent the runoff of sediment or pollutant laden stormwater into the river or wetlands.
- **Erosion Controls:** Site planning and site erosion control measures will be installed prior to construction to prevent erosion and sediment discharge. Temporary erosion control measures including fiber wattles, site fences, jute matting, wood fiber mulch, or geotextiles will be installed, as appropriate, before any significant alteration of the site occurs. Additional sediment barriers will be stored on site if needed.
- **Hazardous Material Spill Prevention Control:** An erosion and pollution control plan will be prepared for each individual project site and carried out, commensurate with the scope of the action that includes the following information: (a) the name, phone number, and address of the person responsible for accomplishing the plan; (b) best management practices to confine vegetation and soil disturbance to the minimum area, and minimum length of time, as necessary to complete the action, and otherwise prevent or minimize erosion associated with the action; (c) best management practices to confine, remove, and dispose of construction waste, including debris, discharge water, concrete, cement, grout, washout facility, petroleum product, or other hazardous materials generated, used, or stored on-site; (d) procedures to contain and control a spill of any hazardous material generated, used or stored on-site, including notification of proper authorities; and (e) steps to cease work under high flows, except for efforts to avoid or minimize resource damage.
- **Equipment, Vehicles, and Power Tools:** Equipment will be selected to minimize adverse effects on the environment. Vehicles and equipment will be inspected daily for fluid leaks before leaving the staging area when operating within 50 feet of any stream, waterbody, or wetland and the equipment will be steam cleaned before operation below the ordinary high water or as necessary to remain grease free and prevent invasive species contamination. Biodegradable lubricants and fuels will be used as available.
- **Temporary Access Roads:** Temporary access roads will not be built on steep slopes, where grade, soil, or other features suggest a likelihood of excessive erosion or failure. For the most part, existing access roads are present, and only limited additional grading or placement of gravel/rock for access will be required to facilitate construction.
- **Dust Abatement:** Dust abatement measures will be commensurate with soil type, equipment use, wind conditions, and the effects of other erosion control measures; work will be sequenced to reduce the exposure of bare soil to wind erosion; spill containment supplies will be maintained on site; petroleum-based products will not be used for dust abatement.
- **Temporary Stream Crossings:** No stream crossings will occur at active spawning sites, when adult listed fish are present or holding, or when eggs or alevins are in the gravel; temporary crossings will not be placed in areas that may increase the risk of channel re-routing or avulsion, or in potential spawning habitat, *e.g.*, pools and pool tailouts. The number of temporary stream crossings will be minimized, and existing stream crossings will be used whenever reasonable; temporary bridges and culverts will be installed to

allow for equipment and vehicle crossing over perennial streams during construction. Whenever possible, vehicles and machinery will cross streams at right angles to the main channel or equipment and vehicles will 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. All temporary stream crossings will be obliterated as soon as they are no longer needed, and any damage to affected stream banks or channel will be fully restored following project implementation.

- **Surface Water Withdrawal and Construction Discharge Water:** Surface water will only be diverted to meet construction needs if developed sources are unavailable or inadequate. Diversions will not exceed 10% of the available flow and will have a juvenile fish exclusion device that is consistent with NMFS's criteria. Screens will be installed, operated, and maintained to meet NMFS fish screen criteria. All construction discharge water will be treated 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.

- **Fish Passage**: Fish passage will be provided for adult or juvenile fish present in the action area during construction, or fish will be salvaged and removed if waters are diverted. All reconnection channels and passageways will meet NMFS fish passage criteria.
- **In-water Work Period:** All work below the ordinary high water line will occur during the designated ODFW in-water work periods for the Lower Willamette River and tributaries, as appropriate (Tryon Creek- July 15 to September 30, Mainstem Willamette- July 1 to October 31, Columbia Slough- June 15 to September 15).
- **Fisheries, Hydrology, Geomorphology, Wildlife, Botany, and Cultural Surveys in Support of Aquatic Restoration:** A monitoring and adaptive management plan to track the success of the restoration features will be developed.
- **Work Area Isolation:** Any work within the wetted channel will be isolated from the Lower Willamette River and its tributaries by installation of coffer dams and other measures, as appropriate. A work area isolation and fish salvage plan will be prepared for each site for approval by ODFW and NMFS and carried out with a scientific collection permit. Fish and wildlife will be salvaged and removed from the work area. Any pumps used outside of isolated areas will be screened per ODFW requirements. Any groundwater present in the excavation area will be pumped and treated via infiltration or other methods (such as Baker tanks or silt bags) prior to discharge back to either the river or wetlands.
- **Fish Capture and Release:** Any fish that may be trapped within the isolated work area will be captured using a trap, seine, electrofishing, or other methods as prudent to minimize the risk of injury, then released at a safe release site. A scientific collection permit will be obtained to conduct this work, with approval of the fish salvage plan from NMFS and ODFW. Capture and release will be supervised by a fishery biologist experienced with work area isolation and competent to ensure the safe handling of fish. If

electrofishing is used, the NMFS electrofishing guidelines will be followed (NMFS 2000).

- **Invasive and non-native plant control**: Invasive and non-native plant control will use manual, mechanical, or hydro-mechanical methods as a priority. Herbicide use will be used secondarily and will follow all NMFS approved herbicide label instructions and application will occur or be supervised by a licensed applicator.
- **Site Restoration**: Any temporary access routes constructed will be removed in their entirety and the locations will be restored via mulching and hydroseeding and then planting of native shrub and tree species. Any fill placed in wetlands for temporary construction purposes will be removed and the area will be fully restored. Any large wood, native vegetation, topsoil and native channel material displaced by construction will be stockpiled for reuse on-site during restoration, as feasible. When construction is complete, all disturbed areas will be restored as necessary to renew ecosystem processes. Fencing will be installed as necessary to prevent damage to newly revegetated sites by unauthorized persons.
- **Planting or Installing Vegetation:** Disturbed areas will be planted and seeded before or at the beginning of the first growing season after construction. A diverse mix of native species adapted to the site conditions will be used for all revegetation efforts. Non-native or invasive species will not be included. Existing non-native or invasive species will be controlled as feasible on the site to promote native vegetation growth and dominance.

NMFS relied on the foregoing description of the proposed action, including all features identified to reduce adverse effects, to complete this consultation. To ensure that this opinion remains valid, NMFS requests that the action agency or applicant keep NMFS informed of any changes to the proposed action.

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 action area is the east bank of the Willamette River at RM 0 and 16.2, the Columbia Slough at RM 7.5 and 9, and Tryon Creek at RM 0.5 (Figure 1). The action area also includes the area 500 feet upstream and downstream of these locations where the impacts from construction of the restoration projects (such as suspended sediment and turbidity) could affect ESA-listed salmonids.

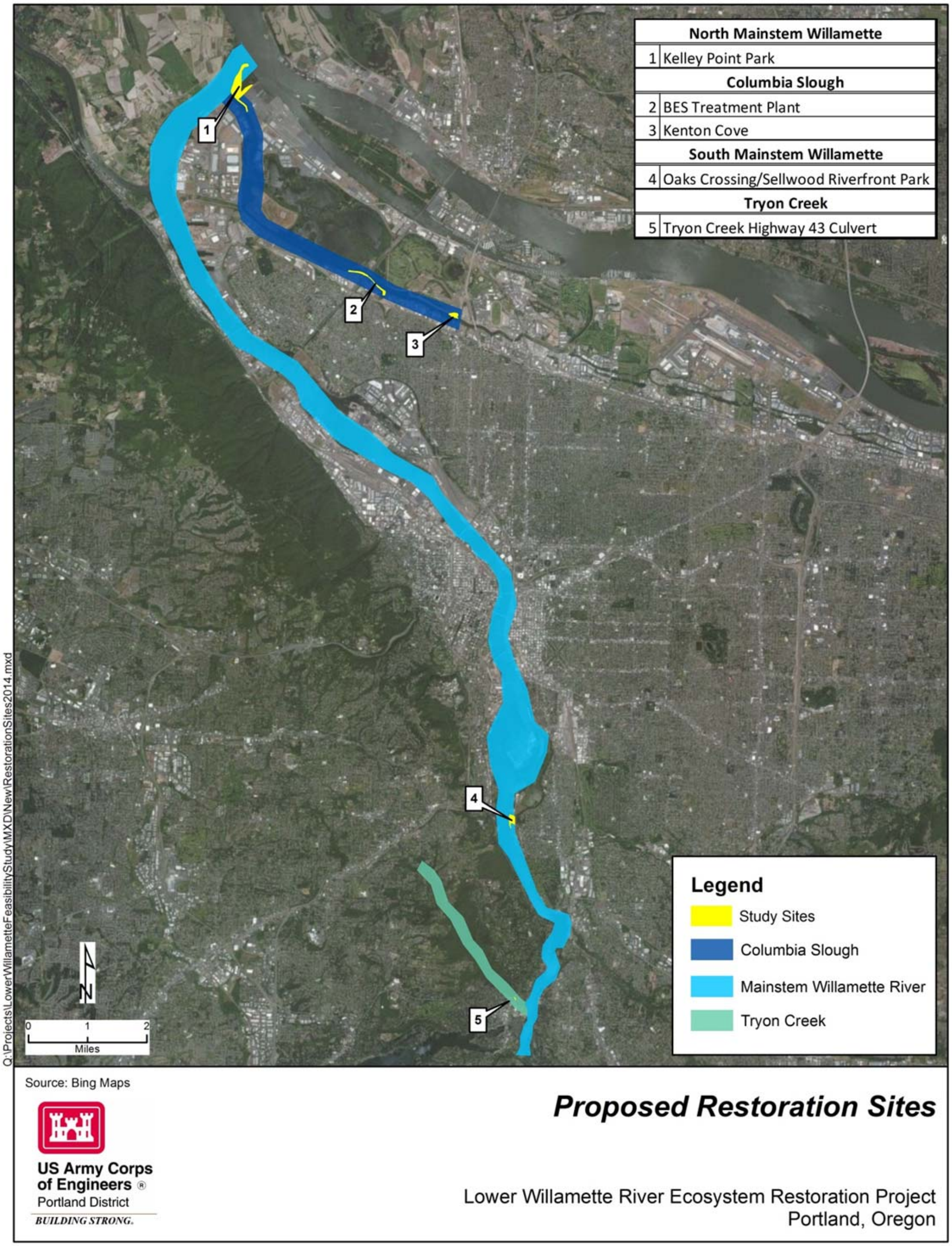

Figure 1. The five project areas.

Five ESA-listed species use the action area for adult migration and spawning, and juvenile rearing and migration. Critical habitat has been designated for all species except LCR coho salmon, for which critical habitat has been proposed but not yet designated. The action area is designated EFH for Chinook salmon and coho salmon (PFMC 1999), and is an area where environmental effects of the proposed action may adversely affect EFH of those species. The effects to EFH are analyzed in the MSA portion of the document.

2. ENDANGERED SPECIES ACT: BIOLOGICAL AND CONFERENCE OPINION AND INCIDENTAL TAKE STATEMENT

The ESA establishes a national program for conserving threatened and endangered species of fish, wildlife, plants, and the habitat upon which they depend. Section 7(a)(2) of the ESA requires Federal agencies to consult with the United States 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 and their critical habitat. If incidental take is expected, section 7(b)(4) requires the consulting agency to provide an incidental take statement (ITS) that specifies the impact of any incidental taking and includes reasonable and prudent measures to minimize such impacts.

2.1 Approach to the Analysis

Section 7(a)(2) of the ESA requires Federal agencies, in consultation with NMFS, to insure that their actions are not likely to jeopardize the continued existence of endangered or threatened species, or adversely modify or destroy their designated critical habitat. The jeopardy analysis considers both survival and recovery of the species. The adverse modification analysis considers the impacts on the conservation value of 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.[1]

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

[1] 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).

- *Identify the rangewide status of the species and critical habitat likely to be adversely affected by the proposed action*. This section (2.2) describes the current status of each listed species and its critical habitat relative to the conditions needed for recovery. For listed salmon and steelhead, NMFS has developed specific guidance for analyzing the status of the listed species' component populations in a "viable salmonid populations" paper (VSP; McElhany et al. 2000). The VSP approach considers the abundance, productivity, spatial structure, and diversity of each population as part of the overall review of a species' status. For listed salmon and steelhead, the VSP criteria therefore encompass the species' "reproduction, numbers, or distribution" (50 CFR 402.02). In describing the rangewide status of listed species, we rely on viability assessments and criteria in technical recovery team documents and recovery plans, where available, that describe how VSP criteria are applied to specific populations, major population groups, and species. We determine the rangewide status of critical habitat by examining the condition of its physical or biological features (also called "primary constituent elements" or PCEs in some designations) which were identified when the critical habitat was designated.
- *Describe the environmental baseline in the action area*. The environmental baseline (Section 2.3) includes the past and present impacts of Federal, state, or private actions and other human activities *in the action area*. It includes the anticipated impacts of proposed Federal projects that have already undergone formal or early section 7 consultation and the impacts of state or private actions that are contemporaneous with the consultation in process.
- *Analyze the effects of the proposed action on both species and their habitat*. In this step (Section 2.4), we consider how the proposed action would affect the species' reproduction, numbers, and distribution or, in the case of salmon and steelhead, their VSP parameters. We also evaluate the proposed action's effects on critical habitat features.
- *Describe any cumulative effects in the action area*. Cumulative effects (Section 2.5), as defined in our implementing regulations (50 CFR 402.02), are the effects of future state or private activities, not involving Federal activities, that are reasonably certain to occur within the action area. Future Federal actions that are unrelated to the proposed action are not considered because they require separate section 7 consultation.
- *Integrate and synthesize the above factors to assess the risk that the proposed action poses to species and critical habitat*. In this step (Section 2.6), 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 assess whether the action could reasonably be expected to: (1) reduce appreciably the likelihood of both survival and recovery of the species in the wild by reducing its numbers, reproduction, or distribution; or (2) reduce the conservation value of designated or proposed critical habitat. These assessments are made in full consideration of the status of the species and critical habitat (Section 2.2).
- *Reach jeopardy and adverse modification conclusions*. In this step (Section 2.7) we state our conclusions regarding jeopardy and the destruction or adverse modification of critical habitat. These conclusions flow from the logic and rationale presented in Section 2.6 (Integration and Synthesis).
- *If necessary, define a reasonable and prudent alternative to the proposed action*. If, in completing the last step in the analysis, we determine that the action under consultation is likely to jeopardize the continued existence of listed species or destroy or adversely

modify designated critical habitat, we must identify a reasonable and prudent alternative (RPA) to the action in Section 2.8. The RPA must not be likely to jeopardize the continued existence of listed species nor adversely modify their designated critical habitat and it must meet other regulatory requirements.

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 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 the 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 5 ESA-listed species, and their designated critical habitats, that occur within the geographic area of this proposed action and are considered in this opinion. More detailed information on the status and trends of these listed resources, and their biology and ecology, are in the listing regulations and critical habitat designations published in the Federal Register (Table 1).

Table 1. 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; '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	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
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

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; Zabel *et al.* 2006; USGCRP 2009). Ocean conditions adverse to salmon and steelhead may be more likely under a warming climate (Zabel *et al.* 2006).

The status of species and critical habitat sections below are organized under one recovery domain (Table 2) to better integrate recovery planning information that NMFS is developing on the conservation status of the species and critical habitats considered in this consultation. Recovery domains are the geographically-based areas that NMFS is using to prepare multi-species recovery plans.

Table 2. Relevant recovery planning domain identified by NMFS and its 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

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.[2]

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 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 (McElhany *et al.* 2000; McElhany *et al.* 2007; Ford 2011). 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.

[2] For Pacific salmon, NMFS uses its 1991 ESU policy, which states that a population or group of populations will be considered a distinct population segment if it is an evolutionarily significant unit. An evolutionarily significant unit 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 January, 2006 ESA listing determinations, NMFS elected to use the 1996 joint FWS-NMFS DPS policy for this species.

- 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 [3] metrics (Table 3) (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 2013b). 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 (IC-TRT 2007; Ford 2011).

Table 3. 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. 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

[3] 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.

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.

Willamette-Lower Columbia Recovery Domain. Species in the Willamette-Lower Columbia (WLC) recovery domain include LCR Chinook salmon, UWR Chinook salmon, CR chum salmon, LCR coho salmon, LCR steelhead, UWR steelhead, southern DPS green sturgeon, and eulachon. CR chum salmon, southern DPS green sturgeon, and eulachon are not included in this opinion due to the location of the action area. The WLC-TRT has identified 107 demographically independent populations of Pacific salmon and steelhead (Table 4). 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 4. Populations of ESA-listed salmon and steelhead in the WLC recovery domain.

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.[4] 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 5). 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; NMFS 2013b). 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

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

populations (23 out of 32) have a very low probability of persistence over the next 100 years (and some are extirpated or nearly so) (Lower Columbia Fish Recovery Board 2010; ODFW 2010; Ford 2011; NMFS 2013b). 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 2013b).

Table 5. 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 2013b). Persistence probability ratings range from very low (VL), low (L), moderate (M), high (H), to very high (VH).

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

<u>Abundance and Productivity</u>. 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 2013b). Low abundance of natural-origin spawners (100 fish or fewer) has increased genetic and demographic risks. Other LCR Chinook salmon populations have higher total abundance, but several of these also have high proportions of hatchery-origin spawners. Particularly for tule fall Chinook salmon populations, poor data quality prevents precise quantification of population abundance and productivity; data quality has been poor because of inadequate spawning surveys and the presence of unmarked hatchery-origin spawners (Ford 2011). A recovery plan was finalized for this species in June 2013.

Limiting Factors include (NOAA Fisheries 2011; NMFS 2013b):

- 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 6). 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 6. 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 status update in 2005 (Good et al. 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). A recovery plan was finalized for this species on August 5, 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 LCR Coho Salmon

Spatial Structure and Diversity. This species includes all naturally-spawned populations of coho salmon in the Columbia River and its tributaries in Washington and Oregon, from the mouth of the Columbia up to and including the Big White Salmon and Hood rivers; in the Willamette River to Willamette Falls, Oregon; and progeny of 25 artificial propagation programs.[5] 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 2013b). Out of the 24 populations that make up this ESU (Table 7), 21 are considered to have a very low probability of persisting for the next 100 years, and none is considered viable (Lower Columbia Fish Recovery Board 2010; ODFW 2010; Ford 2011; NMFS 2013b).

Table 7. 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 2013b). 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

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

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 2013b). Uncertainty is high because of a lack of adult spawner surveys. Smolt traps indicate some natural production in Washington populations, though given the high fraction of hatchery origin spawners suspected to occur in these populations it is not clear that any are self-sustaining. Overall, the new information considered does not indicate a change in the biological risk category since the last status review (Ford 2011; NMFS 2011a; NMFS 2013b). A recovery plan was finalized for this species in June 2013.

Limiting Factors include (NOAA Fisheries 2011; NMFS 2013b):

- 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 8).[6] The DPS also includes the progeny of ten artificial propagation programs.[7] 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.

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[6] 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).

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

Table 8. 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 2013b). 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 (Lower Columbia Fish Recovery Board 2010; ODFW 2010; Ford 2011; NMFS 2013b). All four strata in the DPS fall short of the WLC-TRT criteria for viability (NMFS 2013b).

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. 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 8) (Lower Columbia Fish Recovery Board 2010; ODFW 2010; NMFS 2013b).

Abundance and Productivity. The “low” to “very low” baseline persistence probabilities of most Lower Columbia River steelhead populations reflects low abundance and productivity (NMFS 2013b). 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 2013b). A recovery plan was finalized for this species in June 2013.

Limiting Factors include (NOAA Fisheries 2011; NMFS 2013b):

- 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 9). 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 9. 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). A recovery plan was finalized for this species on August 5, 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.

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 rearing, migration and foraging).

Salmon and Steelhead. 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.[8] 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 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 (Table 10). 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 10. PCEs of critical habitats designated for ESA-listed salmon and steelhead species considered in the opinion and corresponding species life history events.

Primary Constituent Elements		**Species Life History Event**
Site Type	**Site Attribute**	
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

CHART Salmon and Steelhead Critical Habitat Assessments

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 HUC5 watershed for:

[8] 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).

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.

Willamette-Lower Columbia Recovery Domain. Critical habitat was designated in the WLC recovery domain for UWR Chinook salmon, LCR Chinook salmon, LCR steelhead, UWR steelhead, CR chum salmon, southern green sturgeon, and eulachon, and proposed for LCR coho salmon. Critical habitat for CR chum salmon, southern DPS green sturgeon and eulachon is not considered in this opinion due to the location of the action area outside of critical habitat for these species. 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. Logging in the Cascade and Coast Ranges, and agriculture, urbanization, and gravel mining on valley floors have contributed to increased erosion and sediment loads throughout the WLC domain.

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

On the mainstem of the Columbia River, hydropower projects, including the Federal Columbia River Hydropower System (FCRPS), have significantly degraded salmon and steelhead habitats (Bottom *et al.* 2005; Fresh *et al.* 2005; NMFS 2011b; NMFS 2013b). 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 2011b; NMFS 2013b). 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 (PAHs), have been identified in Lower Columbia River watersheds in the vicinity of the ports and associated industrial facilities.

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

The Columbia River estuary has lost a significant amount of the tidal marsh and tidal swamp habitats that are critical to juvenile salmon and steelhead, particularly small or ocean-type species (Bottom *et al.* 2005; Fresh *et al.* 2005; NMFS 2011b; NMFS 2013b). Edges of marsh areas provide sheltered habitats for juvenile salmon and steelhead where food, in the form of amphipods or other small invertebrates which feed on marsh detritus, is plentiful, and larger predatory fish can be avoided. Historically, floodwaters of the Columbia River inundated the margins and floodplains along the estuary, allowing juvenile salmon and steelhead access to a wide expanse of low-velocity marshland and tidal channel habitats. In general, the riverbanks were gently sloping, with riparian and wetland vegetation at the higher elevations of the river floodplain becoming habitat for salmon and steelhead during flooding river discharges or flood tides. Sherwood *et al.* (1990) estimated that the Columbia River estuary lost 20,000 acres of tidal swamps, 10,000 acres of tidal marshes, and 3,000 acres of tidal flats between 1870 and 1970. This study further estimated an 80% reduction in emergent vegetation production and a 15% decline in benthic algal production.

Habitat and food-web changes within the estuary, and other factors affecting salmon population structure and life histories, have altered the estuary's capacity to support juvenile salmon (Bottom *et al.* 2005; Fresh *et al.* 2005; NMFS 2011b; NMFS 2013b). 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. 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 11).

Table 11. **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).[9] 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

[9] 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 PS steelhead, was also completed (NMFS 2012). 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
Big Creek (602)	CK/CM	2/2	2/2
Coweeman River (508)	CK/CM/ST	2/2/1	2/1/2
Kalama River (301)	CK/CM/ST	1/2/2	2/1/2
Cowlitz Headwaters (401)	CK/ST	2/2	1/1
Skamokawa/Elochoman (305)	CK/CM	2/1	2
Salmon Creek (109)	CK/CM/ST	1/2/1	2/3/2
Green (505) & South Fork Toutle (506) rivers	CK/CM/ST	1/1/2	2/1/2
Jackson Prairie (503) & East Willapa (507)	CK/CM/ST	1/2/1	1/1/2
Grays Bay (603)	CK/CM	1/2	2/3
Upper Middle Fork Willamette River (101)	CK	2	1
Germany/Abernathy creeks (304)	CK/CM	1/2	2
Mid-Sandy (104), Bull Run (105), & Lower Sandy (108) rivers	CK/ST	1/1	2/2
Washougal (106) & East Fork Lewis (205) rivers	CK/CM/ST	1/1/1	2/1/2
Upper Cowlitz (402) & Tilton rivers (501) & Cowlitz Valley Frontal (403)	CK/ST	1/1	2/1
Clatskanie (303) & Young rivers (601)	CK	1	2
Rifle Reservoir (502)	CK/ST	1	1
Beaver Creek (302)	CK	0	1
Unoccupied Habitat: Upper Lewis (201) & Muddy (202) rivers; Swift (203) & Yale (204) reservoirs	CK & ST Conservation Value "Possibly High"		
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)	CK/ST	1/1	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(s) and HUC_5 Code(s)	Listed Species	Current Quality	Restoration Potential
creeks/Pudding River; & Senecal Creek/Mill Creek (904)			
Row River (201), Mosby (202) & Muddy (302) creeks, Upper (203) & Lower (205) Coast Fork Willamette River	CK	1	0
Unoccupied habitat in North Santiam (501) & North Fork Breitenbush (502) rivers; Quartzville Creek (604) and Middle Santiam River (605)	CK & ST Conservation Value "Possibly High"		
Unoccupied habitat in Detroit Reservoir/Blowout Divide Creek (503)	Conservation Value: CK "Possibly Medium"; ST Possibly High"		
Lower Willamette #1709001xxx			
Collawash (101), Upper Clackamas (102), & Oak Grove Fork (103) Clackamas rivers	CK/ST	2/2	3/2
Middle Clackamas River (104)	CK/ST	2/1	3/2
Eagle Creek (105)	CK/ST	2/2	1/2
Gales Creek (002)	ST	2	1
Lower Clackamas River (106) & Scappoose Creek (202)	CK/ST	1	2
Dairy (001) & Scoggins (003) creeks; Rock Creek/Tualatin River (004); & Tualatin River (005)	ST	1	1
Johnson Creek (201)	CK/ST	0/1	2/2
Lower Willamette/Columbia Slough (203)	CK/ST	0	2

2.3 Environmental Baseline

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

The climate change effects on the environmental baseline are described in Section 2.2 above.

Over the past several years, NMFS has engaged in various Section 7 consultations on Federal projects impacting these populations and their habitats, and those impacts have been taken into account in this opinion. These consultations include consultations on dredging and pier maintenance and repair in and around the action area, recently including Advanced American Construction's Facility Maintenance (NWR-2013-9954), the Vigor Industrial Maintenance Dredging (NWR-2013-10001), the Port of Portland Terminal-Wide Maintenance Dredging (NWR-2012-3169), the Shore Terminals LLC Piling Removal and Replacement (NWR-2012-03085), and the Kinder Morgan Bulk Terminals Off Loader Construction (NWR-2011-03868). These projects had a temporary negative effect on local baseline conditions, but no significant long-term effects.

Lower Willamette River

Habitat conditions within the Lower Willamette River are highly degraded. The streambanks have been channelized, off-channel areas removed, tributaries put into pipes, and the river disconnected from its floodplain as the lower valley was urbanized. Silt loading to the lower Willamette River has increased over historical levels due to logging, agriculture, road building, and urban and suburban development within the watershed. Limited opportunity exists for large wood recruitment to the lower Willamette River due to the paucity of mature trees along the shoreline, and the lack of relief along the shoreline to catch and hold the material. The lower Willamette River has been deepened and narrowed through channelization, diking and filling, and much of the shallow-water habitat (important for rearing juvenile salmonids) has been converted to deep water habitat; 79% of the shallow water through the lower river has been lost through historic channel deepening (Northwest Power and Conservation Council 2004). Most recently, the Federal Navigation Channel at Post Office Bar was dredged in October 2011. In addition, much of the historical off-channel habitat (also important habitat for juvenile salmonids) has been lost due to diking and filling of connected channels and wetlands. Gravel continues to be extracted from the river and floodplain and much of the sediment trying to move downstream in the Willamette River is blocked by dams. All of these river changes contribute to the factors limiting recovery of ESA-listed salmonids using the action area.

The Lower Willamette River through the City of Portland is highly developed for industrial, commercial and residential purposes. Much of the river is fringed by seawalls or riprapped embankments. Water quality in the action area reach of the Willamette River reflects its urban location and disturbance history. The Lower Willamette River is currently listed on the Oregon Department of Environmental Quality (DEQ) Clean Water Act 303(d) List of Water Quality Limited Water Bodies. DEQ listed water quality problems identified in the action area include toxics, biological criteria (fish skeletal deformities), bacteria (fecal coliform) and temperature. Cleanup of contaminated sediments in Portland Harbor is presently being addressed under the Federal Superfund process.

Juvenile and adult Chinook salmon, coho salmon, and steelhead use this area as a migratory corridor and as rearing habitat for juveniles (Friesen 2005). The results of the Friesen study demonstrate that juvenile salmon and steelhead are present in the Lower Willamette River nearly year-round. Of the more than 5,000 juvenile salmonids collected during the study, over 87% were Chinook salmon, 9% were coho salmon, and 3% were steelhead. Friesen concluded that the Chinook salmon juveniles were largely spring-run stocks that rear in fresh water for a year or more before migrating to the ocean. Chinook salmon juveniles caught exhibited a bimodal distribution in length, indicating the presence of both subyearlings and yearlings. Although at lower abundance, coho salmon juveniles also exhibited this bimodal distribution of yearlings and subyearlings. The abundance of all juvenile salmon and steelhead increased beginning in November, peaked in April, and declined to near zero by July. Some of the larger juveniles may spend extended periods of time in off-channel habitat. Mean migration rates of juvenile salmon and steelhead ranged from 1.68 miles/day for steelhead to 5.34 miles/day for sub-yearling Chinook salmon. Residence time in the Lower Willamette River ranged from 4.9 days for Chinook to 15.8 days for steelhead. Catch rates of juvenile salmon were significantly higher at sites composed of natural habitat (*e.g.*, beaches and alcoves).

Steelhead are not known to spawn in the mainstem of the Willamette River in the vicinity of the action area. Chinook salmon may spawn upstream from the action area in the lower end of the Clackamas River or in the Willamette River just below Willamette Falls, where suitable gravel-type substrate for spawning may occur, and in Johnson Creek. Recent observations of coho salmon juveniles in Miller Creek (tributary at RM 3 on the Willamette River) and in Johnson Creek by City of Portland biologists suggest that coho spawning may occur in small tributaries in the Lower Willamette River.

Adult Chinook salmon and steelhead have been documented holding in the lower Willamette River for a period of time before moving upriver. Adults migrate upstream to spawn during early spring (spring Chinook salmon), early fall (coho salmon), and late fall through winter (steelhead), and spawn in early to mid-fall (Chinook and coho salmon) and spring (steelhead). Adult steelhead have been documented entering the mouth of the Clackamas River with a darkened coloration, indicating that they have been in freshwater for some time.

The 2005 Friesen study's key finding is that the Lower Willamette River is no longer appropriately considered simply a migration corridor. The presence of naturally-spawned Chinook salmon from November through July, as well as significant evidence of fish growth, contradicts a longstanding assumption that spring Chinook salmon primarily reared in their natal streams over the winter and migrated out of the Willamette River during the spring. In this study, juvenile Chinook salmon were present in the Lower Willamette River in every month sampled from May, 2000 through July, 2003. Juvenile salmon were captured more frequently during winter and spring than during other seasons. Coho salmon and steelhead were generally present only during winter and spring. Therefore, juvenile Chinook salmon will be present in the river during the proposed action, and there will likely be a few LCR coho salmon and steelhead juveniles present as well. The degraded habitat conditions in the action area likely reduce survival for salmonids rearing and migrating through this reach of the Willamette River.

Tryon Creek

Tryon Creek is a 5-mile long, perennial tributary to the Willamette River, with headwaters in the West Hills of Portland (west of Interstate 5).The historic hydrology of Tryon Creek is typical of a low to moderate gradient headwater streams, with steep landscape slopes that have been modified by the effects of development and urbanization.

No contaminated sediments were identified in or near Tryon Creek during a database search. The headwaters of the creek are highly developed, and stormwater may bring pollutants associated with urban runoff. Culverts on Tryon Creek at Boones Ferry Road, Highway 43, and on Arnold Creek at Arnold Creek Road partially or completely block fish passage into the upper reaches of these streams. Relatively extensive wildlife habitat is found between Highway 43 and Boones Ferry Road. Much of this area is undeveloped and part of the Tryon Creek State Natural Area. Above Boones Ferry Road, the watershed is more highly developed and wildlife habitat quality is lower.

Columbia Slough

Hydrology within the Columbia Slough watershed has also changed from historic conditions. Levee construction and reinforcement; filling of lakes and wetland complexes with dredge materials; draining of wetlands and other adjacent low-lying areas; and heavy industrial, commercial, residential, and agricultural development have all occurred within and around the slough (PBES 2005). The result has been disconnection of the slough from its floodplain and only seasonal connection to the Columbia River. These activities have left Columbia Slough with complex and highly managed hydrologic features that affect flows directly above the confluence of the Lower Willamette River with the Columbia River.

Several obstructions to fish access in the subbasin also affect native fish. Access to the middle and upper Columbia Slough is prevented by the Multnomah County Drainage District dike and pumping system. Columbia Slough at the location of the project sites is fully accessible to fish moving upstream from the confluence of the slough with the Willamette River.

In summary, habitat within the action area has been degraded by a number of factors. This degradation generally reduces survival of juvenile and adult salmonids migrating through the action area. The reduction in survival negatively impacts population abundance and productivity. However, critical habitat in the action area, although degraded, provides a critical migration corridor and important rearing habitat. Therefore, this habitat has high conservation value.

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.

The proposed action will affect the salmonid species considered in this opinion by causing physical, chemical, and biological changes to the environment, and through direct effects to individual fish. These effects include a temporary reduction in water quality from increased suspended sediment during construction, a temporary loss of riparian vegetation, and harassment/displacement from fish salvage or disturbance caused by other construction activities. There is also a small chance of an accidental contaminant release from construction equipment or activities, however any release would likely be small and quickly contained due to the implementation of a pollution control plan. Beneficial effects will be long term and include all effects associated with habitat restoration.

The projects considered in this opinion are intended to have long-term beneficial effects on listed species and their critical habitats and help contribute towards recovery. However, there are also likely to be temporary adverse effects associated with the construction of the projects. These adverse effects will be minimized because the projects will be deferred until the time of year when the fewest fish are present.

The types of effects associated with construction of the various habitat features are described generally in the following paragraph, and more specifically for each type of restoration action in the following section.

Construction will have direct physical effects on the environment including vegetation clearing, development of access roads, construction staging areas, and materials storage areas; water diversion and pumping, excavation, fill, and grading; followed by site restoration such as placement of wood, revegetation, placement of topsoil and other substrates, and other actions to restore habitats and ecosystem processes. These construction activities can disrupt or reduce the natural vegetative and fluvial processes at a project site, such as the recruitment of large wood, riparian shading, sediment and nutrient deposition, and groundwater recharge (NMFS 2013a). During wet weather, cleared areas can erode and suspend sediments in runoff and also potentially increase the volume and frequency of runoff. This can elevate turbidity in receiving waterbodies and adversely affect habitat as well as increasing volumes into streams during runoff events. In-water work can also resuspend sediments or generate turbidity that can be transported downstream. Heavy equipment can compact soils, reduce suitability for plant growth and reduce infiltration. The use of heavy equipment also creates a risk of spills of fuels, lubricants and other contaminants.

However, these effects are likely to be short-term at any one site (few months). Turbidity from in-water excavation and installation of large wood is likely to abate very quickly (few hours). Other effects may persist for longer until riparian and floodplain vegetation is fully reestablished.

Large Wood and Boulder Placement

Installation of LW and boulders will require disruption of the riparian area and excavation of stream beds and banks to allow these materials to be keyed into the substrate, or for installation of anchoring materials.

Beneficial effects from installing LW and boulders will include increased stream habitat complexity, reestablished natural hydraulic processes, increased overhead cover, increased prey and food-web dynamics, and sediment retention. Large wood and boulders in a stream will trap gravel above the structure, creating pools, increasing the connection with the floodplain vegetation. As a result of these benefits, an increase in habitat functions is expected.
Adverse effects of this action may include minor damage to riparian soil and vegetation and minor disturbance of streambanks and channel substrate. Harassment or mortality of listed species through contact with in-water construction equipment or materials may occur. Temporary effects to suitable habitat and water quality are likely to occur from in-water work, resulting in increased turbidity and suspended sediments and sediment deposition. Effects to species from these actions may include the temporary displacement of individual fish.

To the degree possible, installation of LW will occur in the dry, and installation of boulders and LW in the active channel will occur during the in-water work window. Additionally, fill placement will occur when creating small habitat islands in Kenton Cove. The island creation would be isolated by silt curtains or coffer dams, and fish will be removed from the area prior to construction.

If fish are present in the work area, flowing water will be isolated and fish captured and relocated to an appropriate location in an effort to minimize possible mortality. Juveniles will likely experience increased levels of stress and injury during handling, which could be exacerbated by poor water quality (increased temperatures, low dissolved oxygen saturation), prolonged periods of holding between capture and release, and any debris that may accumulate in the traps. The appropriate conservation measures and handling techniques will be employed to ensure that the stress resulting from handling and transport is short-lived and minor.

Invasive Species Removal and Riparian Revegetation

Riparian restoration would consist primarily of mechanical removal of invasive species and revegetating with native species by hand and with light machinery. The intent of this action is to restore native riparian functions.

Beneficial effects of this action would be the reestablishment of native riparian forests and plant communities which will increase overhead cover, and provide a long-term source of instream wood, reduce fine sediment supply, increase shade, nutrient input, and moderate microclimate effects.

This work will occur above the ordinary high water mark and in the dry, so adverse effects to listed anadromous species would be limited to temporary increases in input of fine sediment from soils disturbed during removal and planting. Tiny amounts of herbicides will be applied in upland areas well above ordinary high water by spraying individual plants. No herbicides or herbicide residues are expected to reach the water. All effects associated with invasive species removal and riparian revegetation are expected to be very limited and temporary.

In-Stream and Channel Modifications

The intent of this action is to reduce artificially increased channel height and steepness. Increased streambank heights may result in increased bank erosion, disconnection from the floodplain, and may be responsible for a significant portion of sediment loads in streams. Beneficial effects include improving aquatic and riparian habitat diversity and complexity, reconnecting stream channels to floodplains, reducing bed and bank erosion, increasing hyporheic exchange, and moderating flow disturbance. Grading banks to gentler slopes is proposed to allow for restored hydrologic connections and create shallow water habitat, reduce erosion, stabilize banks and to allow riparian and aquatic habitats to form more naturally.

Although most of this work would occur in the dry, potential direct construction effects include harassment or direct mortality through contact with construction equipment during in-water work, stress related to fish displacement, handling, or removal, increased suspended sediment and deposition, blocked migration, disrupted or disturbed behavior, and temporary displacement from bank areas that may be dewatered during construction. Potential adverse effects also include temporary loss of riparian vegetation and temporary loss or imbalance of nutrients and food supply.

In-water work associated with channel modifications will occur during the in-water work window, when fish are least likely to be present. Given the low potential for listed salmonids to access the construction areas at this time, and because fish will have ample room to avoid the construction areas and any associated turbidity plume, these effects are considered minor.

During construction, biologists will be on-site to observe if any fish are present. If fish are present in the work area, flowing water will be isolated and fish captured and relocated to an appropriate location in an effort to minimize possible mortality. Juveniles would likely experience increased levels of stress and injury during handling, which could be exacerbated by poor water quality (increased temperatures, low dissolved oxygen saturation), prolonged periods of holding between capture and release, and any debris that may accumulate in the traps. The appropriate conservation measures and handling techniques will be employed to ensure that the stress resulting from handling and transport is short-lived and minor.

Off-Channel Habitat and Floodplain Reconnection

Creating off-channel habitat and floodplain reconnections will increase habitat diversity, provide rearing habitat for juvenile salmonids, and refuge habitat for fish during high flows. Off-channel habitat creation and floodplain reconnection will involve excavation of fill to create side channels and backwater habitat, and installation of woody debris and boulders to enhance habitat.

The main beneficial effects of this action will be to provide high water refuge and winter and summer rearing habitat for fish. Additional benefits include increased habitat complexity, long-term nutrient storage and food web production, and increased sediment storage.

This work will occur in the dry, with the exception of final excavation which will occur to allow the river to access the excavated channels and backwater areas. However, the amount of excavation and earthwork required could be substantial. Adverse effects of the action include a loss of riparian vegetation and temporary loss or imbalance of nutrients and food supply, and harassment or mortality through contact with in-water construction equipment or materials. Temporary effects to suitable habitat and water quality are likely to result from in-water work, resulting in increased turbidity and suspended sediments and sediment deposition. Effects to species from these actions may include the temporary displacement of individual fish.

During the final phase of construction when side channels are connected to the main channel, a fish biologist will be present to identify if fish are present in the work area. If fish are observed, flowing water will be isolated and fish captured and relocated to an appropriate location in an effort to minimize possible mortality. Juveniles will likely experience increased levels of stress and injury during handling, which could be exacerbated by poor water quality (increased temperatures, low dissolved oxygen saturation), prolonged periods of holding between capture and release, and any debris that may accumulate in the traps. The appropriate conservation measures and handling techniques will be employed to ensure that the stress resulting from handling and transport is short-lived and minor.

Fish Barrier Removal

Replacing the culvert at the Tryon Creek Highway 43 site will include removal of overburden above the culvert; excavation of the culvert; replacement with a new culvert; replacement of the overburden; recontouring of affected stretches of streambed and bank; and revegetation of affected riparian areas. The intent of this action is to restore and improve juvenile and adult fish passage where it has been partially or completely eliminated by past actions.

The main beneficial effect to listed salmonid species from culvert replacement expected over the long-term is increased access to historic spawning grounds in Tryon Creek, restoring the spatial and temporal connectivity of the creek, and permitting fish to access upstream areas essential for spawning and rearing. Enhanced access to almost three miles of tributary habitat will significantly increase the amount of such habitat in the Lower Willamette River watershed. In addition, the natural bedload movements will be restored in the lower portion of Tryon Creek. Potential adverse effects resulting from construction actions include harassment or mortality through contact with in-water construction equipment or materials. Temporary effects to water quality are likely to result from in-water work, resulting in increased turbidity and suspended sediments and sediment deposition. Effects to species from these actions may include the temporary displacement of individual fish. If the streambed is dewatered during construction, fish passage will be temporarily restricted.

In-stream work associated with culvert replacement will occur in the late summer during the in-water work window, which coincides with low flow and highest water temperatures in Tryon Creek. Given the low potential for listed salmonids to access the construction area at this time, and because the construction area is located in close proximity to the Willamette River, it is considered unlikely that construction would force listed salmonids into unsuitable habitats or cause migration delays.

If fish are present in the work area, flowing water will be isolated and fish captured and relocated to an appropriate location in an effort to minimize possible mortality. Juveniles would likely experience increased levels of stress and injury during handling, which could be exacerbated by poor water quality (increased temperatures, low dissolved oxygen saturation), prolonged periods of holding between capture and release, and any debris that may accumulate in the traps. The appropriate conservation measures and handling techniques will be employed to ensure that the stress resulting from handling and transport is short-lived and minor.

Below is a more in-depth discussion of the primary adverse effects on listed species expected to occur during construction of the proposed projects:

Most direct, lethal effects of authorizing and carrying out the proposed projects are likely to be caused by the isolation of in-water work areas, 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. While adults are unlikely to be present, most salmon in the vicinity are of a size that allows them to easily escape during isolation of the proposed project areas. 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). 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 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. Best management practices 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).

Except for fish that are captured during work area isolation, 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.

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. 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.

Salmon are generally able to avoid adverse conditions if those conditions are limited to areas that are small or local compared to the total habitat area, and if the aquatic system can recover before the next disturbance. This means juvenile and adult salmon will, to the maximum extent possible, readily move out of a construction area to obtain a more favorable position within their range of tolerance along a complex gradient of temperature, turbidity, flow, noise, contaminants, and other environmental features. The degree and effectiveness of the avoidance response varies with life stage, season and the frequency and duration of exposure to the unfavorable condition, and the ability of the individual to balance other behavioral needs for feeding, growth, migration, and territory.

Excavation of channels at the project sites will cause elevated turbidity in the action area. Exposure duration is a critical determinant of the occurrence and magnitude of turbidity-caused physical or behavioral effects (Newcombe and Jensen 1996). Salmonids have evolved in systems that periodically experience short-term pulses (days to weeks) of high suspended sediment loads, often associated with flood events, and are adapted to such high pulse exposures. Behavioral avoidance of turbid waters may be one of the most important effects of suspended sediments; salmonids have been observed moving laterally and downstream to avoid turbid plumes (Sigler 1988, Lloyd 1987, Servizi and Martens 1991). At moderate levels, turbidity has the potential to adversely affect primary and secondary productivity, and at high levels, has the potential to injure and kill adult and juvenile fish (Newcombe and Jensen 1996). Turbidity might also interfere with feeding (Spence *et al*. 1996). Other behavioral effects on fish, such as gill flaring and feeding changes, have been observed in response to pulses of suspended sediment (Berg and Northcote 1985). Localized increases of turbidity during in-water work will likely displace fish in the project area and disrupt normal behavior. There is a low probability of direct mortality from turbidity associated with proposed activities because the turbidity should be infrequent, localized, and take place when adult fish are least likely to be present. The most likely effects from turbidity will be behavioral, as juveniles move away from the suspended sediments, potentially leading to greater exposure to predators.

Invasive and non-native plant control actions, including manual, mechanical, and herbicidal treatment, are commonly employed as part of streambank restoration 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 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. For these proposed projects, only very limited spot applications of herbicides will occur well away from stream channels, so contamination of aquatic areas is not likely to occur.

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. Off- and side-channel habitat restoration to reconnect stream channels with historical river floodplain swales, abandoned side channels, and floodplain channels, and setting back existing berms, dikes and levees, are likely to have similar but significantly greater positive indirect effects on habitat diversity and complexity by affecting a larger habitat area (Cramer 2012). These effects include 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 stream bank restoration are likely to include the construction effects discussed above, and reestablishment of native riparian forests or other appropriate native riparian plant communities, which will 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.

Summary of Effects on Listed Species. The applicant proposes to complete all in-water work during the relevant in-water work window. The overall number of listed salmonids in the project areas is lowest during these times. Therefore, the potential for direct interaction between construction equipment/impacts and salmon and steelhead will be significantly lower during the in-water work windows than during the rest of the year because salmon presence is low.

However, NMFS does expect some fish to be present during construction. Most of the fish present will incur short-term stress due to salvage and reduced water quality during construction. Any non-lethal stress experienced by individual fish is likely to be brief (minutes to days). A few fish may be injured or killed by salvage or by the culmination of joint causes, such as a previous wound inflicted by the environmental baseline and genetic weakness.

Considering the low abundance and short residence time of juvenile ESA-listed salmonids in the action area during the in-water work window, any effects to the growth, survival, and distribution of ESA-listed salmonids in the action area will be small and isolated. These effects are unlikely to be significant at either the local or population scale. The proposed action will improve the long-term abundance trends of the populations addressed by this opinion.

Critical Habitat within the Action Area. Designated critical habitat within the action area for ESA-listed salmon and steelhead considered in this opinion consists of freshwater rearing sites and freshwater migration corridors and their essential physical and biological features (PCEs) as listed below. The effects of the proposed action on these features are summarized as a subset of the habitat-related effects of the action that were discussed more fully above. The adverse water quality, forage, cover and passage effects described will be short-term (*i.e.,* months) during and immediately following project construction. All beneficial effects will be long-term.

Freshwater rearing

Floodplain connectivity – This will improve due to construction of several of the projects proposed, especially those involving off- and side-channel habitat restoration.

Forage – Decreased quantity and quality of forage due to disturbance during construction. Forage will improve over the long-term due to improved habitat diversity and complexity, and improved riparian function and floodplain connectivity.

Natural cover – 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, and off- and side channel habitat restoration.

Water quality – Increased suspended sediment during and for a short period following project construction. Water quality will increase over the long-term due to better floodplain and riparian function.

Water quantity – No effect.

Freshwater migration

Free of artificial obstruction – Possible delayed juvenile migration during construction due to work area isolation and suspended sediment. The replacement of the culvert in Tryon Creek will remove an artificial obstruction and allow passage to upstream areas. Passage will also be improved over the long-term due to improved water quality, habitat diversity and complexity, forage, and natural cover

Natural cover – 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, and off- and side channel habitat restoration.

Water quality – Increased suspended sediment during and for a short period following project construction. Water quality will increase over the long-term due to better floodplain and riparian function.

Water quantity – No effect.

The proposed action is likely to cause minor, localized and temporary degradation of critical habitat PCEs for water quality, natural cover, forage, and free passage. None of the effects are likely to reduce the quality and function of the PCEs within the action area over the long term. Instead, the quality and function of PCEs within the action area will be significantly improved over the long term due to construction of the proposed restoration projects. The critical habitat in the action area will retain its ability to provide rearing sites and freshwater migration corridors for the species considered in this opinion.

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.

For this action, state or private activities in the vicinity of the project locations are expected to cause cumulative effects in the action area. Additionally, future state and private activities in upstream areas are expected to cause habitat and water quality changes that are expressed as cumulative effects in the action area. Our analysis considers: (1) How future activities in the Willamette basin are likely to influence habitat conditions in the action area, and (2) cumulative effects caused by specific future activities in the vicinity of the project locations.

The action area has a high population density since it is located in the Portland metropolitan area. The past effect of that population is expressed as changes to physical habitat and loadings of pollutants contributed to the Willamette River. These changes were caused by residential, commercial, industrial, agricultural, and other land uses for economic development, and are described in the Environmental Baseline (Section 2.3). The collective effects of these activities tend to be expressed most strongly in lower river systems where the impacts of numerous upstream land management actions aggregate to influence natural habitat processes and water quality.

Resource-based industries (*e.g.*, agriculture, hydropower facilities, timber harvest, fishing, and metals and gravel mining) caused many long-lasting environmental changes that harmed ESA-listed species and their critical habitats, such as basin-wide loss or degradation of stream channel morphology, spawning substrates, instream roughness and cover, estuarine rearing habitats, wetlands, floodplains, 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.

Many of the activities described in Section 2.3 are ongoing and will continue into the future. Over time, the level of extraction of some natural resources and the associated habitat degradation in Oregon has declined and industry standards and regulatory requirements have improved. For instance, large-scale placer mining for gold (NRC 1995, Lichatowich 1999) has been replaced by smaller recreational mining operations. Timber harvest in Oregon has decreased from roughly 8.5 billion board feet in the 1980s to about 4 billion board feet in 2004 (Oregon Department of Forestry 2005). Timber harvest for Oregon from 2005 to 2010 ranged from 4.4 billion board feet to 2.7 billion board feet.[10] In 1971, Oregon passed the first comprehensive forest practices act in the nation. The law became effective on July 1, 1972, and implementation began immediately following adoption of the first set of forest practice rules (Everest and Reeves 2007). Although the Oregon Forest Practices Act and associated forest practice rules generally have become more protective of riparian and aquatic habitats over time, significant concerns remain over their ability to adequately protect water quality and salmon habitat (Everest and Reeves 2007, IMST 1999).

While widespread degradation of aquatic habitat associated with intense natural resource extraction is no longer common, ongoing and future land management actions are likely to continue to have a depressive effect on aquatic habitat quality in the Willamette basin. As a result, recovery of aquatic habitat is likely to be slow in most areas and cumulative effects at the basin-wide scale are likely to have a neutral to negative impact on population abundance trends and the quality of critical habitat PCEs.

The human population in the Portland area is likely to continue to grow in the foreseeable future (Portland State University 2012). No specific projection of future pollutant loadings in the Willamette River as a result of that population increase is available, but a larger population is likely to have a commensurate level of demand for residential, commercial, industrial, and other land uses that produce contaminants that enter rivers. Thus, it is likely that trends in habitat and water quality in the area of the proposed project will continue, but with changes as described below.

To counteract past trends in pollution of the lower Willamette River, State, tribal, local or private parties, including groups such as the Portland Harbor responsible parties, together with non-Federal members of the Portland Harbor Natural Resource Trustee Council acting in their own capacity, are reasonably certain to continue taking aggressive actions to reduce toxic pollution and runoff to the Willamette River from all sources (U.S. EPA 2011). Those actions include public education, increased toxic reduction and clean-up actions, monitoring to better identify and control sources, research into ecosystem effects of toxic pollutants, and development of a regional data management system. Upland remediation activities are often unlikely to have a Federal nexus and thus will not be the subject of a section 7 consultation. These future actions

[10] Data available at: http://www.oregon.gov/ODF/Pages/state_forests/frp/Charts.aspx (accessed Sept. 2013)

will likely lead to a significant reduction in the volume of some pollutants delivered to the lower Willamette River, although data are still insufficient to identify a trend in the concentration of most of those contaminants in the water itself (Johnson *et al.* 2005; U.S. EPA 2009; U.S. EPA 2011). We did not find any other specific information about non-Federal actions reasonably certain to occur in the vicinity of the projects.

2.6 Integration and Synthesis

The Integration and Synthesis Section is the final step in our assessment of the risk posed to species and critical habitat as a result of implementing the proposed action. In this section, we will add the effects of the action (Section 2.4) to the environmental baseline (Section 2.3) and the cumulative effects (Section 2.5) to formulate the agency's biological opinion as to whether the proposed action is likely to: (1) Reduce appreciably the likelihood of both the survival and recovery of a listed 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).

All adult UWR Chinook salmon and UWR steelhead must migrate through the action area to the Upper Willamette River basin and all juvenile UWR Chinook salmon and UWR steelhead must migrate from the Upper Willamette River basin to the ocean through the action area. Therefore, individuals from all populations of these two species could potentially be affected by the proposed projects. The LCR Chinook salmon, LCR steelhead and LCR coho salmon individuals in the action area are likely to be from the Clackamas River populations and must also pass through the action area as juveniles and adults. Over the past several years, NMFS has engaged in various Section 7 consultations on Federal projects impacting these populations and their habitats, and those impacts have been taken into account in this opinion.

The current extinction risk for UWR Chinook salmon is very high and the recovery goal for the extinction risk is very low. The current extinction risk for UWR steelhead is low and the recovery goal for the extinction risk is very low. The current extinction risk for the Clackamas River population of LCR Chinook salmon is very high and the recovery goal for the extinction risk is medium. The current extinction risk for the Clackamas River population of LCR coho salmon is medium and the recovery goal for the extinction risk is very low. The current extinction risk for the Clackamas River population of LCR steelhead is medium and the recovery goal for the extinction risk is low. The Clackamas River population is identified as a "core" population. In order to meet the ESU-viability criteria, representative populations, such as the Clackamas River population, need to achieve viability criteria or be maintained (ODFW 2010).

The environmental baseline is such that individual ESA-listed salmonids in the action area are exposed to reduced water quality, lack of suitable riparian and aquatic habitat and restricted movement due to developed urban areas and land use practices. These stressors, as well as those from climate change, already exist and are in addition to any adverse effects produced by the proposed action. Major factors limiting recovery of the ESA-listed salmonids considered in this opinion include degraded estuarine and nearshore habitat; degraded floodplain connectivity and function; channel structure and complexity; riparian areas and large wood recruitment; stream substrate, streamflow; fish passage; water quality; harvest and hatchery impacts; predation/competition; and disease.

The effects of the proposed action on the factors limiting recovery for the ESA-listed salmonids considered in this opinion include a temporary reduction in water quality and riparian vegetation in the action area from suspended sediment and the removal of vegetation during construction. Fish passage may also be temporarily reduced due to work area isolation. The reduction in water quality and passage will be short term (a few months) during project construction, while newly planted riparian vegetation may take several years to reach full function. Because these effects are relatively brief and small in scale, survival and recovery of ESA-listed salmonids will not be affected. This is primarily because the number of fish within the action area during construction activities will be extremely small when compared to the total abundance of individuals within the populations affected by this action. In addition, the proposed projects will have positive effects on the factors limiting recovery by restoring floodplain connectivity and function, channel structure and complexity, riparian areas and large wood recruitment, fish passage, and water quality. The cumulative effects described above should have a neutral to slightly negative effect on ESA-listed populations.

The few adults and juveniles that are likely to be injured or killed due to the action are too few to cause a measurable effect on the long-term abundance or productivity of any affected population or to appreciably reduce the likelihood of survival and recovery of any listed species.
The proposed action will have no adverse effect on population diversity or spatial structure. Therefore, the proposed action will not reduce the productivity or survival of the affected populations of LCR Chinook salmon, UWR Chinook salmon, LCR steelhead, UWR steelhead or LCR coho salmon, even when combined with a degraded environmental baseline and additional pressure from cumulative effects and climate change.

The value of critical habitat for these species in the Lower Willamette River is limited by poor water quality, altered hydrology, lack of floodplain connectivity and shallow-water habitat, and lack of complex habitat to provide forage and cover. The action area is in an urban area where the habitat has been degraded due to past land use practices including stormwater runoff and industrial and urban development. Despite this, the critical habitat in the action area has a high conservation value for LCR Chinook salmon, LCR steelhead, LCR coho salmon (proposed), UWR Chinook salmon, and UWR steelhead due to its critical role as a migration corridor.

The same effects of the proposed action that will have an effect on ESA-listed salmon and steelhead will also have an effect on critical habitat PCEs for salmon and steelhead critical habitat. The proposed action is likely to result in the short-term (months) reduction in the quality and function of critical habitat PCEs in the action area during construction due to suspended sediment, loss of riparian vegetation, reduction in forage and passage effects. A long-term increase in the quality and function of critical habitat PCEs will occur due to habitat restoration that will increase floodplain connectivity, fish passage, water quality, natural cover, and forage.

The effects of this action will not lower the quality and function of the necessary habitat attributes in the action area over the long term. Instead, it will increase the quality and function of the habitat attributes in the area over the long term. At the watershed scale, the proposed action will not increase the extent of degraded habitat within the basin, add to the degradation of water quality, or further decrease limited rearing areas or limit access to rearing habitat. Even when cumulative effects and climate change are included, the proposed action will not negatively influence the function or conservation role of critical habitat at the watershed scale. Critical habitat for LCR Chinook salmon, LCR steelhead, UWR Chinook salmon, and UWR steelhead, and proposed critical habitat for LCR coho salmon will remain functional, or retain the current ability for the PCEs to become functionally established, to serve the intended conservation role for the species (in this case, to provide freshwater rearing sites and migration corridors).

For all the reasons described in the preceding paragraphs of this section, the proposed action will not appreciably reduce the likelihood of both survival and recovery of the species in the wild by reducing its numbers, reproduction or distribution nor will the proposed action reduce the value of designated 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 action, any effects of interrelated and interdependent actions, and cumulative effects, it is NMFS' biological opinion that the proposed action is not likely to jeopardize the continued existence of LCR Chinook salmon, UWR Chinook salmon, LCR coho salmon, LCR steelhead, or UWR steelhead or to destroy or adversely modify critical habitat designated or proposed for these species.

You may ask NMFS to adopt the conference opinion as a biological opinion when critical habitat for LCR coho salmon 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.[11] Section 7(b)(4) and section 7(o)(2)

[11] 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

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

The proposed construction of the five projects considered in this opinion will take place within and along the active channel of the Willamette River, Columbia Slough and Tryon Creek when individual Chinook salmon, coho salmon, and steelhead considered in this opinion are reasonably certain to be present. Adverse effects of the proposed action will include harm and harassment from work area isolation and fish salvage, an increase in suspended sediment, turbidity, and pollutants during the months when project construction is occurring, and a temporary reduction in riparian vegetation and associated forage. These effects are reasonably certain to result in harassment of adults and juveniles and injury or death of a few individuals.

The amount of take for this action is 500 ESA-listed fish captured during fish salvage for all five projects.

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 the proposed action. Thus, the distribution and abundance of fish within the 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 the proposed action. In such circumstances, NMFS cannot provide an amount of take that would be caused by the proposed action.

The best available indicator for the extent of take is the extent of suspended sediment plumes. This feature best integrates the likely take pathways associated with this action, is proportional to the anticipated amount of take, and is the most practical and feasible indicator to measure. Thus, the extent of take indicator that will be used as a reinitiation trigger for this consultation is: increased suspended sediment from construction activities with suspended sediment plumes 100 feet from the boundary of construction activities at 10% over the background level.

The increase in suspended sediment and the number of fish captured are thresholds for reinitiating consultation. Exceeding either for the amount or extent of take will trigger the reinitiation provisions of this opinion.

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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.

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 action, 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 action:

The Corps shall:

1. Minimize incidental take from project-related activities by applying conditions to the proposed action that avoid or minimize adverse effects to fish from work area isolation and salvage, water quality, and loss of riparian vegetation.
2. Ensure NMFS has opportunities for formal involvement in the pre-construction, engineering, and design (PED) phases of the project to allow for NMFS review and input into final project design.
3. Ensure completion of a monitoring and reporting program to confirm that the take exemption for the proposed action is not exceeded, and that the terms and conditions in this incidental take statement are effective in minimizing incidental take.

2.8.4 Terms and Conditions

The terms and conditions described below are non-discretionary, and the Corps or any applicant must comply with them in order to implement the reasonable and prudent measures (50 CFR 402.14). The Corps or any applicant 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, the Corps shall ensure that:

    a. Work Window. To minimize effects to juvenile salmonids, construction shall be limited to the appropriate in-water work window (Tryon Creek- July 15 to September 30, Mainstem Willamette- July 1 to October 31, Columbia Slough- June 15 to September 15).

    b. Notice to Contractors. Before beginning work, all contractors working on site shall be provided with a complete list of Corps permit special conditions, reasonable and prudent measures, and terms and conditions intended to minimize the amount and extent of take resulting from in-water work.

c. <u>Minimize Impact Area</u>. The applicant will confine construction impacts to the minimum area necessary to complete the project, including minimizing effects to native riparian vegetation.

d. <u>Fish Capture and Release</u>. If practicable, allow listed fish species to migrate out of the work area or remove fish before isolating the area; otherwise remove fish from an exclusion area with methods such as hand or dip-nets, seining, or trapping with minnow traps (or gee-minnow traps).

   i. Fish capture will be supervised by a qualified fisheries biologist, with experience in work area isolation and competent to ensure the safe handling of fish.
   ii. 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.
   iii. Monitor the nets frequently enough to ensure they stay secured to the banks and free of organic accumulation.
   iv. Electrofishing will be used during the coolest time of day, and only after other means of fish capture are determined to be not feasible or ineffective.
      1. Follow the most recent version of NMFS (2000) electrofishing guidelines.
      2. Do not electrofish when the water appears turbid, *e.g.*, when objects are not visible at depth of 12 inches.
      3. Do not intentionally contact fish with the anode.
      4. Use direct current (DC) or pulsed direct current within the following ranges:
         - If conductivity is less than 100 µs, use 900 to 1100 volts.
         - If conductivity is between 100 and 300 µs, use 500 to 800 volts.
         - If conductivity greater than 300 µs, use less than 400 volts.
      5. Begin electrofishing with a minimum pulse width and recommended voltage, then gradually increase to the point where fish are immobilized.
      6. 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.
   v. If buckets are used to transport fish:
      1. Minimize the time fish are in a transport bucket.
      2. Keep buckets in shaded areas or, if no shade is available, covered by a canopy.
      3. Limit the number of fish within a bucket; fish will be of relatively comparable size to minimize predation.
      4. Use aerators or replace the water in the buckets at least every 15 minutes with cold clear water.

5. 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.
6. Be careful to avoid mortality counting errors.

vi. Monitor and record fish presence, handling, and injury during all phases of fish capture and submit a fish salvage report to NMFS within 60 days of capture that documents date, time of day, fish handling procedures, air and water temperatures, and total numbers of each salmon and steelhead handled, and numbers of ESA-listed fish injured or killed.

e. Turbidity. Monitoring shall be conducted and recorded as described below. Monitoring shall occur each day during daylight hours when in-water work is being conducted.

i. Representative background point. An observation must be taken every 2 hours at a relatively undisturbed area at least 600 feet upcurrent from in-water disturbance to establish background turbidity levels for each monitoring cycle. Background turbidity, location, time, and tidal stage must be recorded prior to monitoring downcurrent.

ii. Compliance point. Monitoring shall occur every 2 hours approximately 100 feet downcurrent from the point of disturbance and be compared against the background observation. The turbidity, location, time, and tidal stage must be recorded for each sample.

iii. Compliance. Results from the compliance points should be compared to the background levels taken during that monitoring interval. Turbidity may not exceed an increase of **10%** above background at the compliance point during construction.

iv. Exceedence. If an exceedence occurs, the applicant must modify the activity and continue to monitor every 2 hours. If an exceedence over the background level continues after the second monitoring interval, then work must be stopped and NMFS notified so that revisions to the BMPs can be evaluated.

v. If the weather conditions are unsuitable for monitoring (heavy fog, ice/snow, excessive winds, rough water, *etc*.), then operations must cease until conditions are suitable for monitoring.

vi. Copies of daily logs for turbidity monitoring shall be available to NMFS upon request.

f. Pollution Control Plan. The applicant will implement a pollution control plan (PCP) to prevent pollution caused by construction activities from entering the river. The PCP must have the following components:

i. The name and address of the party responsible for accomplishment of the PCP.

ii. Practices to prevent contaminant releases associated with equipment and material storage sites and fueling staging areas.

iii. A description of any regulated or hazardous products or materials that will be used for the project, including procedures for inventory, storage, handling, and monitoring.

iv. A spill containment and control plan with notification procedures, specific cleanup and disposal instructions for different products, quick response containment and cleanup measures that will be available on the site, proposed methods for disposal of spilled materials, and employee training for spill containment.

v. Practices to prevent debris from dropping into any stream or waterbody, and to remove any material that does drop with a minimum disturbance to the streambed and water quality.

vi. During construction activities, monitoring will be done as often as necessary to ensure the controls discussed above are working properly. If monitoring or inspection shows that the controls are ineffective, work crews will be mobilized immediately to make repairs, install replacements, or install additional controls as necessary.

g. The applicant will maintain an absorptive boom during all in-water activities to capture contaminants that may be floating on the water surface as a consequence of construction activities.

h. The applicant will follow proposed actions #1 through #5 and their associated design criteria as listed in the proposed action section of this biological opinion (from NMFS's PROJECTS biological opinion (NMFS 2013a)).

2. To implement reasonable and prudent measure #2 (NMFS involvement in the pre-construction, engineering, and design phase), the Corps shall:

a. Notify NMFS within 90 days of execution of the pre-construction, engineering, and design phase (PED) agreement and invite NMFS staff to participate in design development.

b. As part of design development, the Corps and NMFS will mutually agree on:

i. Frequency and timing of involvement in development of project designs.

ii. Timing of delivery and review of draft project designs related to NMFS fish passage criteria (NMFS 2011c).

c. For all projects undertaken pursuant to the proposed action, the Corps will provide (at least 60 days before construction) site plans and other pertinent information to NMFS for review to ensure the consistency of the action with this opinion.

3. To implement reasonable and prudent measure #3, the Corps shall ensure that:

a. Reporting. The Corps reports all monitoring items, including a fish salvage report, turbidity observations, dates of initiation and completion of in-water work, and compliance with all relevant project design criteria from the PROJECTS biological opinion (NMFS 2013a) to NMFS within 60 days of the close of any work window that had in-water work within it. Any exceedence of take covered by this opinion must be reported to NMFS immediately. The report will include a discussion of implementation of the terms and conditions in #1, above.

b. The applicant will submit monitoring reports to:

National Marine Fisheries Service
Oregon Washington Coastal Area Office
Attn: WCR-2014-633
1201 NE Lloyd Boulevard, Suite 1100
Portland, OR 97232-2778

2.9 Conservation Recommendations

Section 7(a)(1) of the ESA directs Federal agencies to use their authorities to further the purposes of the ESA by carrying out conservation programs for the benefit of the threatened and endangered species. Specifically, conservation recommendations are suggestions regarding discretionary measures to minimize or avoid adverse effects of a proposed action on listed species or critical habitat or regarding the development of information (50 CFR 402.02). The following conservation recommendation is a discretionary measure that NMFS believes is consistent with this obligation and therefore should be carried out by the Corps or applicants should be encouraged to conduct this activity:

- 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 cost-share partners to use species' recovery plans to help ensure that their actions will address those underlying processes that limit fish recovery.

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

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.

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 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 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 Chinook and coho salmon as identified in the Fishery Management Plan for Pacific coast salmon (PFMC 1999).

3.2 Adverse Effects on Essential Fish Habitat

Based on information provided by the action agency and the analysis of effects presented in the ESA portion of this document, NMFS concludes that the proposed action will have adverse effects on EFH designated for Chinook and coho salmon. These effects include a temporary reduction in riparian vegetation, a temporary reduction in water quality from sediment disturbance, and harassment/displacement from disturbance caused by construction. There will also be many long- term beneficial effects from habitat restoration due to the proposed action.

3.3 Essential Fish Habitat Conservation Recommendations

1. Implement all terms and conditions (except those relating to fish salvage) as presented in the ESA portion of this document.
2. 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.

NMFS expects that fully implementing these EFH conservation recommendations would protect, by avoiding or minimizing the adverse effects described in Section 3.2 above, approximately 30 acres of designated EFH for Pacific coast salmon.

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 U.S. Army Corps of Engineers. Other interested users could include the City of Portland, citizens living near the action area, or others interested in the conservation of the affected ESUs/DPS. Individual copies of this opinion were provided to the Corps. This opinion will be posted on the NMFS West Coast Region web site (http://www.westcoast.fisheries.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/EFH consultation 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 West Coast Region ESA quality control and assurance processes.

5. REFERENCES

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Appendix C – USFWS Proposed Conditions and Other Recommendations

United States Department of the Interior

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File Type: F

SEP 22 2014

Lieutenant Colonel Glenn O. Pratt
Portland District, Corps of Engineer
ATTN: CENWP-PME, Chief, Environmental Resources Branch (Ms. Joyce E. Casey)
P.O. Box 2946
Portland, Oregon 97208-2946

Subject: Final Review of the Lower Willamette River Ecosystem Restoration Study Draft Integrated Feasibility Report / Environmental Assessment, Lower Willamette River, Rivermile 0 to Rivermile 26, Multnomah County, Oregon (USFWS reference # 01EOFW00-2014-CPA-0023).

Dear Lieutenant Colonel Pratt:

On May 16, 2014, the U.S. Fish and Wildlife Service's (Service) Oregon Fish and Wildlife Office received a letter from the Portland District Corps of Engineers (Corps) requesting review and recommendations on the Lower Willamette River Ecosystem Restoration Study Draft Integrated Feasibility/Environmental Assessment Report (Report) under the Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S.C. 661 et seq) (FWCA). The Service submitted draft comments to the Corps on June 17, 2014, and we received comments from the Corps on our draft letter on August 18, 2014. This letter represents our final comments.

The Corps met with the Service in August 2013 to solicit input and feedback on the identification and evaluation of specific project locations, restoration alternatives, and the development of site-specific design elements. More recently, the Corps and the Service met on January 13th and 14th to discuss several on-going feasibility studies for general investigations, including the Lower Willamette Restoration project. At this time, both agencies reviewed project history and the current scope, specific study areas, and the various design elements of the project. Summary meeting notes were prepared and shared among meeting participants and both agencies agreed the notes may function as a roadmap for developing formal conservation recommendations for the Lower Willamette River Ecosystem Restoration Study Draft.

The Service is supportive of the goals of the Lower Willamette River Ecosystem Restoration Study and recognizes the Corps' need to include formal FWCA recommendations as part of its draft Feasibility Report. The Service is able to offer a number of proposed conditions and other recommendations in-lieu of a Coordination Act Report (CAR). These in-lieu recommendations, once incorporated into the Feasibility Study Report, will satisfy the Service's FWCA goals for the Report (Corps 2014) and the Corps' compliance with the FWCA.

The Service looks forward to continuing to coordinate with the Corps throughout the Pre-construction, Engineering, and Design (PED) Phase for the Study. On August 27, 2014, a final work plan (Attachment 1) for the PED Phase was developed by the Service and modified to reflect comments and suggestions from several Corps' project managers. The work plan identifies a pathway for future involvement from the Service to review and comment on engineering designs, participation in the development of monitoring plans, provide up to date information on newly listed and delisted species, evaluate estimated levels of take, and provide updated conservation measures. Through this involvement, the Corps and the Service will further address their respective mission standards and goals under both FWCA and the Endangered Species Act.

Consistent with the above, the Service has reviewed the Report prepared in March of 2014 and provides the following comments and recommendations.

Objective of the Recommended Restoration Plan

The Lower Willamette River Ecosystem Restoration Project is currently in Phase 3 and is part of a larger, overarching study to conduct ecosystem restoration actions in the Lower Willamette River. The project was initiated in 2002 and has been led by the Corps along with cost-sharing sponsors, the City of Portland and the Port of Portland. This proposed study is a final response to the 2002 study authorization. Since 2002, the City of Portland has identified over 50 individual sites with the potential to restore aquatic and riparian habitat. The current proposed project has selected five projects sites for this restoration plan and these projects will be moved forward for feasibility level designs.

The overall goal of this project is to improve site specific habitat benefits through improved aquatic habitat structure and function. The main objectives include: 1) reestablish communities of native plants in the floodplain and riparian areas; 2) improve aquatic and riparian habitat conditions to support the quality and diversity of biological communities; and 3) restore floodplain function by reestablishing key components of bank configuration and floodplain connectivity while continuing to support river dependent activities (Table 1).

Description of the Project and Site Specific Project Recommendations

The study area encompasses the Lower Willamette River and its tributaries Tryon Creek and the Columbia Slough, from its confluence with the Columbia River at River Mile (RM) 0 to Willamette Falls, located at RM 26.

Table 1. Site restoration objectives for the Lower Willamette River Ecosystem Restoration Project.

	Objective 1	Objective 2			Objective 3
Measures	Revegetation	LW	Off Channel Habitat	Fish Barrier Removal	Floodplain Reconnection
SITES					
Kelly Point Park	X	X	X		X
BES Plant	X	X	X		X
Kenton Cove	X	X			

Oaks Crossing	X	X	X		X
Tryon Creek	X			X	

These project sites include Kelly Point Park, Bureau of Environmental Services (BES) Treatment and Kenton Cove (both in the Columbia Slough), Oaks Crossing, and Tryon Creek. A description of the proposed action is incorporated by reference and is located in the draft biological assessment (Appendix C) of the Report.

Site 1 - Kelly Point Park

Project Categories (as defined by the 2013 NMFS PROJECTS BiOp):

- 2 – Large Wood (LW), Boulder, and Gravel Placement
- 5 – Off- and Side-Channel Habitat Restoration
- 6 – Streambank Restoration

A. NMFS Project Design Criteria for LW, Boulder, and Gravel Placement include:
  a. **Large wood and boulder projects**
    i. Place LW and boulders in areas where they would naturally occur and in a manner that closely mimics natural accumulations for that particular stream type. For example, boulder placement may not be appropriate in low-gradient meadow streams.
    ii. Structure types shall simulate disturbance events to the greatest degree possible and include, but are not limited to, log jams, debris flows, wind-throw, and tree breakage.
    iii. No limits are to be placed on the size or shape of structures as long as such structures are within the range of natural variability of a given location and do not block fish passage.
    iv. Projects can include grade control and streambank stabilization structures, while size and configuration of such structures will be commensurate with scale of project site and hydraulic forces.
    v. The partial burial of LW and boulders is permitted and may constitute the dominant means of placement. This applies to all stream systems but more so for larger stream systems where use of adjacent riparian trees or channel features is not feasible or does not provide the full stability desired.
    vi. LW includes whole conifer and hardwood trees, logs, and rootwads. LW size (diameter and length) should account for bankfull width and stream discharge rates. When available, trees with rootwads should be a minimum of 1.5x bankfull channel width, while logs without rootwads should be a minimum of 2.0 x bankfull widths.
    vii. Structures may partially or completely span stream channels or be positioned along stream banks.
    viii. Stabilizing or key pieces of LW will be intact, hard, with little decay, and if possible have root wads (untrimmed) to provide functional refugia habitat for fish. Consider orienting key pieces such that the hydraulic forces upon the LW increase stability.
    ix. Anchoring LW – 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 or rock) to increase the mass of the structure to resist movement
4. Use of large boulders as anchor points for the LW
5. Pin LW with rebar to large rock to increase its weight. For streams that are entrenched (Rosgen F, G, A, and potentially B) or for other streams with very low width to depth ratios (less than 12) an additional 60% ballast weight may be necessary due to greater flow depths and higher velocities.
6. Anchoring LW by cable is not allowed under this opinion.

b. **Gravel augmentation**
   i. Gravel can be placed directly into the stream channel, at tributary junctions, or other areas in a manner that mimics natural debris flows and erosion.
   ii. Augmentation will only occur in areas where the natural supply has been eliminated, significantly reduced through anthropogenic disruptions, or used to initiate gravel accumulations in conjunction with other projects, such as simulated log jams and debris flows.
   iii. Gravel to be placed in streams shall be a properly sized gradation for that stream, clean alluvium with similar angularity as the natural bed material. When possible use gravel of the same lithology as found in the watershed. Reference *Stream Simulation: An Ecological Approach to Providing Passage for Aquatic Organisms at Road-Stream Crossings* (USDA-Forest Service 2008) to determine gravel sizes appropriate for the stream.
   iv. Gravel can be mined from the floodplain at elevations above bankfull, but not in a manner that will cause stranding during future flood events.
   v. Crushed rock is not permitted.
   vi. After gravel placement in areas accessible to higher stream flow, allow the stream to naturally sort and distribute the material.
   vii. Do not place gravel directly on bars and riffles that are known spawning areas, which may cause fish to spawn on the unsorted and unstable gravel, thus potentially resulting in redd destruction.
   viii. Imported gravel will be free of invasive species and non-native seeds. If necessary, wash gravel prior to placement.

B. NMFS Project Design Criteria for Off- and Side- Channel Restoration include:
   a. **Off- and Side-Channel Habitat Restoration** projects will be implemented to reconnect historical side-channels with floodplains by removing off-channel fill and plugs. Furthermore, new side-channels and alcoves can be constructed in geomorphic settings that will accommodate such features. This activity category typically applies to areas where side channels, alcoves, and other backwater habitats have been filled or blocked from the main channel, disconnecting them from most if not all flow events.
   b. **NMFS fish passage review and approval.** When a proposed side channel will contain greater than 20% of the bankfull flow,[1] the action will be reviewed by the

[1] Large side channels projects are essentially channel construction projects if they contain more than 20% of flow.

RRT and reviewed and approved by NMFS for consistency with NMFS (2011a) *Anadromous Salmonid Passage Facility Design* criteria.

c. **Data requirements.** Data requirements and analysis for off- and side-channel habitat restoration include evidence of historical channel location, such as land use surveys, historical photographs, topographic maps, remote sensing information, or personal observation.

d. **Allowable excavation.** Off- and side-channel improvements can include minor excavation (less than or equal to 10% of volume) of naturally accumulated sediment within historical channels, *i.e.,* based on the OHW level as the elevation datum. The calculation of the 10% excavation volume does not include manually placed fill, such as dikes, berms, or earthen plugs (see PDC 39). There is no limit as to the amount of excavation of anthropogenic fill within historical side channels as long as such channels can be clearly identified through field or aerial photographs. Excavation depth will not exceed the maximum thalweg depth in the main channel. 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. NMFS Project Design Criteria for Streambank Restoration include:

Streambank Restoration

a. The following streambank stabilization methods may be used individually or in combination:
   i. Alluvium placement
   ii. LW placement
   iii. Roughened toe
   iv. Woody plantings
   v. Herbaceous cover, in areas where the native vegetation does not include trees or shrubs
   vi. Bank reshaping and slope grading
   vii. Coir logs
   viii. Deformable soil reinforcement
   ix. Engineered log jams (ELJ)
   x. Floodplain flow spreaders
   xi. Floodplain roughness

b. For more information on the above methods see Federal Emergency Management Agency (2009)[2] or Cramer *et al.* (2003).[3] Other than those methods relying solely upon woody and herbaceous plantings, streambank stabilization projects should be designed by a qualified engineer that is appropriately registered in the state where the work is performed.

c. Rock will not be used for streambank restoration, except as ballast to stabilize LW. Stream barbs and full-spanning weirs are not allowed for stream bank stabilization under this opinion.

d. **Alluvium Placement** can be used as a method for providing bank stabilization using imported gravel/cobble/boulder-sized material of the same composition and size as that in the channel bed and banks to halt or attenuate streambank erosion, stabilize

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[2] http://www.fema.gov/pdf/about/regions/regionx/Engineering_With_Nature_Web.pdf

[3] http://wdfw.wa.gov/publications/00046/wdfw00046.pdf

riffles, and provide critical spawning substrate for native fish. This method is predominantly for use in small to moderately sized channels and is not appropriate for application in mainstem systems. These structures are designed to provide roughness, redirect flow, and provide stability to adjacent streambed and banks or downstream reaches, while providing valuable fish and wildlife habitat.

i. **NMFS fish passage review and approval.** NMFS will review alluvium placement projects that occupy more than 25% of the channel bed or more than 25% of the bankfull cross sectional area.
ii. This design method is only approved in those areas where the natural sediment supply has been eliminated, significantly reduced through anthropogenic disruptions, or used to initiate or simulate sediment accumulations in conjunction with other structures, such as LW placements and ELJs.
iii. Material used to construct the toe should be placed in a manner that mimics attached longitudinal bars or point bars.
iv. Size distribution of toe material will be diverse and predominately comprised of D_{84} to D_{max} size class material.
v. Spawning gravels will constitute at least one-third of the total alluvial material used in the design.
vi. Spawning gravels are to be placed at or below an elevation consistent with the water surface elevation of a bankfull event.
vii. Spawning size gravel can be used to fill the voids within toe and bank material and placed directly onto stream banks in a manner that mimics natural debris flows and erosion.
viii. All material will be clean alluvium with similar angularity as the natural bed material. When possible use material of the same lithology as found in the watershed. Reference *Stream Simulation: An Ecological Approach to Providing Passage for Aquatic Organisms at Road-Stream Crossings* (USDA-Forest Service 2008) to determine gravel sizes appropriate for the stream.
ix. Material can be mined from the floodplain at elevations above bankfull, but not in a manner that will cause stranding during future flood events.
x. Crushed rock is not permitted.
xi. After placement in areas accessible to higher stream flow, allow the stream to naturally sort and distribute the material.
xii. Do not place material directly on bars and riffles that are known spawning areas, which may cause fish to spawn on the unsorted and unstable gravel, thus potentially resulting in redd destruction.
xiii. Imported material will be free of invasive species and non-native seeds. If necessary, wash prior to placement.

e. **Large Wood Placements** are defined as structures composed of LW that do not use mechanical methods as the means of providing structure stability (*i.e.,* large rock, rebar, rope, cable, *etc.*). The use of native soil, run of alluvium, wood, or buttressing with adjacent trees as methods for providing structure stability are authorized. This method is predominantly for use in small to moderately sized channels and is not appropriate for application in mainstem systems. These structures are designed to provide roughness, redirect flow, and provide stability to adjacent streambed and banks or downstream reaches, while providing valuable fish and wildlife habitat.

i. **NMFS Review and Approval.** NMFS will review LW placement projects that would occupy greater than 25% of the bankfull cross section area.
ii. Structure shall simulate disturbance events to the greatest degree possible and include, but not be limited to, log jams, debris flows, wind-throw, and tree breakage.
iii. Structures may partially or completely span stream channels or be positioned along stream banks.
iv. Where structures partially or completely span the stream channel LW should be comprised of whole conifer and hardwood trees, logs, and rootwads. LW size (diameter and length) should account for bankfull width and stream discharge rates.
v. Structures will incorporate a diverse size (diameter and length) distribution of rootwad or non-rootwad, trimmed or untrimmed, whole trees, logs, snags, slash, *etc.*
vi. For individual logs that are completely exposed, or embedded less than half their length, logs with rootwads should be a minimum of 1.5 times bankfull channel width, while logs without rootwads should be a minimum of 2.0 times bankfull width.
vii. Consider orienting key pieces such that the hydraulic forces upon the LW increase stability.

f. **Roughened toe**
   i. Minimum amount of wood incorporated into the treated area, for mitigation of riprap, is equal to the number of whole trees whose cumulative summation of rootwad diameters is equal to 80% of linear-feet of treated streambank.
g. **Engineered log jams**
   i. See PDC 34b.
h. If LW mechanical anchoring is required, a variety of methods may be used. These include large angular rock, buttressing the wood between adjacent trees, or the use of manila, sisal or other biodegradable ropes for lashing connections. If hydraulic conditions warrant use of structural connections, rebar pinning or bolted connections may be used. Use of cable is not covered by this opinion.
i. When a hole in the channel bed caused by local scour will be filled with rock to prevent damage to a culvert, road, or bridge foundation, the amount of rock will be limited to the minimum necessary to protect the integrity of the structure.
j. When a footing, facing, head wall, or other protection will be constructed with rock to prevent scouring or down-cutting of, or fill slope erosion or failure at, an existing culvert or bridge, the amount of rock used will be limited to the minimum necessary to protect the integrity of the structure. Whenever feasible, include soil and woody vegetation as a covering and throughout the structure.
k. Use a diverse assemblage of vegetation species native to the action area or region, including trees, shrubs, and herbaceous species. Vegetation, such as willow, sedge and rush mats, may be gathered from abandoned floodplains, stream channels, *etc.*
l. Do not apply surface fertilizer within 50 feet of any stream channel.
m. Install fencing as necessary to prevent access to revegetated sites by livestock or unauthorized persons.
n. Conduct post-construction monitoring and treatment or removal of invasive plants until native plant species are well established.

Current Project Description:

The proposed actions at this 47 acre site will excavate two off-channel backwater areas, remove invasive plants, revegetate with native species, re-grade steep banks for floodplain enhancement, and place 50 pieces of LW to enhance habitat complexity. Trails throughout the park would be adjusted to allow for restoration. To reduce the amount of fill to be removed, rather than excavating large areas of floodplain, meandering channels would be cut along existing swales to allow for off-channel refugia. An estimated 197,000 cubic yards (cy) of material will be excavated and hauled either by barge or truck, as appropriate.

Habitat value in Kelly Point Park is moderate, but implementation of the project would result in the creation of approximately 5,000 linear feet of high-flow channel to allow rearing and refugia for juvenile salmonids. Habitat complexity and riparian vegetation would be restored on approximately 5,000 feet (10.9 acres) of shoreline by re-contouring banks, removing invasive species, and re-vegetating with riparian shrubs and trees. Canopy cover would be most dense after 10 years, after which the understory layer may diminish somewhat due to shading.

Service Recommendations for Kelly Point:

- Follow the relevant NMFS PROJECTS design criteria for project categories 2, 5, and 6 (Appendix 1).
- Follow General Conservations Measures listed below.
- Slope banks in the dry and at low flow. Place toe of slope above low flow elevation.
- Maximize the opportunity to create distributary and high flow channels as well as wetlands.
- Add snags and large wood on the floodplain and throughout the site.
- Minimize recreational access to high value habitat by placing trails where they will have the lowest impact, minimize trail crossings in aquatic habitat, and if needed, use bridges or boardwalks to maintain hydrologic connections, reduce soil compaction and maintain native vegetation and water quality.
- Create painted turtle habitat using woody material and limit the use of boulders. Also, provide open areas for nesting habitat.
- Use vertical posts for LW stability and structural habitat for perching birds.
- Remove the word "debris" from all reference to large wood.
- Use anchoring system for LW in preferential order per the PROJECTS programmatic biological opinion.
- Use live willow "play pens" around LW.
- Do not develop water control structures.

<u>Site 2 – BES Treatment</u>

Project Categories (as defined by the 2013 NMFS PROJECTS BiOp):

- 2 – Large Wood (LW), Boulder, and Gravel Placement
- 5 – Off- and Side-Channel Habitat Restoration
- 6 – Streambank Restoration

Current Project Description:

The intent of this six acre project is to excavate a connection to a floodplain backwater/swale area to allow more frequent inundation and enhance the riparian zone along Columbia Slough. Steepened bank angles would be reduced and 35 pieces of LW would be added along the banks to increase habitat complexity. Habitat quality is currently moderate to good, but opportunities to improve and expand wetland and backwater habitats exist in several parts of the project site. Off-channel rearing and high-water refugia would be enhanced by excavating a connection from Columbia Slough to the low swale at the southeast end of the site and by excavating an alcove at the base of the slope near the northwest end of the site. Habitat value would be increased by removing invasive species and re-vegetating with native trees and shrubs. Painted turtle habitat would be enhanced by addition of LW near the mouth of the channel between the slough and the low swale. An estimated 13,000 cy of material will be excavated and hauled either by barge or truck, as appropriate.

Service Recommendations for BES:

- Follow relevant NMFS PROJECTS design criteria for project categories 2, 5, and 6 (Appendix 1).
- Follow General Conservations Measures listed below.
- Slope banks in the dry and at low flow. Place toe of slope above low flow elevation.
- Create painted turtle habitat using woody material and limit the use of boulders. Also, provide open areas for nesting habitat.
- Use vertical posts for LW stability instead of boulders.
- Use live willow "play pens" around LW.
- Use anchoring system for LW in preferential order per the PROJECTS programmatic biological opinion.

<u>Site 3 – Kenton Cove</u>

Project Categories (as defined by the 2013 NMFS PROJECTS BiOp):

- 2 – Large Wood (LW), Boulder, and Gravel Placement, Engineered Logjams (ELJ)
- 6 – Streambank Restoration

D. NMFS Project Design Criteria for Engineered Log Jams:

   c. **Engineered Logjams (ELJs)** are structures designed to redirect flow and change scour and deposition patterns.[4] While providing valuable fish and wildlife habitat, they are also designed to redirect flow and can provide stability to a streambank or downstream gravel bar. To the extent practical, ELJs are designed to simulate stable natural log jams and can be either naturally stable due to LW size and/or stream width or anchored in place using rebar, rock, or piles (driven into a dewatered area or the streambank, but not in water). They are also designed to create a hydraulic

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[4] ELJs are defined as structures composed of LW with at least three key members incorporating the use of an anchoring system as defined in PDC 33.a.ix.

shadow, a low-velocity zone downstream that allows sediment to settle out and scour holes adjacent to the structure.

i. **NMFS fish passage review and approval.** For ELJs that occupy greater than 25% of the bankfull area, NMFS will review the action for consistency with criteria in *Anadromous Salmonid Passage Facility Design* (NMFS 2011a).
ii. ELJs will be patterned, to the greatest degree possible, after stable natural log jams.
iii. Grade control ELJs are designed to arrest channel down-cutting or incision by providing a grade control that retains sediment, lowers stream energy, and increases water elevations to reconnect floodplain habitat and diffuse downstream flood peaks.
iv. Stabilizing or key pieces of LW that will be relied on to provide streambank stability or redirect flows will be intact and solid (little decay). If possible, acquire LW with untrimmed rootwads to provide functional refugia habitat for fish.
v. When available, trees with rootwads attached should be a minimum length of 1.5 times the bankfull channel width, while logs without rootwads should be a minimum of 2.0 times the bankfull width.
vi. The partial burial of LW and boulders may constitute the dominant means of placement, and key boulders (footings) or LW can be buried into the streambank or channel.
vii. Angle and offset – The LW portions of ELJ structures should be oriented such that the force of water upon the LW increases stability. If a rootwad is left exposed to the flow, the bole placed into the streambank should be oriented downstream parallel to the flow direction so the pressure on the rootwad pushes the bole into the streambank and bed.
Wood members that are oriented parallel to flow are more stable than members oriented at 45 or 90 degrees to the flow.
viii. If LW anchoring is required, a variety of methods may be used. These include buttressing the wood between riparian trees, or the use of manila, sisal, or other biodegradable ropes for lashing connections. If hydraulic conditions warrant use of structural connections, rebar pinning or bolted connections may be used. Rock may be used for ballast but is limited to that needed to anchor the LW.

Current Project Description:

This four acre site is surrounded by a highly maintained levee, with a natural riparian floodplain zone along Columbia Slough and is devoid of riparian habitat. The dominant species include Himalayan blackberry and reed canary grass. The intent of this project is to enhance this backwater cove with 16 pieces of LW, remove invasive species, and revegetate with native trees and shrubs. Because the edges of the cove are very uniform and offer very little habitat complexity, the conceptual plan recommends creating small habitat islands at the location of each woody debris jam, with the wood as the centerpiece of the habitat island. An estimated 1600 cy of clean fill material will be imported and hauled by truck for the creation of the habitat islands.

Service Recommendations for Kenton Cove:

- Follow NMFS PROJECTS design criteria for project categories 2 and 6 (Appendix 1).
- Follow General Conservation Measures listed below.
- Slope banks in the dry and at low flow. Place toe of slope above low flow elevation.
- Use vertical posts for LW stability.
- Use live willow "play pens" around LW.
- Use LW anchoring system in preferential order per the PROJECTS programmatic biological opinion.
- Do not use materials that are inappropriate for the habitat type – i.e. large boulders in a fine sediment-dominated area.
- Create small islands with LW, gravel and/or sand.

Site 4 – Oaks Crossing

Project Categories (as defined by the 2013 NMFS PROJECTS BiOp):

- 2 – Large Wood (LW), Boulder, and Gravel Placement
- 5 – Off- and Side-Channel Habitat Restoration
- 17 – Wetland Restoration

E. NMFS Project Design Criteria for Wetland Restoration:

Wetland Restoration restores degraded wetlands by (a) excavation and removal of fill materials; (b) contouring to reestablish more natural topography; (c) setting back existing dikes, berms and levees; (d) reconnecting or recreating historical tidal and fluvial channels; (e) planting native wetland species; or (f) a combination of the above methods. This action does not include installation of water control structures or fish passage structures.

a. Include applicable General Construction Measures (PDC 13-32) and PDC for specific types of actions as applicable (*e.g.*, Off- and Side-Channel Habitat Restoration (PDC 37); Set-Back or Removal of Existing Berms, Dikes, and Levees for Wetland and Estuary Restoration (PDC 39); and Dam and Legacy Structure Removal (PDC 35)) to ensure that all adverse effects to fish and their designated critical habitats are within the range of effects considered in this opinion.

Current Project Description:

The intent of this 20 acre project is to enhance salmonid habitat in the floodplain by connecting off-channel habitat to the river, removing invasive species, and re-vegetating with native floodplain and riparian species. Habitat at this site consists of a gallery forest composed of both native and invasive species. Dominant species in the riparian zone include black cottonwood, willows, cedars, Himalayan blackberry, English ivy, and reed canary grass. Sandy beach habitat would be enhanced by addition of 8 pieces of LW. An estimated 9,000 cy of material will be excavated and hauled either by barge or truck, as appropriate.

Service Recommendations for Oaks Crossing:

- Follow the relevant NMFS PROJECTS design criteria for project categories 2, 5, and 17 (Appendix 1).
- Follow General Conservation Measures listed below.
- Add snags and large wood on the floodplain.
- Minimize access to high value habitat by siting trails where they will have the lowest impact; minimize trail crossings in aquatic habitat, and if needed use bridges or boardwalks to maintain hydrologic connections, reduce soil compaction and maintain native vegetation and water quality.
- Use vertical posts for LW stability.
- Use live willow "play pens" around LW.
- Use anchoring system for LW in preferential order per the PROJECTS programmatic biological opinion.

Site 5 – Tryon Creek Highway 43 Culvert

Project Categories (as defined by the 2013 NMFS PROJECTS BiOp):

- 1 – Fish Passage Restoration (Stream Simulation Culvert and Bridge Projects

F. NMFS Project Design Criteria for Fish Passage Restoration:

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, stream isolation and dewatering is required during project implementation, or the stream is naturally impassable at the time of construction.
b. After construction, provide fish passage that meets NMFS' fish passage criteria for any adult or juvenile ESA-listed fish (NMFS 2011a), for the life of the action.

Current Project Description:

The intent of this project is to replace the culvert under Highway 43 and the railroad. The new culvert would simulate the natural stream dimensions, allowing for sediment and debris to pass through and give fish and wildlife unhindered passage beneath the roadway and railroad line. The existing culvert is a fish and wildlife barrier under most flow conditions. Implementation of this project would allow unhindered fish and wildlife passage for 3 miles up into the Tyron Creek Watershed. The Tryon Creek State Natural Area has had numerous restoration projects completed upstream of the Highway 43 culvert for improved fish and wildlife habitat. If constructed in combination with installation of a fish-passable culvert at Boones Ferry Road, fish would have access up Tryon Creek to the upstream end of Marshall Park. Without this project, the benefits of stream and riparian restoration in Tryon Creek State Natural Area and in Marshall Park would be significantly diminished.

Service Recommendations for Tryon Creek Hwy 43 Culvert:

- Follow the relevant NMFS PROJECTS design criteria for project category 1 (Appendix 1).

- Follow General Conservation Measures listed below.
- Take out "excavate flow channel" on any maps that contain this language.
- Only use large boulders if they are part of the native habitat; LW is a better material.
- We appreciate your efforts to design a solution to the fish passage issues at the Tryon Creek culvert. As we mentioned at the workshop, a separate planning effort coordinated by the Tryon Creek Watershed Council has been underway that has involved many of the major stakeholders with an interest and role to play in the restoration outcome for that site. We recommend that you coordinate with members of that group, consider the alternatives and design features that have been and are being evaluated (e.g., replacing the culvert with a bridge), and factor their interests and long-term vision into your decisions. Their current work advances former efforts by stakeholders to address the culvert, as described in the 2007 Tryon Creek @ HWY 43 Culvert Alternates Analysis (http://www.fws.gov/oregonfwo/ToolsForLandowners/UrbanConservation/Greenspaces/Documents/Projects/2003/6505.0309%20Mouth%20of%20Tryon%20Creek/Tryon%20Creek%20Hwy%2043AltAnal.pdf).
- Make sure stakeholders, via Carl Axelsen (Tryon Creek Watershed Council Coordinator), are informed and updated about this effort.

Fish and Wildlife Resource Concerns

The Lower Willamette River supports a network of fish and wildlife species including plants, benthic invertebrates, fish, reptiles, amphibians, birds, and mammals. Included in this network are migratory birds and anadromous and resident fish. Wildlife of importance to the Service includes migratory and resident piscivorous birds such as bald eagle (*Haliaeetus leucocephalus*) and osprey (*Pandion haliaetus*). Anadromous fish spawn throughout the upper river basin, upstream of the proposed study area. The lower Willamette River is a migratory corridor for juvenile and adult anadromous fish and provides rearing habitat for several juvenile anadromous fish species. Important representatives of fish species include Chinook (*Oncorhynchus tshawytscha*), chum (*O. keta*), and coho (*O. Kisutch*) salmon; steelhead (*O. myskiss*) and coastal cutthroat (*O. clarki clarki*) trout; and Pacific lamprey (*Entosphenus tridentata*).

A number of fish and wildlife have reduced or limited number of individuals and are the focus of conservation concerns. Factors contributing to these declines include habitat loss, introduced species, and direct human disturbance. For example, predation by introduced species may be at least partly responsible for observed declines in populations of the red-legged frogs (*Rana aurora*) and the Western pond turtle (*Clemmys marmorata*). These species may have relied heavily on the backwater habitats along the Willamette River and other wetland that have been substantially reduced in the past 150 years. Although this restoration plan is intended to enhance habitat features for these sensitive species, we are concerned construction activities, may have short-term adverse impacts to fish and wildlife, and if not properly implemented, may inadvertently cause exotic species such as bull frogs (*Rana catesbeiana*) and warm water game fish to be introduced or proliferate.

General Conservation Recommendations

The restoration plan proposes to restore natural floodplain functions and fish and wildlife habitats along the Lower Willamette River and its tributaries Tryon Creek and the Columbia Slough. The types of individual restoration measures proposed in this restoration plan proposes to be conducted using appropriate conservation measures and best management practices (BMPs) to avoid and minimize any adverse effects during construction, including the NMFS PROJECTS Programmatic Restoration Biological Opinion (NMFS 2013). The long-term effects of this proposed plan are intended to be beneficial and specifically benefit sensitive fish and wildlife species and contribute to the restoration of natural riverine and floodplain processes. Due to the large scale of the feasibility study, site specific information regarding current fish and wildlife habitat conditions is not available for each of the individual sites. The Service therefore is unable to specifically evaluate the potential short-term adverse effects of the constructions activities to fish and wildlife resources. At this time, the Service requests the Corps incorporate the following conservation measures or BMPs into this restoration plan in addition to those measures already considered, to provide protection to listed and sensitive species, and further minimize any short-term negative impacts to their habitats during construction activities. These conservation recommendations provided below should reduce the overall project impacts and improve habitat conditions for aquatic and riparian dependent species.

General Aquatic Conservation Measures

The activities considered by this restoration plan are intended to protect and restore fish and wildlife habitat with long-term benefits to ESA listed species and species of concern. However, project construction may have short-term adverse effects. To minimize these short-term adverse effects and make them predictable for purposes of programmatic analysis, the following general conservation measures are recommended to be followed for all projects.

Documentation

1) Name(s), phone number(s), and address(es) of the person(s) responsible for oversight will be posted at the work site;
2) A description of hazardous materials that will be used, including inventory, storage, and handling procedures will be available on-site;
3) Procedures to contain and control a spill of any hazardous material generated, used or stored on-site, including notification of proper authorities, will be readily available on-site;
4) A standing order to cease work in the event of high flows (above those addressed in the design and implementation plans), or exceedance of incidental take or water quality limits, will be posted on-site.

Project Design and Site Preparation

1) Climate change. Best available science regarding the future effects within the project area of climate change, such as changes in stream flows and water temperatures, will be considered during project design.

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

3) Timing of in-water work. Appropriate state Oregon Department of Fish and Wildlife (ODFW) guidelines for timing of in-water work windows (IWW) will be followed.
   a) Proposed restoration activities will not adversely modify designated and/or proposed critical habitats for Chinook salmon, chum, or steelhead.
   b) Lamprey – the project sponsor and/or their contractors will avoid working in stream or river channels that contain Pacific Lamprey from March 1 to July 1. If this timeframe is incompatible with other objectives, the area will be surveyed for nests and lamprey presence, and avoided if possible. If lampreys are known to exist, the project sponsor will utilize dewatering and salvage procedures outlined in US Fish and Wildlife Service (2010)[5].
   c) Proposed restoration activities will follow the Oregon guidelines for the timing of IWW (2008)[2] for each affected stream reach, unless ODFW approves an extension based on current year site specific conditions. Work will not proceed outside of the IWW until the exception is approved by e-mails from NMFS and the Service.

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

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

6) Temporary access roads and paths.
   a) Existing access roads and paths will be preferentially used whenever reasonable, and the number and length of temporary access roads and paths through riparian areas and floodplains will be minimized to lessen soil disturbance and compaction, and impacts to vegetation.

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[5] U.S. Fish and Wildlife Service. 2010. Best management practices to minimize adverse effects to Pacific lamprey. Available online at: http://www.fws.gov/pacific/Fisheries/sphabcon/lamprey/pdf/Best%20Management%20Practices%20for%20Pacific%20Lamprey%20April%202010%20Version.pdf.

[2] Oregon Department of Fish and Wildlife. 2008. Oregon guidelines for timing of in-water work to protect fish and wildlife resources. Available online at: http://www.dfw.state.or.us/lands/inwater/Oregon_Guidelines_for_Timing_of_%20InWater_Work2008.pdf.

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

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

8) Staging, storage, and stockpile areas.
   a) Staging areas (used for construction equipment storage, vehicle storage, fueling, servicing, and hazardous material storage) will be 150 feet or more from any natural water body or wetland, or on an adjacent, established road area in a location and manner that will preclude erosion into or contamination of the stream or floodplain.
   b) Natural materials used for implementation of aquatic restoration, such as large wood, gravel, and boulders, may be staged within the 100-year floodplain.
   c) Any large wood, topsoil, and native channel material displaced by construction will be stockpiled for use during site restoration at a specifically identified and flagged area.
   d) Any material not used in restoration, and not native to the floodplain, will be removed to a location outside of the 100-year floodplain for disposal.

9) Equipment. Mechanized equipment and vehicles will be selected, operated, and maintained in a manner that minimizes adverse effects on the environment (e.g., minimally-sized, low

pressure tires; minimal hard-turn paths for tracked vehicles; temporary mats or plates within wet areas or on sensitive soils). All vehicles and other mechanized equipment will be:

a) Stored, fueled, and maintained in a vehicle staging area placed 150 feet or more from any natural water body or wetland or on an adjacent, established road area;
b) Refueled in a vehicle staging area placed 150 feet or more from a natural waterbody or wetland, or in an isolated hard zone, such as a paved parking lot or adjacent, established road (this measure applies only to gas-powered equipment with tanks larger than 5 gallons);
c) Biodegradable lubricants and fluids should be used, if possible, on equipment operating in and adjacent to the stream channel and live water.
d) Inspected daily for fluid leaks before leaving the vehicle staging area for operation within 150 feet of any natural water body or wetland; and
e) Thoroughly cleaned before operation below ordinary high water, and as often as necessary during operation, to remain grease free.

10) Erosion control. Erosion control measures will be prepared and carried out, commensurate in scope with the action, that may include the following:

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

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

a) Work will be sequenced and scheduled to reduce exposed bare soil subject to wind erosion.
b) Dust-abatement additives and stabilization chemicals (typically magnesium chloride, calcium chloride salts, or ligninsulfonate) will not be applied within 25 feet of water or a stream channel and will be applied so as to minimize the likelihood that they will enter streams. Applications of ligninsulfonate will be limited to a maximum rate of 0.5 gallons per square yard of road surface, assuming a 50:50 (ligninsulfonate to water) solution.
c) Application of dust abatement chemicals will be avoided during or just before wet weather, and at stream crossings or other areas that could result in unfiltered delivery of the dust

abatement materials to a waterbody (typically these would be areas within 25 feet of a waterbody or stream channel; distances may be greater where vegetation is sparse or slopes are steep).

d) Spill containment equipment will be available during application of dust abatement chemicals.
e) Petroleum-based products will not be used for dust abatement.

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

13) Invasive species control. The following measures will be followed to avoid introduction of invasive plants and noxious weeds into project areas:
   a) Prior to entering the site, all vehicles and equipment will be power washed, allowed to fully dry, and inspected to make sure no plants, soil, or other organic material adheres to the surface.
   b) Watercraft, waders, boots, and any other gear to be used in or near water will be inspected for aquatic invasive species.
   c) During project design, actions will be identified and implemented, in conjunction with ODFW, to prevent, if feasible, future introductions of bull frogs, warm water game fish, and other aquatic invasive species.

Construction Conservation Measures

1) Work Area Isolation & Fish Salvage.
   a) Any work area within the wetted channel will be isolated from the active stream whenever ESA listed fish are reasonably certain to be present, or if the work area is less than 300-feet upstream from known spawning habitats.
   b) When work area isolation is required, engineering design plans will include all isolation elements, fish release areas, and, when a pump is used to dewater the isolation area and fish

are present, a fish screen that meets NMFS's fish screen criteria (NMFS 2011[6], or most current).

c) Work area isolation and fish capture activities will occur during periods of the coolest air and water temperatures possible, normally early in the morning versus late in the day, and during conditions appropriate to minimize stress and death of species present.

d) Salvage operations will follow the ordering, methodologies, and conservation measures specified below in Steps 1 through 6. Steps 1 and 2 will be implemented for all projects where work area isolation is necessary according to condition 1(a) above. Electrofishing (Step 3) can be implemented to ensure all fish have been removed following Steps 1 and 2, or when other means of fish capture may not be feasible or effective. Dewatering and rewatering (Steps 4 and 5) will be implemented unless wetted in-stream work is deemed to be minimally harmful to fish, and is beneficial to other aquatic species. Dewatering will not be conducted in areas occupied by lamprey, unless lampreys are salvaged using guidance set forth in US Fish and Wildlife Service (2010)[7].

i) **Step 1: Isolate**

(1) Block nets will be installed at up and downstream locations and maintained in a secured position to exclude fish from entering the project area.

(2) Nets will be secured to the stream channel bed and banks until fish capture and transport activities are complete. Nets may be left in place for the duration of the project to exclude fish.

(3) If block nets or traps remain in place more than one day, the nets and traps will be monitored at least daily to ensure they are secured to the banks and free of organic accumulation, and to minimize fish predation in the trap.

(4) Nets and traps will be monitored hourly anytime there is instream disturbance.

ii) **Step 2: Salvage** – As described below, fish trapped within the isolated work area will be captured to minimize the risk of injury, then released at a safe site:

(1) Remove as many fish as possible prior to dewatering.

(2) During dewatering, any remaining fish will be collected by hand or dip nets.

(3) Seines with a mesh size to ensure entrapment of the residing ESA-listed fish will be used.

(4) Minnow traps will be left in place overnight and used in conjunction with seining.

(5) If buckets are used to transport fish:

(a) The time fish are in a transport bucket will be limited, and will be released as quickly as possible;

(b) The number of fish within a bucket will be limited based on size, and fish will be of relatively comparable size to minimize predation;

(c) Aerators for buckets will be used or the bucket water will be frequently changed with cold clear water at 15 minute or more frequent intervals.

(d) Buckets will be kept in shaded areas or will be covered by a canopy in exposed areas.

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

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[6] National Marine Fisheries Service. 2011. Anadromous salmonid passage facility design. Northwest Region. Available online at: http://www.nwr.noaa.gov/Salmon-Hydropower/FERC/upload/Fish-Passage-Design.pdf

[7] U.S. Fish and Wildlife Service. 2010. Best management practices to minimize adverse effects to Pacific lamprey. Available online at: http://www.fws.gov/pacific/Fisheries/sphabcon/lamprey/pdf/Best%20Management%20Practices%20for%20Pacific%20Lamprey%20April%202010%20Version.pdf

(6) As rapidly as possible (especially for temperature-sensitive bull trout), fish will be released in an area that provides adequate cover and flow refuge. Upstream release is generally preferred, but fish released downstream will be sufficiently outside of the influence of construction.
(7) Salvage will be supervised by a qualified fisheries biologist experienced with work area isolation and competent to ensure the safe handling of all fish.

iii) **Step 3: Electrofishing** – Electrofishing will be used only after other salvage methods have been employed or when other means of fish capture may not be feasible or effective.

(1) If electrofishing will be used to capture fish for salvage, the salvage operation will be led by an experienced fisheries biologist and the following guidelines will be followed:
(a) The NMFS's electrofishing guidelines (NMFS 2000)[8].
(b) Only direct current (DC) or pulsed direct current (PDC) will be used.
(i) If conductivity is less than 100 μs, voltage ranges from 900 to 1100 will be used;
(ii) For conductivity ranges between 100 to 300 μs, voltage ranges will be 500 to 800;
(iii) For conductivity greater than 300 μs, voltage will be less than 400.
(c) Electrofishing will begin with a minimum pulse width and recommended voltage and then gradually increase to the point where fish are immobilized.
(d) The anode will not intentionally contact fish.
(e) Electrofishing shall not be conducted when the water conditions are turbid and visibility is poor. This condition may be experienced when the sampler cannot see the stream bottom in 1-foot of water.
(f) If mortality or obvious injury (defined as dark bands on the body, spinal deformations, de-scaling of 25% or more of body, and torpidity or inability to maintain upright attitude after sufficient recovery time) occurs during electrofishing, operations will be immediately discontinued, machine settings, water temperature and conductivity checked, and procedures adjusted or postponed to reduce mortality.

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

(1) Diversion around the construction site may be accomplished with a coffer dam and a by-pass culvert or pipe, or a lined, non-erodible diversion ditch. Where gravity feed is not possible, a pump may be used, but must be operated in such a way as to avoid repetitive dewatering and rewatering of the site. Impoundment behind the cofferdam must occur slowly through the transition, while constant flow is delivered to the downstream reaches.
(2) All pumps will have fish screens to avoid juvenile fish entrainment, and will be operated in accordance with NMFS's current fish screen criteria (NMFS 2011[9], or

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

[9] National Marine Fisheries Service. 2011. Anadromous salmonid passage facility design. Northwest Region. Available online at: http://www.nwr.noaa.gov/Salmon-Hydropower/FERC/upload/Fish-Passage-Design.pdf

most recent version). If the pumping rate exceeds 3 cfs, a NMFS Hydro fish passage review will be necessary.

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

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

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

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

vi) **Step 6: Salvage Notice** – Monitoring and recording of fish presence, handling, and mortality must occur during the duration of the isolation, salvage, electrofishing, dewatering, and rewatering operations. Once operations are completed, a salvage report will document procedures used, any fish injuries or deaths (including numbers of fish affected), and causes of any deaths.

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

3) Construction and discharge water.

a) Surface water may be diverted to meet construction needs, but only if developed sources are unavailable or inadequate.

b) Diversions will not exceed 10% of the available flow.

c) All construction discharge water will be collected and treated using the best available technology applicable to site conditions.

d) Treatments to remove debris, nutrients, sediment, petroleum hydrocarbons, metals and other pollutants likely to be present will be provided.

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

5) Cessation of work. Project operations will cease under the following conditions:

a) High flow conditions that may result in inundation of the project area, except for efforts to avoid or minimize resource damage;
b) When allowable water quality impacts, as defined by the state CWA section 401 water quality certification, have been exceeded; or
c) When take limitations have been reached or exceeded.

Post-construction Conservation Measures

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

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

3) Site access. The project sponsor will retain the right of reasonable access to the site in order to monitor the success of the project over its life.

Inspections and Monitoring

1) Implementation monitoring. Project sponsor staff or their designated representative will provide implementation monitoring to ensure compliance with the applicable biological opinion, including:
   a) General conservation measures are adequately followed; and
   b) Effects to listed species are not greater than predicted and incidental take limitations are not exceeded.

2) CWA section 401 water quality certification. The project sponsor or designated representative will complete and record water quality observations to ensure that in-water work is not degrading water quality. During construction, CWA section 401 water quality certification provisions provided by the Oregon Department of Environmental Quality will be followed.

Reptiles and Amphibians

Work with the local ODFW biologist to obtain a salvage permit, if needed, and jointly develop a plan to avoid and minimize disturbance and/or mortality to native turtles and amphibians.

ESA Listed Plants

Field surveys for listed plants and suitable habitat known or suspected to occur in the action area will occur prior to federal activities during the growing season, before aquatic restoration activities would occur. Any listed plant or plant suitable habitat discovered during the survey that is within 0.25 miles of the proposed aquatic restoration project will cause project planners to design the restoration activities to not "likely to adversely affect" listed plants. Understanding plant distribution and avoiding the plants during restoration activities has proven to be the best way to facilitate conservation for these species and to meet the goals of the agencies. In some cases restoration activities are consistent with listed plant recovery actions and can benefit listed species.

Migratory Birds

Migratory birds are protected under the Migratory Bird Treaty Act of 1918, as amended (16 USC 703-712). Under the Act, taking, killing or possessing migratory birds is unlawful. The best way to avoid disturbing nesting birds is to schedule activities outside the nesting season. The nesting season is not the same for all species, and not all sites will have nesting birds present during the entire nesting season. Here are some general guidelines to help you plan project activities:

1) The time between August 1 – January 31 is the best time to plan for tree removal, invasive plant species management, and grubbing and clearing.
2) Avoid disturbance activities between February 1 – April 15. This is considered the early nesting season. Disturbance to vegetation, especially trees, should be avoided during this time.
3) Avoid disturbance activities between April 15 – July 31. This is considered the primary nesting season. Disturbance to vegetation should be avoided during this time. If birds are not present during nesting season, vegetation removal and other disturbance activities may proceed.
4) If work must occur in the recommended avoidance time frames, the project area and specific vegetation impacted should be surveyed for nesting birds. We recommend you follow the City of Portland bird nesting guidelines at: http://www.portlandoregon.gov/bes/article/322164.
5) Field surveys for the western yellow-billed cuckoo (Coccyzus americanus), proposed as threatened under the ESA, and suitable habitat should be conducted if known or suspected to

occur in the action area prior to federal activities early in the nesting season. Consult with the Service prior to any construction activity if detected.

Bald Eagles

The bald eagle was formally delisted from the federal Endangered Species Act in 2008 but remains protected under the Migratory Bird Treaty Act of 1918, as amended (16 USC 703-712), and the Bald and Golden Eagle Protection Act of 1940, as amended (16 USC 668-668d). The nesting season for the bald eagle occurs between January 1 and August 31. If bald eagles are likely to be in the project area and Corps activities may disturb bald eagles during the nesting season, we recommend the Corps refer to the Service's guidance and restrictions at our website: http://www.fws.gov/pacific/eagle/disturb.html .

Thank you for the opportunity to provide these comments. Please contact Kathy Roberts or Rollie White at (503-231-6179) if you have any questions or concerns regarding this letter.

Sincerely yours,

Paul Henson, Ph.D
State Supervisor

cc: Kris Lightner, Corps Project Manager

Literature Cited

Corps (U.S. Army Corps of Engineers). 2014. Lower Willamette River Ecosystem Restoration Study Draft Integrated Feasibility Report/Programmatic Environmental Assessment.

NMFS (U.S. National Marine Fisheries Service). 2013. Programmatic Restoration Opinion for Joint Ecosystem Conservation by the Services (PROJECTS) by the U.S. Fish and Wildlife Service Using the Partners for Fish and Wildlife, Fisheries, Coastal, and Recovery Programs and NOAA Restoration Center Using the Damage Assessment, Remediation and Restoration Program (DARRP), and Community-Based Restoration Program (CRP) in the States of Oregon, Washington, and Idaho. 222 pp.