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 97232-1274

Refer to NMFS No.:
WCR-2018-10339

February 8, 2019

Michelle Walker
Corps of Engineers, Seattle District
Regulatory Branch CENWS-OD-RG
P.O. Box 3755
Seattle, Washington 98124-3755

Re: Endangered Species Act Section 7 Formal Consultation and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Consultation for Snohomish County's Riverview/Rivershore Road Embankment Repair Project on the Snohomish River, Snohomish County, Washington, COE Number: NWS-2016-798, Sixth Field HUC: 171100110203 – Snohomish River.

Dear Ms. Walker:

Thank you for your letter of December 27, 2016, requesting initiation of consultation with NOAA's National Marine Fisheries Service (NMFS) pursuant to section 7 of the Endangered Species Act of 1973 (ESA) (16 U.S.C. 1531 et seq.) for U.S Army Corps of Engineers (COE) authorization of Snohomish County's Riverview/Rivershore Road Embankment Repair Project. Thank you, also, for your request for consultation pursuant to the essential fish habitat (EFH) provisions in Section 305(b) of the Magnuson-Stevens Fishery Conservation and Management Act (MSA)(16 U.S.C. 1855(b)) for this action.

The enclosed document contains the biological opinion (Opinion) prepared by NMFS pursuant to section 7(a)(2) of the ESA to assess the effects of the proposed action. In the Opinion, NMFS concluded that the proposed action is likely to adversely affect but not likely to jeopardize the continued existence of Puget Sound (PS) Chinook salmon and PS Sound steelhead. NMFS also concluded that the proposed action is likely to adversely affect, but is not likely to result in the destruction or adverse modification of designated critical habitat for both of those species.

As required by section 7 of the ESA, NMFS has provided an incidental take statement (ITS) with the Opinion. The ITS describes reasonable and prudent measures (RPM) NMFS considers necessary or appropriate to minimize the impact of incidental take associated with this action, and sets forth nondiscretionary terms and conditions that the COE must comply with to meet those 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 MSA. NMFS reviewed the likely effects of the proposed action on EFH, and concluded that the action would adversely affect designated EFH for Pacific Coast Salmon, Pacific Coast Groundfish, and Coastal Pelagic Species. Therefore, we have included the results of that review in Section 3 of this document.

Please contact Donald Hubner in the North Puget Sound Branch of the Oregon/Washington Coastal Office at (206) 526-4359, or by electronic mail at Donald.Hubner@noaa.gov if you have any questions concerning this consultation, or if you require additional information.

Sincerely,

Kim W. Kratz, Ph.D.
Assistant Regional Administrator
Oregon Washington Coastal Office

cc: Andrew Shuckhart, COE

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

for the

Riverview/Rivershore Road Embankment Repair Project
Snohomish County, Washington
(Sixth Field HUC: 171100110203)

NMFS Consultation Numbers: WCR-2018-10339

Action Agency: U.S. Army Corps of Engineers

Affected Species and Determinations:

ESA-Listed Species	Status	Is Action Likely to Adversely Affect Species?	Is Action Likely To Jeopardize the Species?	Is Action Likely to Adversely Affect Critical Habitat?	Is Action Likely To Destroy or Adversely Modify Critical Habitat?
Chinook salmon (*Oncorhynchus tshawytscha*) Puget Sound (PS)	Threatened	Yes	No	Yes	No
steelhead (*O. mykiss*) PS	Threatened	Yes	No	Yes	No

N/A = not applicable. The action area is outside designated critical habitat, or critical habitat has not been designated.

Affected Essential Fish Habitat (EFH) and NMFS' Determinations:

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	No

Consultation Conducted By: National Marine Fisheries Service
West Coast Region

Issued By:

Kim W. Kratz, Ph.D.
Assistant Regional Administrator
Oregon Washington Coastal Office

Date: February 8, 2019

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LIST OF ACRONYMS and ABREVIATIONS

BA – Biological Assessment
BMP – Best Management Practices
CFR – Code of Federal Regulations
cfs – Cubic Feet per Second
dB – Decibel
DIP – Demographically Independent Population
DPS – Distinct Population Segment
DQA – Data Quality Act
EFH – Essential Fish Habitat
ESA – Endangered Species Act
ESU – Evolutionarily Significant Unit
HPA – Hydraulic Project Approval
HUC – Hydrologic Unit Code
ITS – Incidental Take Statement
LWD – Large Woody Debris
mg/L – Milligrams per Liter
MPG – Major Population Group
MSA – Magnuson-Stevens Fishery Conservation and Management Act
NMFS – National Marine Fisheries Service
NTU – Nephlometric Turbidity Units
Opinion – Biological Opinion
OWCO – Oregon Washington Coastal Office
PAH – Polycyclic Aromatic Hydrocarbons
PBF – Physical or Biological Feature
PCB – Polychlorinated Biphenyl
PCE – Primary Constituent Element
PFMC – Pacific Fishery Management Council
PS – Puget Sound
PSSTRT – Puget Sound Steelhead Technical Recovery Team
PSTRT – Puget Sound Technical Recovery Team
RL – Received Level
RM – River Mile
RMS – Root Mean Square
RPA – Reasonable and Prudent Alternative
RPM – Reasonable and Prudent Measure
SEL – Sound Exposure Level
SL – Source Level
TSS – Total Suspended Sediment
VSP – Viable Salmonid Population
WCR – Westcoast Region (NMFS)
WDFW – Washington State Department of Fish and Wildlife
WDOE – Washington State Department of Ecology

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 (16 USC 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.

We completed pre-dissemination review of this document using standards for utility, integrity, and objectivity in compliance with applicable guidelines issued under the Data Quality Act (section 515 of the Treasury and General Government Appropriations Act for Fiscal Year 2001, Public Law 106-554). A complete record of this consultation is on file at the Oregon Washington Coastal Office (OWCO) in Lacey, Washington.

1.2 Consultation History

On December 27, 2016, NMFS received a letter from the US Army Corps of Engineers (COE) requesting informal consultation for the proposed action (COE 2016). That consultation was assigned the tracking number WCR-2016-6134. NMFS informed the COE that formal consultation would be required, and requested additional information. On April 23, 2018, the consultation was closed due to lack of activity. The COE resubmitted a request for informal consultation for the proposed action on June 14, 2018. That consultation was assigned the tracking number WCR-2018-10067.

On July 11, 2018, NMFS sent an e-mail to inform the COE that formal consultation was required, and that additional information was required to initiate formal consultation. The next day, NMFS sent a signed letter to the COE that restated the need for formal consultation and the additional information. On July 12, 2018, the COE requested formal consultation and provided some of the requested information. The new request was assigned the tracking number WCR-2018-10339. On July 27, 2018, NMFS reminded the COE of missing information. Final information was received on August 13, 2018. Formal consultation was initiated on that date.

This Opinion is based on the review of the information and project drawings in the Biological Assessment (BA) for the project (Snohomish County 2016); supplemental materials and responses to NMFS questions (Snohomish County 2018a & b); recovery plans, status reviews, and critical habitat designations for ESA-listed PS Chinook salmon and PS steelhead; published and unpublished scientific information on the biology and ecology of those species; and relevant scientific and gray literature (see Literature Cited).

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 (50 CFR 402.02). “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 (50 CFR 402.02).

The COE proposes to authorize Snohomish County Public Works (the applicant) to repair damaged sections of the Riverview/Rivershore Road and embankment as they occur over 10 years (2019 through 2028). Work would occur along 2.8 miles of riverbank west of the City of Snohomish, Washington, to include about 2.6 miles of the Snohomish River upstream of river mile (RM) 8, and 0.2 mile of the upstream end of Ebey Slough (Figure 1). The COE identified no actions that would be interrelated or interdependent with the proposed action. However, the authorized repairs would extend the useful life of the revetment for several additional decades.

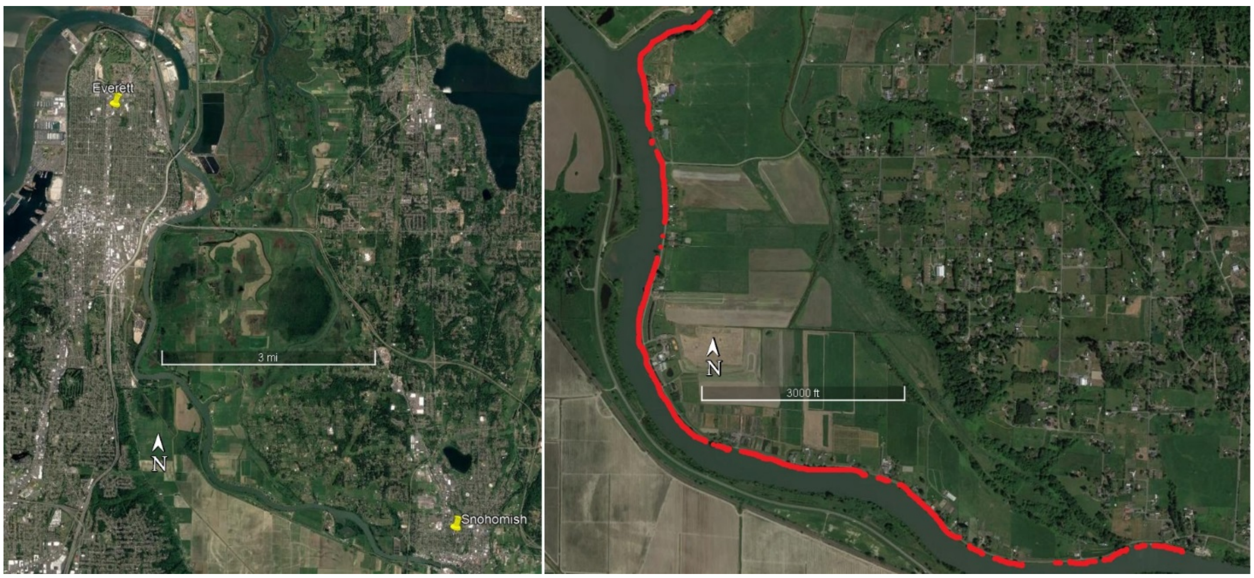

Figure 1. Google satellite photographs of the Riverview/Rivershore Road and Embankment Repair project area in Snohomish County, Washington. The left image shows the Cities of Everett and Snohomish. The project reach is to the right of the North arrow. The right image shows the Snohomish River with the general areas where work would be done shown in red. The breaks in the line indicate areas that were recently repaired. Work under this project would not be done in those 16 areas.

As needed over the next 10 years, Snohomish County Public Works (the county) would repair damaged sections of the existing embankment and roadway. Previous work over an 11-year period repaired 16 sites along this reach, with a cumulative length of 0.4 mile. The individual lengths of repair varied between 50 and 500 feet, with most being 100 feet or less. The amount of construction over the next 10 years is expected to be similar. However, for the purposes of this consultation, the county estimates that up to 5 sites, each up to 500 linear feet in length, may be repaired in any given year, with repairs requiring 12 to 20 weeks of work.

The goal of the project is to conduct repairs prior to failure or imminent failure to avoid emergency conditions and working during high flows. Currently, 5 sites along the reach were damaged during flooding in 2015. Of those five, the sites at mileposts 1.95, 2.4, and 2.45 have been identified as the highest priorities, and FEMA funding has been secured to conduct the work. Proposed repairs in 2019 would involve 12 weeks of work between July 1 and October 3 to repair 3 to 5 sites. The work would total 300 linear feet.

The design and methodology described below would be used at all sites. The county and/or its contractors would operate excavators, back hoes, trucks, and various other equipment and tools from the road and bank to remove damaged sections of embankment, and install reinforced wrapped-soil slopes with 12- to 18-inch diameter logs with root wads anchored along its base.

Construction workers would first establish and mark project and clearing limits, and grade controls. They would then mobilize their equipment and materials, install erosion and pollution prevention controls. No in-water work is anticipated along this tidally influenced section of the Snohomish River. All work below ordinary high water (OHW) would be above the water level during low tide. However, a turbidity curtain would be installed around the project area, and any fish that may be present would be herded away from the site with barrier nets. No electrofishing is planned.

They would then excavate the road and embankment to create a bench that would span the length of the project site. The bench would be about 5 feet below the road grade and above the high tide line (Figure 2). Heavy equipment would be operated from the bench. Each day a section of the embankment between the bench and the bottom of the embankment would be excavated. Typically the excavation would be 10 to 15 feet deep, but the depth will vary by site. The length of the lower excavation would be limited to about 25 feet to allow the work to be done in the dry during low tide. Excavated materials will be hauled off site to an approved location.

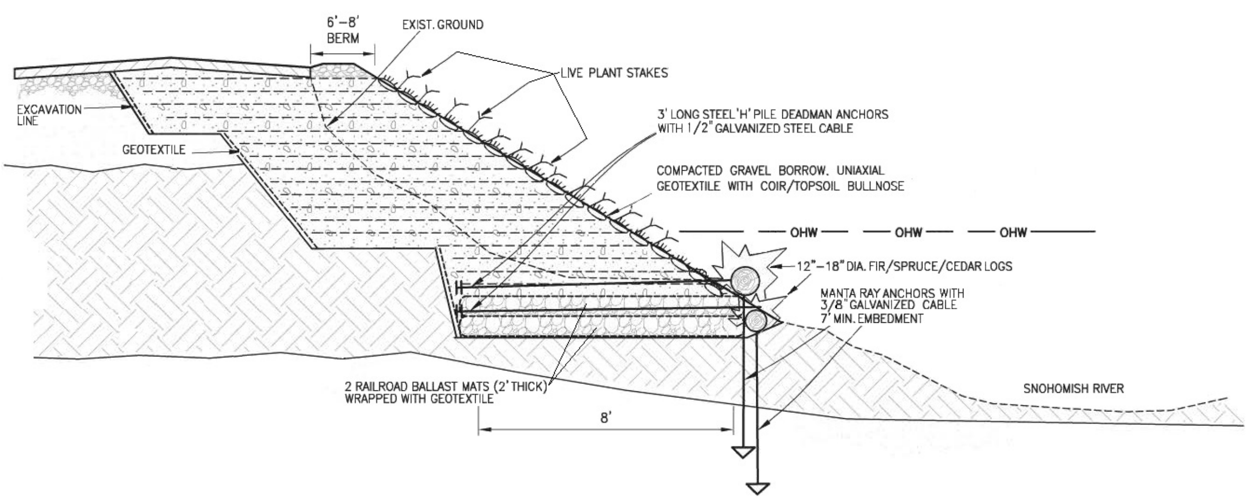

Figure 2. Cross-section drawing of typical embankment repair. (Adapted from Appendix D: Plans, Sheet 4 of 7 in Snohomish County 2016).

The excavated area would be lined with geotextile to prevent the migration of fine materials and settling. Two 18-inch thick layers of geotextile-wrapped railroad ballast (ballast mats) would be installed as the foundation. H-pile deadman anchors would be placed between the mats and the inside wall of the excavated trench. 12- to 18-inch diameter logs with root wads would be installed outboard of the mats. Half-inch diameter galvanized cables would be run across the tops of mats to tie the logs to the deadman anchors. The logs would also be secured with galvanized cable and embedment style anchors that would be installed a minimum of 7 feet deep.

A series of 1-foot high layers of geogrid-wrapped gravel would be installed on top of the ballast mats to create new bank with a 1:1 (45°) slope. The outboard end of each layer would consist of coir-wrapped top soil to form a bullnose of soil to plant live tree and shrub stakes. Live plant stakes would be installed into the bullnose in 3 layers; Willow along the bottom; Red Osier Dogwood in the middle; and Salmon Berry and Nootka Rose at the top (Figure 3). Road work would be done above the new embankment to complete the project.

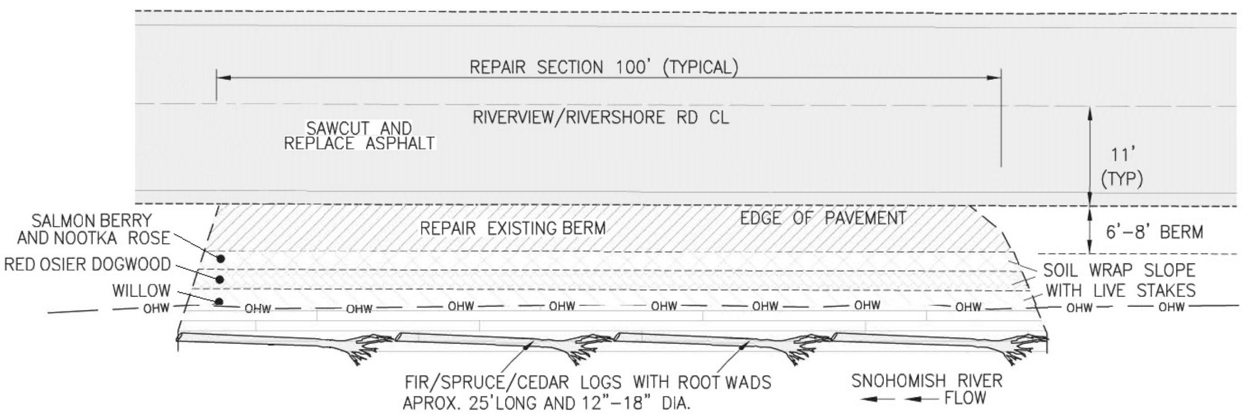

Figure 3. Overhead drawing of typical embankment repair. (Adapted from Appendix D: Plans, Sheets 3 and 7 of 7 in Snohomish County 2016).

The project would also include above-water work to repair sink holes that form along the road, as well as other small-scale road repairs as may be needed. To reduce the potential for, and intensity of impacts on listed species and their habitat resources, the county's contractors would be required to comply with the Impact Avoidance and Conservation Measures identified in the county's BA. They would also be required to comply with Spill Prevention, Control, and Countermeasure (SPCC) and Stormwater Pollution Prevention (SWPP) measures that are consistent with Washington State Department of Transportation's (WDOT) 2010 Regional Road Maintenance Endangered Species Act Program Guidelines, as well the provisions listed in the Washington State Department of Fish and Wildlife (WDFW) Hydraulic Project Approval (HPA) that would be issued annually for this project.

Additionally, invasive plant control may be needed among live stake plantings. Weeds and non-native species would be removed by mechanical techniques and/or the use of herbicides. Herbicide use would be limited to aquatic-labeled glyphosate, imazapyr, and triclopyr TEA, all with vegetable oil based surfactants. The concentrations and volumes used would not exceed the manufacturer's maximum recommendations. Herbicide application would be limited to hand-selective and/or backpack sprayers on dry/non-windy days, with protective barriers placed to minimize drift and over-spray. Spot spraying with imazapyr and triclopyr TEA would occur no closer than 15 feet from the waterline (WDOA 2018; Snohomish County 2018b).

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

The ESA establishes a national program for conserving threatened and endangered species of fish, wildlife, plants, and the habitat upon which they depend. As required by section 7(a)(2) of the ESA, each Federal agency must ensure that its actions are not likely to jeopardize the continued existence of endangered or threatened species, or adversely modify or destroy their designated critical habitat. Per the requirements of the ESA, Federal action agencies consult with NMFS and section 7(b)(3) requires that, at the conclusion of consultation, NMFS provides an opinion stating how the agency's actions would affect listed species and their critical habitats. If incidental take is reasonably certain to occur, section 7(b)(4) requires NMFS to provide an ITS that specifies the impact of any incidental taking and includes non-discretionary reasonable and prudent measures (RPMs) and terms and conditions to minimize such impacts.

2.1 Analytical Approach

This biological opinion includes both a jeopardy analysis and/or an adverse modification analysis. The jeopardy analysis relies upon the regulatory definition of "to jeopardize the continued existence of" a listed species, which is "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). Therefore, the jeopardy analysis considers both survival and recovery of the species.

This biological opinion relies on the definition of "destruction or adverse modification," which "means a direct or indirect alteration that appreciably diminishes the value of critical habitat for the conservation of a listed species. Such alterations may include, but are not limited to, those that alter the physical or biological features essential to the conservation of a species or that preclude or significantly delay development of such features" (81 FR 7214).

The designation(s) of critical habitat for (species) use(s) the term primary constituent element (PCE) or essential features. The new critical habitat regulations (81 FR 7414) replace this term with physical or biological features (PBFs). The shift in terminology does not change the approach used in conducting a ''destruction or adverse modification'' analysis, which is the same regardless of whether the original designation identified PCEs, PBFs, or essential features. In this biological opinion, we use the term PBF to mean PCE or essential feature, as appropriate for the specific critical habitat.

We use the following approach to determine whether a proposed action is likely to jeopardize listed species or to cause the destruction or adverse modification of designated critical habitat:

- Identify the range-wide status of the species and critical habitat expected to be adversely affected by the proposed action.
- Describe the environmental baseline in the action area.
- Analyze the effects of the proposed action on both species and their habitat using an "exposure-response-risk" approach.
- Describe any cumulative effects in the action area.
- Integrate and synthesize the above factors by: (1) Reviewing the status of the species and critical habitat; and (2) adding the effects of the action, the environmental baseline, and cumulative effects to assess the risk that the proposed action poses to species and critical habitat.
- Reach a conclusion about whether species are jeopardized or critical habitat is adversely modified.
- If necessary, suggest a reasonable and prudent alternative (RPA) to the proposed action.

2.2 Range-wide Status of the Species and Critical Habitat

This Opinion examines the status of each species that would be adversely affected by the proposed action. The status is determined by the level of extinction risk that the listed species face, based on parameters considered in documents such as recovery plans, status reviews, and listing decisions. This informs the description of the species' likelihood of both survival and recovery. The species status section also 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 PBFs that help to form that conservation value.

The project sites are located in freshwater streams that are occupied by the Puget Sound (PS) Chinook salmon (*Oncorhynchus tshawytscha*) Evolutionarily Significant Unit (ESU) and the PS steelhead (*O. mykiss*) Distinct Population Segment (DPS), which are both currently listed as threatened under the ESA. These streams are also designated as critical habitat for one or both species (70 FR 52630; September 2, 2005 and 81 FR 9252; February 24, 2016) (Table 1).

Table 1. ESA-listed marine species that may be affected by the proposed action.

ESA-listed marine species and critical habitat likely to be adversely affected (LAA)				
Species	**Status**	**Species**	**Critical Habitat**	**Listed / CH Designated**
Chinook salmon (*Oncorhynchus tshawytscha*) Puget Sound	Threatened	LAA	LAA	06/28/05 (70 FR 37160) / 09/02/05 (70 FR 52630)
steelhead (*O. mykiss*) Puget Sound	Threatened	LAA	LAA	05/11/07 (72 FR 26722) / 02/24/16 (81 FR 9252)

The summaries that follow describe the status of the ESA-listed species, and their designated critical habitats, that occur within the action area and are considered in this opinion. More detailed information on the biology, habitat, and conservation status and trend of these listed resources can be found in the recovery plans and other sources at:

http://www.nmfs.noaa.gov/pr/species/fish/ and, and in the listing regulations and critical habitat designations published in the Federal Register and are incorporated here by reference.

Listed Species

Viable Salmonid Population (VSP) Criteria: For Pacific salmonids, we commonly use four VSP criteria (McElhany *et al*. 2000) to assess the viability of the populations that constitute the species. These four criteria (spatial structure, diversity, abundance, and productivity) 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.

"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 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 in single genes to complex life history traits.

"Abundance" generally refers to the number of naturally-produced adults that return to their natal spawning grounds.

"Productivity" refers to 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 in decline.

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

The summaries that follow describe the status of the ESA-listed species, and their designated critical habitats, that occur within the geographic area of this proposed action and are considered in this opinion. 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.

Puget Sound (PS) Chinook Salmon

The PS Chinook salmon evolutionarily significant unit (ESU) was listed as threatened on June 28, 2005 (70 FR 37160). We adopted the recovery plan for this ESU in January 2007. The recovery plan consists of two documents: the Puget Sound salmon recovery plan (SSPS 2007) and a supplement by NMFS (2006). The recovery plan adopts ESU and population level viability criteria recommended by the Puget Sound Technical Recovery Team (PSTRT) (Ruckelshaus *et al*. 2002). The PSTRT's biological recovery criteria will be met when all of the following conditions are achieved:

- The viability status of all populations in the ESU is improved from current conditions, and when considered in the aggregate, persistence of the ESU is assured;
- Two to four Chinook salmon populations in each of the five biogeographical regions of the ESU (Table 1) achieve viability, depending on the historical biological characteristics and acceptable risk levels for populations within each region;
- At least one population from each major genetic and life history group historically present within each of the five biogeographical regions is viable;
- Tributaries to Puget Sound not identified as primary freshwater habitat for any of the 22 identified populations are functioning in a manner that is sufficient to support an ESU-wide recovery scenario; Production of Chinook salmon from tributaries to Puget Sound not identified as primary freshwater habitat for any of the 22 identified populations occurs in a manner consistent with ESU recovery; and
- Populations that do not meet all the Viable Salmon Population (VSP) parameters are sustained to provide ecological functions and preserve options for ESU recovery.

<u>General Life History:</u> Adult Chinook salmon spawn in freshwater streams, depositing fertilized eggs in gravel "nests" called redds. The eggs incubate for three to five months before juveniles hatch and emerge from the gravel. Juveniles spend from three months to two years in freshwater before migrating to the ocean to feed and mature. Chinook salmon spend from one to six years in the ocean before returning to their natal freshwater streams where they spawn and then die.

Chinook salmon are divided into two races, stream-types and ocean-types, based on the major juvenile development strategies. Stream-type juveniles rear in freshwater for a year or more before entering marine waters. Conversely, ocean-type juveniles tend to leave their natal streams early during their first year of life, and rear in estuarine waters as they transition into their marine life stage.

Chinook salmon are further grouped into "runs" that are based on the timing of adults that return to freshwater. Early- or spring-run chinook salmon tend to enter freshwater as immature fish, migrate far upriver, and finally spawn in the late summer and early autumn. Late- or fall-run Chinook salmon enter freshwater at an advanced stage of maturity, move rapidly to their spawning areas, and spawn within a few days or weeks. Summer-run fish show intermediate characteristics of spring and fall runs, without the extensive delay in maturation exhibited by spring-run Chinook salmon.

<u>Spatial Structure and Diversity:</u> The PS Sound Chinook salmon ESU includes all naturally spawning populations of Chinook salmon from rivers and streams flowing into Puget Sound including the Straits of Juan De Fuca from the Elwha River, eastward, including rivers and streams flowing into Hood Canal, South Sound, North Sound and the Strait of Georgia in Washington. The ESU also includes the progeny of numerous artificial propagation programs (NWFSC 2015). The PSTRT identified 22 extant populations, grouped into five major geographic regions, based on consideration of historical distribution, geographic isolation,

dispersal rates, genetic data, life history information, population dynamics, and environmental and ecological diversity. The PSTRT distributed the 22 populations among five major biogeographical regions, or major population groups (MPGs), that are based on similarities in hydrographic, biogeographic, and geologic characteristics (Table 2).

Table 2. Extant PS Chinook salmon populations in each biogeographic region (Ruckelshaus *et al*. 2002, NWFSC 2015).

Biogeographic Region	Population (Watershed)
Strait of Georgia	North Fork Nooksack River
	South Fork Nooksack River
Strait of Juan de Fuca	Elwha River
	Dungeness River
Hood Canal	Skokomish River
	Mid Hood Canal River
Whidbey Basin	Skykomish River
	Snoqualmie River
	North Fork Stillaguamish River
	South Fork Stillaguamish River
	Upper Skagit River
	Lower Skagit River
	Upper Sauk River
	Lower Sauk River
	Suiattle River
	Upper Cascade River
Central/South Puget Sound Basin	Cedar River
	North Lake Washington/ Sammamish River
	Green/Duwamish River
	Puyallup River
	White River
	Nisqually River

Hatchery-origin spawners are present in high fractions in most populations within the ESU, with the Whidbey Basin the only MPG with consistently high fractions of natural-origin spawners. Between 1990 and 2014, the fraction of natural-origin spawners has declined in many of the populations outside of the Skagit watershed (NWFSC 2015).

Abundance and Productivity: Available data on total abundance since 1980 indicate that abundance trends have fluctuated between positive and negative for individual populations, but productivity remains low in most populations, and hatchery-origin spawners are present in high fractions in most populations outside of the Skagit watershed. Available data now show that most populations have declined in abundance over the past 7 to 10 years. Further, escapement levels for all populations remain well below the PSTRT planning ranges for recovery, and most populations are consistently below the spawner-recruit levels identified by the PSTRT as consistent with recovery (NWFSC 2015). The current information on abundance, productivity, spatial structure and diversity suggest that the Whidbey Basin MPG is at relatively low risk of extinction. The other four MPGs are considered to be at high risk of extinction due to low abundance and productivity (NWFSC 2015). The most recent 5-year status review concluded that the ESU should remain listed as threatened (NMFS 2017).

Limiting Factors: Factors limiting recovery for PS Chinook salmon include:

- Degraded floodplain and in-river channel structure
- Degraded estuarine conditions and loss of estuarine habitat
- Riparian area degradation and loss of in-river large woody debris
- Excessive fine-grained sediment in spawning gravel
- Degraded water quality and temperature
- Degraded nearshore conditions
- Impaired passage for migrating fish
- Severely altered flow regime

PS Chinook Salmon within the Action Area: The PS Chinook salmon that occur in the action area would be summer run fish from the Skykomish River MPG, and fall run fish from the Skykomish and Snohomish River MPGs. The project reach provides migratory habitat for juvenile and adult life stages, as well spawning habitat for summer-run fish along the upstream 1,800 feet of the project reach (Snohomish 2016; WDFW 2018a). Some rearing of juveniles is also likely along the project reach. Documented spawning of fall-run fish occurs well upstream of the project reach.

Since 1965, the estimated total abundance for returning adult PS Chinook salmon has fluctuated between about 1,200 and 7,600 in the Skykomish River basin, and about 321 and 3,600 in the Snoqualmie River basin (WDFW 2018b), with the average trend being slightly negative in both MPGs, and natural productivity in the Skykomish considered below replacement for all years since the mid-1980s (NWFSC 2015). In 2017, the total numbers of returning adults were about 4,400 and 1,700 for the Skykomish and Snoqualmie Rivers, respectively (WDFW 2017b). Since 1997, the fraction of natural-origin spawners has fluctuated between about 34 to 83 percent, and 65 to 93 percent, respectively. The 2017 fraction of natural-origin spawners was about 64 and 80 percent, respectively (WDFW 2017b).

Returning adult Chinook salmon tend to enter the Snohomish River and migrate upstream early-June through mid-October, with most spawning occurring from mid-September to mid-November. Juveniles typically migrate toward marine waters between early-March and mid-July during the first year of life, but stream-type fish may be present in the system year-round.

Puget Sound (PS) Steelhead

The PS steelhead distinct population segment (DPS) was listed as threatened on May 11, 2007 (72 FR 26722). The recovery plan for this DPS is under development. In 2013, the Puget Sound Steelhead Technical Recovery Team (PSSTRT) identified 32 demographically independent populations (DIPs) within the DPS, based on genetic, environmental, and life history characteristics. Those DIPs are distributed among three geographically-based major population groups (MPGs); Northern Cascades, Central and South Puget Sound; and Hood Canal and Strait de Fuca (Myers *et al.* 2015) (Table 3).

Table 3. PS steelhead Major Population Groups (MPGs), Demographically Independent Populations (DIPs), and DIP Viability Estimates (Modified from Figure 58 in Hard *et al.* 2015).

Geographic Region (MPG)	Demographically Independent Population (DIP)	Viability
Northern Cascades	Drayton Harbor Tributaries Winter Run	Moderate
	Nooksack River Winter Run	Moderate
	South Fork Nooksack River Summer Run	Moderate
	Samish River/Bellingham Bay Tributaries Winter Run	Moderate
	Skagit River Summer Run and Winter Run	Moderate
	Nookachamps River Winter Run	Moderate
	Baker River Summer Run and Winter Run	Moderate
	Sauk River Summer Run and Winter Run	Moderate
	Stillaguamish River Winter Run	Low
	Deer Creek Summer Run	Moderate
	Canyon Creek Summer Run	Moderate
	Snohomish/Skykomish Rivers Winter Run	Moderate
	Pilchuck River Winter Run	Low
	North Fork Skykomish River Summer Run	Moderate
	Snoqualmie River Winter Run	Moderate
	Tolt River Summer Run	Moderate
Central and South Puget Sound	Cedar River Summer Run and Winter Run	Low
	North Lake Washington and Lake Sammamish Winter Run	Moderate
	Green River Winter Run	Low
	Puyallup River Winter Run	Low
	White River Winter Run	Low
	Nisqually River Winter Run	Low
	South Sound Tributaries Winter Run	Moderate
	East Kitsap Peninsula Tributaries Winter Run	Moderate
Hood Canal and Strait de Fuca	East Hood Canal Winter Run	Low
	South Hood Canal Tributaries Winter Run	Low
	Skokomish River Winter Run	Low
	West Hood Canal Tributaries Winter Run	Moderate
	Sequim/Discovery Bay Tributaries Winter Run	Low
	Dungeness River Summer Run and Winter Run	Moderate
	Strait of Juan de Fuca Tributaries Winter Run	Low
	Elwha River Summer Run and Winter Run	Low

In 2015, the PSSTRT concluded that the DPS is at "very low" viability; with most of the 32 DIPs and all three MPGs at "low" viability based on widespread diminished abundance, productivity, diversity, and spatial structure when compared with available historical evidence (Hard *et al.* 2015). Based on the PSSTRT viability criteria, the DPS would be considered viable when all three component MPG are considered viable. A given MPG would be considered viable when: 1) 40 percent or more of its component DIP are viable; 2) mean DIP viability within the MPG exceeds the threshold for viability; and 3) 40 percent or more of the historic life history strategies (i.e., summer runs and winter runs) within the MPG are viable. For a given DIP to be considered viable, its probability of persistence must exceed 85 percent, as calculated by Hard *et al.* (2015), based on abundance, productivity, diversity, and spatial structure within the DIP.

General Life History: PS steelhead exhibit two major life history strategies. Ocean-maturing, or winter-run fish typically enter freshwater from November to April at an advanced stage of maturation, and then spawn from February through June. Stream-maturing, or summer-run fish typically enter freshwater from May to October at an early stage of maturation, migrate to headwater areas, and hold for several months prior to spawning in the following spring. After hatching, juveniles rear in freshwater from one to three years prior to migrating to marine habitats (two years is typical). Smoltification and seaward migration typically occurs from April to mid-May. Smolt lengths vary between watersheds, but typically range from 4.3 to 9.2 inches (109 to 235 mm) (Myers et al. 2015). Juvenile steelhead are generally independent of shallow nearshore areas soon after entering marine water (Bax et al. 1978, Brennan et al. 2004, Schreiner et al. 1977), and are not commonly caught in beach seine surveys. Recent acoustic tagging studies (Moore et al. 2010) have shown that smolts migrate from rivers to the Strait of Juan de Fuca from one to three weeks. PS steelhead feed in the ocean waters for one to three years (two years is again typical), before returning to their natal streams to spawn. Unlike Chinook salmon, most female steelhead, and some males, return to marine waters following spawning (Myers et al. 2015).

Spatial Structure and Diversity: The PS steelhead DPS includes all naturally spawned anadromous steelhead populations in streams in the river basins of the Strait of Juan de Fuca, Puget Sound, and Hood Canal, Washington, bounded to the west by the Elwha River (inclusive) and to the north by the Nooksack River and Dakota Creek (inclusive). The DPS also includes six hatchery stocks that are considered no more than moderately diverged from their associated natural-origin counterparts (USDC 2014). PS steelhead are the anadromous form of *O. mykiss* that occur below natural barriers to migration in northwestern Washington State (NWFSC 2015). Non-anadromous ‘‘resident’’ *O. mykiss* (a.k.a. rainbow trout) occur within the range of PS steelhead but are not part of the DPS due to marked differences in physical, physiological, ecological, and behavioral characteristics (Hard *et al*. 2015). As stated above, the DPS consists of 32 DIP that are distributed among three geographically-based MPG. An individual DIP may consist of winter-run only, summer-run only, or a combination of both life history types. Winter-run is the predominant life history type in the DPS (Hard *et al.* 2015).

Abundance and Productivity: Available data on total abundance since the late 1970s and early 1980s indicate that abundance trends have fluctuated between positive and negative for individual DIP. However, low productivity persists throughout the 32 DIP, with most showing downward trends, and a few showing sharply downward trends (Hard *et al.* 2015, NWFSC 2015). Since the mid-1980s, trends in natural spawning abundance have also been temporally variable for most DIP but remain predominantly negative, and well below replacement for at least 8 of the DIP (NWFSC 2015). Smoothed abundance trends since 2009 show modest increases for 13 DIP. However, those trends are similar to variability seen across the DPS, where brief periods of increase are followed by decades of decline. Further, several of the upward trends are not statistically different from neutral, and most populations remain small. Nine of the evaluated DIP had geometric mean abundances of fewer than 250 adults, and 12 had fewer than 500 adults (NWFSC 2015). Over the time series examined, the over-all abundance trends, especially for natural spawners, remain predominantly negative or flat across the DPS, and general steelhead abundance across the DPS remains well below the level needed to sustain natural production into the future (NWFSC 2015). The PSSTRT recently concluded that the PS steelhead DPS is currently not viable (Hard *et al.* 2015). The DPS's current abundance and productivity are considered to be well below the targets needed to achieve delisting and recovery. Growth rates are currently declining at 3 to 10% annually for all but a few DIPs, and the extinction risk for most populations is estimated to be moderate to high. The most recent 5-year status review concluded that the DPS should remain listed as threatened (NMFS 2017).

Limiting Factors: Factors limiting recovery for PS steelhead include:

- The continued destruction and modification of steelhead habitat
- Widespread declines in adult abundance (total run size), despite significant reductions in harvest in recent years
- Threats to diversity posed by use of two hatchery steelhead stocks (Chambers Creek and Skamania)
- Declining diversity in the DPS, including the uncertain but weak status of summer run fish
- A reduction in spatial structure
- Reduced habitat quality through changes in river hydrology, temperature profile, downstream gravel recruitment, and reduced movement of large woody debris
- In the lower reaches of many rivers and their tributaries in Puget Sound where urban development has occurred, increased flood frequency and peak flows during storms and reduced groundwater-driven summer flows, with resultant gravel scour, bank erosion, and sediment deposition
- Dikes, hardening of banks with riprap, and channelization, which have reduced river braiding and sinuosity, increasing the likelihood of gravel scour and dislocation of rearing juveniles

PS Steelhead within the Action Area: The PS steelhead that occur in the action area would be summer-run steelhead from the North Fork Skykomish and Tolt River DIPs, and winter-run steelhead from the Pilchuck, Snohomish/Skykomish, and Snoqualmie River DIPs. NWFSC (2015) reported that abundance trends for the period between 1999 and 2014 was negative for all of the Snohomish system DIPs. Despite brief upward swings, recent information suggests that the overall trend continues to be negative (WDFW 2018c). Since 1981, the estimated total abundance for returning adult PS steelhead in the Snohomish system has fluctuated between about 279 and 1,706; 372 and 4,760; and 292 and 2,536 in the Pilchuck; Snohomish/Skykomish; and Snoqualmie DIPs, respectively. The estimated total abundance for returning adult PS steelhead in the Tolt DIP has fluctuated between about 16 and 366 since 1985. No return data is available for the North Fork Skykomish DIP. In 2018, the total number of returning adults was about 588; 372; 292; and 30 in the Pilchuck; Snohomish/Skykomish; Snoqualmie; and Tolt DIPs, respectively (WDFW 2018c).

The project reach provides migratory habitat for juvenile and adult life stages, as well rearing habitat for juveniles (WDFW 2018a). Summer-Run adults typically enter the river from May to October. Winter-run adults typically enter the river between early November and the end of April. Juveniles may be present year-round, but typically migrate to marine waters between April and mid-May when they smoltify (Myers *et al*. 2015).

Critical Habitat

This section describes the status of designated critical habitat that would be affected by the proposed action by examining the condition and trends of physical or biological features (PBFs) that are essential to the conservation of the listed species throughout the designated areas. The PBFs are essential because they support one or more of the species' life stages (e.g., sites with conditions that support spawning, rearing, migration and foraging). The proposed project would affect critical habitat for PS Chinook salmon and PS steelhead.

Puget Sound Chinook Salmon Critical Habitat: NMFS designated critical habitat for PS Chinook salmon on September 2, 2005 (70 FR 52630). That critical habitat is located in 16 freshwater subbasins and watersheds between the Dungeness/Elwha Watershed and the Nooksack Subbasin, inclusively, as well as in nearshore marine waters of the Puget Sound that are south of the US-Canada border and east of the Elwha River, and out to a depth of 30 meters. Although offshore marine is an area type identified in the final rule, it was not designated as critical habitat for PS Chinook salmon.

PS steelhead critical habitat: Critical habitat for PS steelhead was designated in 18 freshwater subbasins between the Strait of Georgia Subbasin and the Dungeness-Elwha Subbasin, inclusively. No marine waters were designated as critical habitat for PS steelhead.

The PBFs of salmonid critical habitat include: (1) Freshwater spawning sites with water quantity and quality conditions and substrate supporting spawning, incubation and larval development; (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; (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; (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; (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; and (6) Offshore marine areas with water quality conditions and forage, including aquatic invertebrates and fishes, supporting growth and maturation. The PBF for PS Chinook salmon and PS steelhead critical habitat are listed in Table 4.

Major tributary river basins in the Puget Sound basin include the Nooksack, Samish, Skagit, Sauk, Stillaguamish, Snohomish, Lake Washington, Cedar, Sammamish, Green, Duwamish, Puyallup, White, Carbon, Nisqually, Deschutes, Skokomish, Duckabush, Dosewallips, Big

Quilcene, Elwha, and Dungeness rivers and Soos Creek. Critical habitat throughout the Puget Sound basin has been degraded by numerous activities, including hydropower development, loss of mature riparian forests, increased sediment inputs, removal of large woody debris (LWD) from the waterways, intense urbanization, agriculture, alteration of floodplain and stream morphology (*i.e*., channel modifications and diking), riparian vegetation disturbance, wetland draining and conversion, dredging, armoring of shorelines, marina and port development, road and railroad construction and maintenance, logging, and mining. Changes in habitat quantity, availability, and diversity, and flow, temperature, sediment load and channel instability are common limiting factors of critical habitat throughout the basin.

Table 4. Physical or biological features (PBFs) of designated critical habitat for PS Chinook salmon and PS steelhead, and the corresponding life history events. Although nearshore and offshore marine areas were identified in both respective FR, no offshore marine areas were designated as critical habitat for PS Chinook salmon, and neither was designated as critical habitat for PS steelhead.

Physical or Biological Features		
Site Type	**Site Attribute**	**Life History Event**
Freshwater spawning	Water quantity Water quality Substrate	Adult spawning Embryo incubation Alevin growth and development
Freshwater rearing	Water quantity and Floodplain connectivity Water quality and Forage Natural cover	Fry emergence from gravel Fry/parr/smolt growth and development
Freshwater migration	(Free of obstruction and excessive predation) Water quantity and quality Natural cover	Adult sexual maturation Adult upstream migration and holding Kelt (steelhead) seaward migration Fry/parr/smolt growth, development, and seaward migration
Estuarine	(Free of obstruction and excessive predation) Water quality, quantity, and salinity Natural cover Forage	Adult sexual maturation and "reverse smoltification" Adult upstream migration and holding Kelt (steelhead) seaward migration Fry/parr/smolt growth, development, and seaward migration
Nearshore marine	(Free of obstruction and excessive predation) Water quality, quantity, and forage Natural cover	Adult growth and sexual maturation Adult spawning migration Nearshore juvenile rearing
Offshore marine	Water quality and forage	Adult growth and sexual maturation Adult spawning migration Subadult rearing

Land use practices have likely accelerated the frequency of landslides delivering sediment to streams. Fine sediment from unpaved roads also contributes to stream sedimentation. Unpaved roads are widespread on forested lands in the Puget Sound basin, and to a lesser extent, in rural residential areas. Historical logging removed most of the riparian trees near stream channels. Subsequent agricultural and urban conversion permanently altered riparian vegetation in the river valleys, leaving either no trees, or a thin band of trees. The riparian zones along many agricultural areas are now dominated by alder, invasive canary grass and blackberries, and provide substantially reduced stream shade and LW recruitment (SSPS 2007).

Diking, agriculture, revetments, railroads and roads in lower stream reaches have caused significant loss of secondary channels in major valley floodplains in this region. Confined main channels create high-energy peak flows that remove smaller substrate particles and LWD. The loss of side-channels, oxbow lakes, and backwater habitats has resulted in a significant loss of juvenile salmonid rearing and refuge habitat.

Wetlands play an important role in hydrologic processes, as they store water which ameliorates high and low flows. The interchange of surface and groundwater in complex stream and wetland systems helps to moderate stream temperatures. Thousands of acres of lowland wetlands across the region have been drained and converted to agricultural and urban uses, and forest wetlands are estimated to have diminished by one-third in Washington State (FEMAT 1993; Spence *et al*. 1996; SSPS 2007).

Loss of riparian habitat, elevated water temperatures, elevated levels of nutrients, increased nitrogen and phosphorus, and higher levels of suspended sediment, presumably from urban and highway runoff, wastewater treatment, failing septic systems, and agriculture or livestock impacts, have been documented in many Puget Sound tributaries (SSPS 2007).

Peak stream flows have increased over time due to paving (roads and parking areas), reduced percolation through surface soils on residential and agricultural lands, simplified and extended drainage networks, loss of wetlands, and rain-on-snow events in higher elevation clear cuts (SSPS 2007). In urbanized Puget Sound, there is a strong association between land use and land cover attributes and rates of coho spawner mortality likely due to runoff containing contaminants emitted from motor vehicles (Feist *et al*. 2011).

Dams constructed for hydropower generation, irrigation, or flood control have substantially affected PS Chinook salmon populations in a number of river systems. The construction and operation of dams have blocked access to spawning and rearing habitat (*e.g*., Elwha River dams block anadromous fish access to 70 miles of potential habitat) changed flow patterns, resulted in elevated temperatures and stranding of juvenile migrants, and degraded downstream spawning and rearing habitat by reducing recruitment of spawning gravel and LW to downstream areas (SSPS 2007). These actions tend to promote downstream channel incision and simplification (Kondolf 1997), limiting fish habitat. Water withdrawals reduce available fish habitat and alter sediment transport. Hydropower projects often change flow rates, stranding and killing fish, and reducing aquatic invertebrate (food source) productivity (Hunter 1992).

Juvenile mortality occurs in unscreened or inadequately screened diversions. Water diversion ditches resemble side channels in which juvenile salmonids normally find refuge. When diversion headgates are shut, access back to the main channel is cut off and the channel goes dry. Mortality can also occur with inadequately screened diversions from impingement on the screen, or mutilation in pumps where gaps or oversized screen openings allow juveniles to get into the system. Blockages by dams, water diversions, and shifts in flow regime due to hydroelectric development and flood control projects are major habitat problems in many Puget Sound tributary basins (SSPS 2007).

The nearshore marine habitat has been extensively altered and armored by industrial and residential development near the mouths of many of Puget Sound's tributaries. A railroad runs along large portions of the eastern shoreline of Puget Sound, eliminating natural cover along the shore and natural recruitment of beach sand (SSPS 2007).

Degradation of the near-shore environment has occurred in the southeastern areas of Hood Canal in recent years, resulting in late summer marine oxygen depletion and significant fish kills. Circulation of marine waters is naturally limited, and partially driven by freshwater runoff, which is often low in the late summer. However, human development has increased nutrient loads from failing septic systems along the shoreline, and from use of nitrate and phosphate fertilizers on lawns and farms. Shoreline residential development is widespread and dense in many places. The combination of highways and dense residential development has degraded certain physical and chemical characteristics of the near-shore environment (HCCC 2005; SSPS 2007).

Critical Habitat within the Action Area: Critical habitat has been designated in the Snohomish River for PS Chinook salmon and PS steelhead, at and well up- and downstream of the project reach. The critical habitat along the reach provides the Freshwater Spawning PBF for PS Chinook salmon, and the Freshwater Rearing and Migration PBFs for PS Chinook and PS steelhead (Snohomish 2016; WDFW 2018a).

2.3 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). As described in subsection 1.3, the project would occur along 2.8 miles of the Snohomish River starting about 1.6 miles west of the City of Snohomish. As described in the Effects of the Action Section (2.5), construction related effects would be limited to the in-water area within 300 feet of the project sites. However, hydrological impacts may extend to the nearest bends in the river from the revetments. The longest distance to the nearest river bend is about 1,500 yards upstream from the southeast end of the project reach. To be conservative, the action area for this project is considered to be the Snohomish River within 1,500 yards of either end of the project reach, and 1,000 yards of Ebey Slough downstream from its confluence with the Snohomish River.

2.4 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).

Environmental conditions in the Snohomish River watershed: The project reach extends about 2.8 miles upstream from RM 8 on the Snohomish River (Figure 1). The Snohomish River basin originates on the western slopes of the Cascade Mountains, at elevations of about 8,000 feet. It drains about 1.2 million acres as it flows westerly through broad, glaciated lowland valleys, before it enters Puget Sound north of Everett. The basin includes the Skykomish and Snoqualmie rivers, which join to become the Snohomish River, and numerous smaller tributaries such as the Pilchuck and Tolt Rivers. The Snohomish River It is the second-largest watershed that flows into Puget Sound. Average annual precipitation ranges from about 35 inches in the western lowlands to over 120 inches in the headwaters.

Since the mid-1800s, most of the land along the rivers and streams within the basin have been converted from dense old-growth forests to agricultural and low-density residential lands, with high density residential and industrial development occurring mostly near the Snohomish River estuary. Current land uses across the basin include forestry, agriculture, residential/ urban, infrastructure (roads and railroads; gas, water, and power lines), light industry, recreation, and mining. Agricultural lands, account for about 5% of the basin, but dominate the floodplains (SBRSF 2005). Rural residential development is also scattered throughout the lowlands and river floodplains, and many roads follow stream banks, resulting in the loss of mature riparian vegetation in many areas. Although conditions vary between individual reaches, water quality, wetlands, streambanks, large-wood abundance, and floodplain connectivity are considered generally degraded throughout the basin (SRBSRTC 2002).

The Basin now includes large portions of King and Snohomish Counties, with a combined population of a bit over 2.9 million people, and an average annual growth rate of about 1.4 % since 2010 (King County 2017; Snohomish County 2017). The basin is the major source of municipal water for the area, including the cities of Everett and Seattle. It is also the receptor for the effluent from numerous municipal wastewater treatment plants.

Near the project area, the Snohomish River is a low gradient, partially confined, meandering river, with a channel bottom composed mostly of sands and silts. River flow at the city of Snohomish ranges between about 1,140 and 150,000 cubic feet per second (cfs). The project reach is not identified on the Washington State Department of Ecology (WDOE) 303d list for water quality concerns (Category 5), but the reach is identified as Category 2 for water temperature and bacteria (WDOE 2018). Most of the riverbank within the action area is lined by dikes and levees to prevent flooding. Those levees and dikes were first constructed in the 1800s using fine grained alluvial sands that were pulled from the river and piled on top of the bank. A large portion of the project reach has also been armored with rip rap. Along the project reach, as in many other areas, a road was constructed along the top of the levee. The road was first constructed in the late 1800s, improved in the early 1900s, and maintained since. The land bordering the project reach consists primarily of agricultural fields with a relatively low number of residential and other structures scattered along its length. The narrow strip of land between the road and the river supports limited riparian vegetation that consists of black cottonwood, red alder, Pacific willow, and Sitka willow trees. Himalayan blackberry, Reed canary grass, and other grasses are also present along the riverbank (Snohomish County 2016).

The past and ongoing anthropogenic impacts described above have reduced the Snohomish River's ability to support PS Chinook salmon PS steelhead within the action area. However, the area continues to provide rearing and migratory habitat for both of these species, and spawning habitat for summer-run PS Chinook salmon.

Climate Change: Climate change has affected the environmental baseline of aquatic habitats across the region and within the action area. However, the effects of climate change have not been homogeneous across the region, nor are they likely to be in the future. During the last century, average air temperatures in the Pacific Northwest have increased by 1 to 1.4° F (0.6 to 0.8 °C), and up to 2° F (1.1 °C) in some seasons (based on average linear increase per decade; Abatzoglou *et al*. 2014; Kunkel *et al*. 2013). Recent temperatures in all but two years since 1998 ranked above the 20th century average (Mote *et al*. 2013). Warming is likely to continue during the next century as average temperatures are projected to increase another 3 to 10° F (1.7 to 5.6° C), with the largest increases predicted to occur in the summer (Mote *et al*. 2014).

Decreases in summer precipitation of as much as 30% by the end of the century are consistently predicted across climate models (Mote *et al*. 2014). Precipitation is more likely to occur during October through March, less during summer months, and more winter precipitation will be rain than snow (ISAB 2007; Mote *et al*. 2013 and 2014). Earlier snowmelt will cause lower stream flows in late spring, summer, and fall, and water temperatures will be warmer (ISAB 2007; Mote *et al*. 2014). Models consistently predict increases in the frequency of severe winter precipitation events (i.e., 20-year and 50-year events), in the western United States (Dominguez *et al*. 2012). The largest increases in winter flood frequency and magnitude are predicted in mixed rain-snow watersheds (Mote *et al*. 2014).

The combined effects of increasing air temperatures and decreasing spring through fall flows are expected to cause increasing stream temperatures; in 2015 this resulted in 3.5-5.3°C increases in Columbia Basin streams and a peak temperature of 26°C in the Willamette (NWFSC 2015). Overall, about one-third of the current cold-water salmonid habitat in the Pacific Northwest is likely to exceed key water temperature thresholds by the end of this century (Mantua *et al*. 2009).

Higher temperatures will reduce the quality of available salmonid habitat for most freshwater life stages (ISAB 2007). Reduced flows will make it more difficult for migrating fish to pass physical and thermal obstructions, limiting their access to available habitat (Isaak *et al*. 2012; Mantua *et al*. 2010). Temperature increases shift timing of key life cycle events for salmonids and species forming the base of their aquatic foodwebs (Crozier *et al*. 2011; Tillmann and Siemann 2011; Winder and Schindler 2004). Higher stream temperatures will also cause decreases in dissolved oxygen and may also cause earlier onset of stratification and reduced mixing between layers in lakes and reservoirs, which can also result in reduced oxygen (Meyer *et al*. 1999; Raymondi *et al*. 2013; Winder and Schindler 2004). Higher temperatures are likely to cause several species to become more susceptible to parasites, disease, and higher predation rates (Crozier *et al*. 2008; Raymondi *et al*. 2013; Wainwright and Weitkamp 2013).

As more basins become rain-dominated and prone to more severe winter storms, higher winter stream flows may increase the risk that winter or spring floods in sensitive watersheds will damage spawning redds and wash away incubating eggs (Goode *et al*. 2013). Earlier peak stream flows will also alter migration timing for salmon smolts, and may flush some young salmon and steelhead from rivers to estuaries before they are physically mature, increasing stress and reducing smolt survival (Lawson *et al*. 2004; McMahon and Hartman 1989).

The adaptive ability of these threatened and endangered species is depressed due to reductions in population size, habitat quantity and diversity, and loss of behavioral and genetic variation. Without these natural sources of resilience, systematic changes in local and regional climatic conditions due to anthropogenic global climate change will likely reduce long-term viability and sustainability of populations in many of these ESUs (NWFSC 2015). New stressors generated by climate change, or existing stressors with effects that have been amplified by climate change, may also have synergistic impacts on species and ecosystems (Doney *et al*. 2012). These conditions will possibly intensify the climate change stressors inhibiting recovery of ESA-listed species in the future.

2.5 Effects of the Action on Species and Designated Critical Habitat

Under the ESA, "effects of the action" means the direct and indirect effects of an action on the species, 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). Direct effects are caused by exposure to action-related stressors that occur at the time of the action. Indirect effects are effects caused by the proposed action that occur later in time but are still reasonably certain to occur.

As described in Section 1.3, the County's project would repair damaged sections of the Riverview/Rivershore Road and embankment as they occur over 10 years (2019 through 2028). Work would include the use of heavy equipment such as excavators and trucks working from above the water and during low tide to remove damaged sections of rip rap embankment, and install a vegetated slope with a root wad log toe along a 2.8 mile long section of the right bank of the Snohomish River. About 12 weeks of work would be done between July 1 and October 3 each year. The County's contractors are required to comply with the Impact Avoidance and Conservation Measures identified in the County's BA as well as WDFW and WDOT guidelines.

As described in Section 2.2, PS Chinook salmon and PS steelhead inhabit the action area. Additionally, critical habitat has been designated for both species within the action area. The planned work window overlaps with the return of adults of both species. It also slightly overlaps with the end of the outmigration season for juvenile Chinook salmon, and with the year-round presence of rearing juveniles for both species.

Construction is likely to cause direct effects through fish removal activities, construction-related noise and activity, and water quality impacts. It may also cause indirect effects through impacts on riparian vegetation. Vegetation control is likely to cause effects from exposure to herbicides. Embankment repair would likely extend the useful life of the structure for several decades beyond its remaining lifespan. The embankment is reasonably certain to cause effects on the species and critical habitats identified above through embankment-related impacts on biological and hydrological processes.

2.5.1 Effects on Listed Species

Construction-related Fish Removal: Fish removal during work area isolation is likely to cause minor effects on PS Chinook salmon and PS steelhead. After installation of the work area turbidity barrier, and prior to low tide, a trained biologist or technician would make several passes through the area with a fine-mesh herding net to drive fish out from behind the barrier and into the river. The sandy substrate in the action area effectively eliminates hiding areas that might allow small fish to avoid the herding net. Therefore, it is extremely likely that any fish that may be present would leave the area during herding, and extremely unlikely that any would remain and require other measures for removal. Exposure to herding may cause short-term minor effects on the normal behaviors of exposed fish, but it is extremely unlikely to cause detectable effects on their fitness.

Construction-related Noise and Activity: Exposure to construction-related noise is likely to adversely affect PS Chinook salmon and PS steelhead. Although construction would occur above the water level, upland work often causes elevated in-water sound levels adjacent to project sites (CalTrans 2009). Studies indicate the effects on fish that are exposed to noise vary with the frequency, intensity, and duration of the exposure, the hearing characteristics of the exposed fish, and the context under which the exposure occurs. At low levels, effects may include the onset of behavioral disturbances such as acoustic masking (Codarin *et al*. 2009), startle responses and altered swimming (Neo *et al*. 2014), abandonment or avoidance of the area of acoustic effect (Picciulin *et al*. 2010; Mueller 1980; Sebastianutto *et al*. 2011; Xie *et al*. 2008) and increased vulnerability to predators (Simpson *et al*. 2016). At higher intensities and/or longer exposure durations, the effects may rise to include temporary hearing loss (Scholik and Yan 2002) and increased stress (Graham and Cooke 2008). At even higher levels, exposure may lead to physical injury that can range from the onset of permanent hearing damage (a.k.a. permanent threshold shift or PTS) and mortality.

The best available information to describe the in-water noise levels that are likely to be caused by this project is a recent study that measured the in-water noise from excavator dredging of rocks (Reine *et al*. 2012). They report that the source level (SL, sound level at 1 meter from the source) for the excavator bucket scooping rocks was about 179 dB_{RMS}. Based on the relationship between dB_{RMS}, dB_{peak}, and dB_{SEL} for impulsive sources, dB_{peak} is often about 16 dB higher than dB_{RMS}, while dB_{SEL} is typically about 10 dB lower. Based on this, NMFS estimates that the construction could cause in-water sound levels of up to 194 dB_{peak} and 169 dB_{SEL}.

The criteria currently used by NMFS to estimate the onset of injury for fish exposed to impulsive sounds uses two metrics: 1) exposure to 206 dB_{peak}; and 2) exposure to 187 dB SEL_{cum} for fish 2 grams or larger, or 183 dB SEL_{cum} for fish under 2 grams; or exposure above 150 dB_{SEL}. Any RL below 150 dB_{SEL} is considered “Effective Quiet”. The distance from a source where the received level (RL) drops to 150 dB_{SEL} is considered the maximum distance from that source where fishes can be affected by the noise, regardless of accumulation of the sound energy (Stadler and Woodbury 2009). Therefore, when there is a difference between the ranges to the isopleths for effective quiet and SEL_{cum}, the shorter range shall apply.

The maximum expected SL of 194 dB_{peak} is well below the 206 dB_{peak} threshold for injury. The number of impulsive events that may occur from a day's worth of construction is impossible to estimate, but the number is likely to be enormous. Therefore, the SEL_{cum} threshold would likely exceed that of effective quiet. If not, the use of effective quiet would over-estimate the area of effect. Therefore, use of effective quiet to estimate the range of acoustic effects for this project would be protective of listed fish.

A commonly used formula to estimate sound attenuation with distance due to the combination spreading, scattering, and absorption is: RL = SL – #Log(R) (RL = received level (dB), SL = source level (dB), # = spreading coefficient (typically between 10 and 20), and R = range in meters). In the absence of site-specific information, NMFS typically uses the practical spreading loss coefficient of -15 for work in shallow water with relatively low spreading loss, but higher rates of scattering and absorption. Applying 169 dB_{SEL} SL to the formula suggests that in-water sound levels above the effective quiet threshold (150 dB_{SEL}) may extend up to about 61 feet (18.5 m) around the construction area (area of acoustic effect).

The most likely effect of exposure to construction-related noise would be temporary behavioral effects. The exposure is extremely unlikely to cause any measurable effects on the fitness of exposed adults. The most likely effect of exposure would be temporary avoidance of the affected area. However, some adult summer-run PS Chinook salmon may avoid spawning habitat that may be within the area of acoustic effect for repair sites along the upstream end of the project reach. The impact that the avoidance may have on the spawning success for affected individuals is uncertain, but would likely be too small to cause any detectable population-level effects.

The juvenile Chinook salmon and steelhead that may be present during construction are more likely to remain in familiar rearing habitats than to migrate past the area like most returning adults. Juveniles that are within the area of acoustic effect are likely to experience behavioral disturbance, such as acoustic masking, startle responses, altered swimming patterns, avoidance, and increased risk of predation. Individuals that remain within the area of acoustic effect long enough to accumulate sound energy in excess of the 183/187 dB SEL_{cum} threshold may also experience some level of auditory- and non-auditory tissue injury, which could reduce their likelihood of survival. The number of individuals of either species that may be impacted by this stressor is unquantifiable with any degree of certainty. However, given the small amount of habitat that would be affected on any given year (500 to 2,500 feet of river bank) and the expectation that the density of stream-type juvenile Chinook salmon and juvenile steelhead in the area is low, the numbers of affected fish would comprise such small subsets of their respective cohorts, that their loss would cause no detectable population-level effects.

<u>Construction-related Water Quality Impacts:</u>

Exposure to construction-related degraded quality would cause minor effects in PS Chinook salmon and PS steelhead. Water quality would be temporarily affected by increased turbidity that may also reduce dissolved oxygen (DO) levels. It may also be affected by the introduction of toxic materials.

Turbidity: Turbidity plumes may be caused by construction and project site runoff. However, those plumes would likely be localized and short-lived, and consist of low concentrations of total suspended sediments (TSS). The intensity of turbidity is typically measured in Nephlometric Turbidity Units (NTU), which describes the opacity caused by the suspended sediments. Whereas, TSS concentrations are typically measured in milligrams per liter (mg/L). A strong positive correlation exists between turbidity and the concentration of TSS (mg/L). Depending on the particle sizes, NTU values roughly equate to the same number of mg/L for TSS concentration (i.e. 10 NTU = ~ 10 mg/L TSS, and 1,000 NTU = ~ 1,000 mg/L TSS) (Campbell Scientific Inc. 2008; Ellison *et al*. 2010). Therefore, the two units of measure can be easily compared.

Water quality is considered adversely affected by suspended sediments when turbidity is increased by 20 NTU for a period of 4 hours or more (Berg and Northcote 1985; Robertson *et al*. 2006). The effects on fish exposed to suspended sediments are somewhat species and size dependent. In general, severity typically increases with sediment concentration and duration of exposure, and decreases with the increasing size of the fish. At concentration levels of about 700 to 1,100 mg/l, minor physiological stress is reported in juvenile salmon only after about three hours of continuous exposure (Newcombe and Jensen 1996).

No specific information is available to describe the intensity and duration of the turbidity plumes that are likely to be caused by the planned construction. The County estimates that water quality impacts would be limited to the area within 300 feet downstream of a project site. The best available information supports that expectation. For example, mechanical dredging in areas containing high levels of fine-grained material creates turbidity plumes that may extend 200 to 500 feet down-current from the point of dredging, with TSS concentrations of 700 to 1,100 mg/l at about 300 feet. By comparison, the turbidity caused by in-water extraction of hollow 30-inch steel piles in Lake Washington was much lower. It reached a peak of about 25 NTU (~25 mg/L) above background levels at 50 feet from the pile, and about 5 NTU (~5 mg/L) above background at 100 feet. Turbidity returned to background levels within 30 to 40 minutes (Bloch 2010).

The project involves no in-water work, and all work would be done behind a turbidity curtain. The project also includes required measures to protect against mobilized sediments reaching the river due to erosion and runoff from upland work. Should any PS Chinook salmon or PS steelhead be exposed to project-related turbidity, the duration of their exposure would likely be measured in minutes, and the plume concentrations would most likely be too low to cause more than temporary, non-injurious behavioral effects such as avoidance of the plume, mild gill flaring (coughing), and slightly reduced feeding rates. None of the potential responses, individually, or in combination would affect the fitness or normal behaviors in exposed fish.

Toxic Materials: Construction related spills and discharges may introduce toxic materials to the water. PS Chinook salmon and PS steelhead can uptake contaminants directly through their gills, and through dietary exposure (Karrow *et al*. 1999; Lee and Dobbs 1972; McCain *et al*. 1990; Meador *et al*. 2006; Neff 1982; Varanasi *et al*. 1993). Some of the petroleum-based fuels, lubricants, and other fluids used by construction-related equipment contain Polycyclic Aromatic Hydrocarbons (PAHs). Sediment contaminants can include metals, pesticides, PAHs, Polychlorinated Biphenyls (PCBs), phlalates, and other organic compounds. Depending on the pollutant, its concentration, and/or the duration of exposure, exposed fish may experience effects that can range from avoidance of an affected area, to reduced growth, altered immune function, and mortality (Brette *et al*. 2014; Feist *et al*. 2011; Gobel *et al*. 2007; Incardona *et al*. 2004, 2005, and 2006; Mcintyre *et al*. 2012; Meadore *et al*. 2006; Sandahl *et al*. 2007; Spromberg *et al*. 2015).

The project involves no in-water work, and includes a comprehensive suite of best management practices (BMPs) to reduce the risk and intensity of construction-related discharges. In the unlikely event of a construction-related spill or discharge, the amount of material released would likely be very small, and it would be quickly contained and cleaned up. Also, many of the fuels and lubricants that are used for this type of work would evaporate relatively quickly, so their residence time in the water would be brief. Further, non-toxic and/or biodegradable lubricants and fluids are strongly encouraged by the State, and are commonly used by many of the local contractors. Therefore, the in-water presence of construction-related contaminants would be very infrequent, very short-lived, and at concentrations too low to cause detectable effects on fitness or normal behaviors in exposed fish.

<u>Construction-related Reduced Riparian Vegetation:</u>

Construction related removal of riparian vegetation would cause minor effects in PS Chinook salmon and PS steelhead. Construction would cause the removal of riparian vegetation that may be present within an area to be repaired, totaling up to 2.8 miles of riverbank over a 10-year period. All affected areas would be replanted with native vegetation. However, it will take several years to decades before the replacement vegetation would provide ecological functions equitable to pre-construction levels in areas where mature vegetation must be removed.

Reduced riparian vegetation can alter in-stream chemical and biological functions. Chemical processes involve inputs of thermal energy and organic matter, as well as linkages to terrestrial food webs, the retention and export of nutrients and nutrient cycling in the aquatic food web, and gas exchange (Beechie *et al*. 2010). Biological processes include aquatic and riparian plant and animal growth, and community development and succession, which establish the biodiversity and influence the life histories of aquatic and riparian organisms (Harman *et al*. 2012).

Reduced riparian vegetation along the upstream half of the project reach is unlikely to cause any detectable shade-related effects because the project reach is located on the north side of the river, and the sun is always to the south of the site. Removal of riparian vegetation along the downstream half of the reach, particularly in the section that is within Ebey Slough where the affected bank is on the south side of the waterway, could increase summer-time insolation. This may slightly increase in-water temperatures along the affected bank. The temperature increases that may result are not predictable with any degree of certainty. However, due to the very small size of the affected area relative to the regularly exposed surface area of the rest of the river in the surrounding area, any project-related temperature increases would likely be too small to cause detectable effects on the water temperature of the river, or the fitness or normal behaviors for any life stage of Chinook salmon and steelhead in the action area.

Removal of riverbank vegetation may also reduce the input of terrestrial-origin leaf litter, insects, and woody debris to streams. Many terrestrial insects are forage for salmonids, while vegetative matter often provides cover. Terrestrial organic matter is also important to nutrient cycling in aquatic food webs that support aquatic algae and invertebrates that are important resources for juvenile salmonids. Riparian impacts along the project reach would slightly reduce the input of terrestrial-origin organic matter until the riparian vegetation returns to pre-construction levels of growth. Due to the relatively small size of the area that may be affected any given year, the input of terrestrial material upstream and downstream of the project reach, and the diluting effects of flowing water, the impacts on aquatic food webs attributable to the planned work would likely be too small to cause detectable effects on the fitness or normal behaviors for any life stage of Chinook salmon and steelhead in the action area.

Exposure to Herbicides:

The application of herbicides is likely to adversely affect PS Chinook salmon and PS steelhead. The best available information about salmonid exposure to glyphosate, imazapyr, triclopyr TEA, and several other herbicides is described in many recent NMFS Opinions (NMFS 2008, NMFS 2010; NMFS 2011a & b; NMFS 2012; NMFS 2013a-d) and in several reports (Syracuse Environmental Research Associates, Inc. (SERA) 2011a-c). In general, exposure to herbicides can cause modified behaviors, decreased predator avoidance, reduced growth and development, altered embryonic development, and mortality in fish, depending the herbicide and its concentration. In the work identified above, exposure to concentrations at 1/20th of the lethal concentration for half of the exposed individuals (LC50) was established as the threshold for the onset of adverse effect in salmonids. Herbicides may also impact aquatic organisms that are important to listed salmonids.

Based on the best available information, terrestrial applications of glyphosate adjacent to stream channels, at application rates and concentrations close the manufacture's recommended maximums, and in rainfall regimes approaching 150 inches per year, can cause in-water concentrations that exceed the threshold for adverse effects in salmonids. It may also adversely affect algae, but not aquatic invertebrates or macrophytes. Similar application of imazapyr and triclopyr TEA is unlikely to adversely affect salmonids or aquatic invertebrates directly, but it may adversely affect algae and aquatic macrophytes.

Herbicides may reach the river via airborne drift and/or runoff. Several factors influence airborne drift, including wind and air stability, droplet size, humidity and temperature, physical properties of herbicides and their formulations, and method of application. The amount of herbicide and the distance of drift both increase as wind velocity increases. Hand application practically eliminates airborne drift, whereas the use of spot sprayers under low-wind conditions, close to the target, and with barriers greatly reduces it. The herbicide contribution from runoff varies depending on site and application variables. The highest concentrations from runoff generally occur in situations when high volumes of herbicide are applied close to a stream, and application is quickly followed by heavy rains (Stenstrom and Kayhanian 2005; Wood 2001). Conversely, the delivery of herbicide via runoff is reduced when small volumes of herbicide are applied, and/or when rainfall occurs more than 24 hours after application.

The County would apply the herbicides at concentrations and volumes that comply with the manufacturer's recommendations, use vegetable oil-based surfactants to maintain toxicity within previously assessed boundaries. The County would also limit herbicide use to hand-application and/or spot-spraying with backpack sprayers on dry non-windy days, with protective barriers used to minimize drift and over-spray. Therefore, the incidence of project-related herbicide contamination at concentrations above the threshold of adverse effects would be infrequent, and the affected area would be relatively small. However, over the 10-year life of this project, some juvenile PS Chinook salmon and PS steelhead are reasonably likely to experience reduced fitness and/or altered normal behaviors due to exposure to herbicides at concentrations above the threshold for the onset of adverse effects.

The number of affected individuals of either species is unquantifiable with any degree of certainty, but it is likely to be very low. The introduction of herbicides to the water would episodic, small, and randomized across temporal and spatial scales, based largely on the frequency of application, weather conditions, and on the skill and care of the person applying the herbicides. The distribution and abundance of juvenile PS Chinook salmon and PS steelhead within the affected areas would also be randomized across temporal and spatial scales due to the complex mix of biotic and environmental processes that drive their movements. Consequently, the co-occurrence of juvenile salmon and steelhead with herbicides at concentrations high enough to cause detectable effects would be very infrequent across the life of this project, and limited to very small areas when it occurs. Therefore, the numbers of affected fish would likely comprise such small subsets of their respective cohorts, that their loss would cause no detectable population-level effects.

Herbicide use may cause temporary and slight reductions in the aquatic invertebrates, algae, and macrophytes near the construction sites. As described above, the introductions of herbicides that may occur would infrequent and small. Detectable concentrations would be present only briefly due to low initial concentrations and fast dilution by river currents. Consequently, the size of the affected areas and the numbers of affected organisms are expected to be very small, and impacted resources would likely begin to recover soon after an exposure event. Therefore, it is extremely unlikely that any herbicide reductions in aquatic invertebrates, algae, and macrophytes would cause no detectable effects on the fitness or normal behaviors of juvenile PS Chinook salmon and PS steelhead in the action area.

<u>Embankment-related Impacts:</u>

The reconstructed embankments would cause habitat conditions that are likely to cause indirect adverse effects on PS Chinook salmon and PS steelhead through alteration of hydrological and biological processes.

Riverine habitats are the product of physical, chemical, and biological processes that interact together to form and maintain the streams (Fischenich 2003). Physical processes involve the interaction of hydrological forces with the substrate and objects in the streambed that drive geomorphic adjustments in the channel, floodplain, and riparian habitats. Chemical processes involve inputs of organic matter, retention and export of nutrients and thermal energy, nutrient cycling in the aquatic food web, linkages to terrestrial food webs, and gas exchange (Beechie *et al*. 2010). Biological processes include aquatic and riparian plant and animal growth, and community development and succession, which establish the biodiversity and influence the life histories of aquatic and riparian organisms (Harman *et al*. 2012).

Hydrological Impacts: Under natural conditions, the physical shape and structure of a channel is ever-evolving in response to the interaction between the native substrate, the volume and velocity of water flow, sediment loads, and the availability of large wood. Changes in any of these can alter erosion and deposition rates that drive geomorphic adjustments that can change the channel alignment and depth, as well as drive side channel formation or abandonment. It can also alter the exposed substrate (rock, gravel, sand, or mud bottoms), and cause changes in the presence of large wood. By design, bank stabilization structures replace dynamic natural processes with a set of semi-permanent conditions that prevent natural channel migration past the structure and alter fundamental channel and aquatic habitat formation processes (Cramer 2012). Revetments redirect water flows, which often increase erosion upstream and/or downstream of the revetment.

At bank stabilization sites, water flow continues to cut into the revetments themselves, so most revetments require periodic maintenance and repair to prevent bank failure, as would be done for this project. The process can lead to an ever-steepening bank, and a simplified aquatic habitat with reductions in velocity diversity, depth diversity, substrate diversity, large wood recruitment and retention, stream bank roughness, and edge habitat features such as undercut banks and alcove habitats (Fischenich 2003; Pracheil 2010). Altered flows may also cause unexpected changes in the physical processes upstream and downstream from the structure that alter sediment recruitment and transport in the streambed, and may discourage the formation of complex off-channel habitats within the affected stream reaches. Also, because the revetments intentionally prevent bank failure, stabilized banks typically prevent large wood contributions along their length, which impacts natural streambed and bank formation processes.

Due to the complex relationships between the processes that are involved, it is virtually impossible to predict and quantify the exact effects that County's new embankments would have on stream hydrology, geomorphology, and habitat forming processes. The new embankments would include logs with root wads that are anchored along their toes, and vegetated slopes up to the road. This design may allow for some natural processes to occur, such as the accumulation of large wood and sediments. However, channel migration would be prevented at the site, and the embankment may cause changes in upstream and downstream erosion and deposition patterns that may not have occurred in its absence. The distance at which hydrological impacts would no longer be detectable is unknown. In the absence of site-specific information, hydrological impacts are estimated to be limited to the river reach within the nearest river bends up and downstream from an embankment. For this project, the longest distance to the nearest bend is about 1,500 yards upstream from the southeast end of the project reach. To be conservative, hydrological impacts from this project are expected to be limited to the Snohomish River within 1,500 yards of either end of the project reach, and to the first 1,000 yards of Ebey Slough downstream from its confluence with the Snohomish River.

Based on the available information, the planned embankments would prevent channel migration past their respective sites into the foreseeable future. They would also likely alter erosion, sediment transport and deposition, and movement of LWD within the nearest bends in the river, which may alter or discourage the formation of spawning habitats and complex off-channel rearing habitats within the affected stream reach. These negative effects on habitat forming processes are expected to be relatively small in this highly confined reach of the river, and the influence the embankments would have on those processes will likely decrease with distance from the sites and with increasing size of flood events. However, over the life of these structures low numbers of individual PS Chinook salmon and PS steelhead are likely to be adversely affected by the altered conditions, as described in more detail below.

Biological Impacts: The exact impacts the embankments would have on in-stream chemical and biological processes are uncertain, but likely include long-term simplified aquatic habitats, and temporarily increased water temperatures and temporarily reduced input of terrestrial-origin organic material due to reduced riparian vegetation.

The repaired embankments would extend, by decades, the useful life of the levee and the simplified aquatic habitat it presents along its length. Juvenile salmonids tend to aggregate more densely in edge habitats than in the center of rivers where adult salmonids occur in greater numbers (Washington Trout 2006). They also rely on off-channel habitats for rearing and refugia during high flow events. Juvenile Chinook salmon tend to select, and are consistently more abundant along, natural banks with wood, cobble, boulder, aquatic plants, and/or undercut banks than along hardened banks, especially rip rap (Beamer and Henderson 1998; Peters *et al*. 1998).

The County's design avoids the use of rip rap, and includes large wood and replaced riparian vegetation. This would reduce the likely impacts of the repaired embankment sections as compared to typical rip rap revetments. However, the habitat provided by the new embankments would be suboptimal as compared to a natural river bank, particularly for the first few years. It would lack, and prevent the formation of, undercut banks and off channel habitats along its length, and overhanging riparian vegetation would be virtually absent until it has had a chance to grow for a few seasons after construction.

Some juvenile Chinook salmon and steelhead are likely to avoid the newly built embankments. Those individuals may experience decreased fitness due to increased competition in other areas. Juveniles that remain in the simplified habitats at the new embankments may also experience decreased fitness due to the suboptimal forage resources that are likely to exist there. The intensity of effect that any individual may experience due to exposure to simplified habitat conditions is uncertain, and over time, the design of the embankments may lessen these impacts. However, over the life of the embankments, low numbers of juvenile PS Chinook salmon and PS steelhead are likely to experience reduced fitness and/or altered normal behaviors due to the conditions that would be caused by the embankments. The number of individuals of either species that may be adversely affected by simplified habitat impacts is unquantifiable with any degree of certainty. However, given the amount of habitat that would be affected on any given year (500 to 2,500 feet of river bank), the numbers of affected fish would be such small subsets of their respective cohorts, that their loss would cause no detectable population-level effects.

As discussed under construction-related reduced riparian vegetation, the project would remove riparian vegetation in some areas, but the loss of that vegetation is unlikely to cause measurable effects on listed fish. Further, the County's design includes the planting of native riparian trees and shrubs as integral components of the new embankments. Therefore, any impacts on shade and input of terrestrial-origin organic material would be reduced as the new riparian vegetation matures. Over future decades, the new vegetation is likely to return to pre-construction maturity, and in some areas, may exceed the riparian vegetation that currently exists.

2.5.2 Effects on Critical Habitat

This assessment considers the intensity of expected effects in terms of the change they would cause in affected Primary Biological Features (PBFs) from their baseline conditions, and the severity of each effect, considered in terms of the time required to recover from the effect. Ephemeral effects are those that are likely to last for hours or days, short-term effects would likely last for weeks, and long-term effects are likely to last for months, years or decades.

Critical Habitat for Puget Sound Chinook Salmon and Puget Sound Steelhead:

The proposed action is likely to adversely affect critical habitat that has been designated for PS Chinook salmon and PS steelhead. The essential PBFs of critical habitat for both species are listed below. The expected effects on those PBFs from completion of the planned project, including full application of the conservation measures and BMPs, would be limited to the impacts on freshwater PBFs as described below. Note that summer-run PS Chinook salmon spawn in the action area, but PS steelhead do not. Therefore, impacts on freshwater spawning sites would only apply to summer-run PS Chinook salmon. Both species utilize the action area for freshwater rearing and migration.

1. Freshwater spawning sites (summer-run PS Chinook salmon only):
   a. Water quantity – No changes expected.
   b. Water quality – The proposed action would cause long term minor adverse effects on water quality. Construction may briefly increase suspended solids and temporarily introduce low levels of contaminants. Low levels of herbicides may enter the water over 10 years, and impacts on riparian vegetation are likely to slightly increase water temperatures for decades. Detectable effects are expected to be limited to the area within about 300 feet of the project site.
   c. Substrate – The proposed action would cause long-term minor adverse effects on substrate. The embankment is likely to slightly alter erosion, sediment transport and deposition, and movement of LWD within the nearest bends in the river, which may slightly reduce the reach's ability to support spawning for PS Chinook salmon.

2. Freshwater rearing sites:
   a. Floodplain connectivity – The proposed action would cause long term minor adverse effects on floodplain connectivity. The embankment would permanently prevent natural channel migration past it, which is likely to lock the physical conditions at the sites in simplified states with relatively steep banks and reduced edge habitat features such as undercut banks and alcove habitats. The altered hydrology at the site may also impact bank habitat forming processes within the nearest bends in the river.
   b. Forage – The proposed action would cause long term minor adverse effects on forage. The simplified aquatic habitats created by embankments are typically less supportive of

salmonid foraging than natural banks. Also, impacts on riparian vegetation at the sites would decrease input of terrestrial insects and leaf litter that support aquatic food webs. Detectable effects would likely be minor and limited to the area immediately adjacent to the embankment, but the effects would persist for decades.

   c. Natural cover – The proposed action would cause long term minor adverse effects on natural cover. The embankment would permanently prevent the formation of edge habitat features such as undercut banks along its length, and may affect similar features within the nearest bends in the river. Impacts on riparian vegetation would remove overhanging vegetation and slightly reduce the availability of woody debris and leaf litter that can provide in-water cover. These effects would persist for decades.
   d. Water quantity – No changes expected.
   e. Water quality – Same as above.

3. <u>Freshwater migration corridors:</u>
   d. Free of obstruction and excessive predation – The proposed action would cause long term minor adverse effects on obstruction and predation. The embankment may alter the migratory behavior of some juvenile salmonids in that some individuals may avoid the altered edge habitat. This effect may persist for years.
   e. Water quantity – No changes expected.
   f. Water quality – Same as above.
   g. Natural Cover – Same as above.
4. <u>Estuarine areas</u> – None in the action area.
5. <u>Nearshore marine areas</u> – None in the action area.
6. <u>Offshore marine areas</u> – None in the action area.

2.6 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 the 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.

Some continuing non-Federal activities are reasonably certain to contribute to climate effects within the action area. However, it is difficult if not impossible to distinguish between the action area's future environmental conditions caused by global climate change that are properly part of the environmental baseline *vs.* cumulative effects. Therefore, all relevant future climate-related environmental conditions in the action area are described in the Environmental Baseline section (Section 2.4).

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

NMFS is unaware of any specific future non-federal activities that are reasonably certain to affect the action area. However, NMFS is reasonably certain that future non-federal actions such as the previously mentioned activities are all likely to continue and increase in the future as the human population continues to grow across the region. Continued habitat loss and degradation of water quality from development and chronic low-level inputs of non-point source pollutants will likely continue into the future. Recreational and commercial use of river waters within the action area is also likely to increase as the human population grows.

The intensity of these influences depends on many social and economic factors, and therefore is difficult to predict. Further, the adoption of more environmentally acceptable practices and standards may gradually reduce some negative environmental impacts over time. Interest in restoration activities has increased as environmental awareness rises among the public. State, tribal, and local governments have developed plans and initiatives to benefit ESA-listed PS Chinook salmon and PS steelhead within the watersheds of the action area. However, the implementation of plans, initiatives, and specific restoration projects are often subject to political, legislative, and fiscal challenges that increase the uncertainty of their success.

2.7 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 add the effects of the action (Section 2.5) to the environmental baseline (Section 2.4) and the cumulative effects (Section 2.6), taking into account the status of the species (Section 2.2), to formulate the agency's biological opinion as to whether the proposed action is likely to: (1) Appreciably reduce the likelihood of both the survival and recovery of a listed species in the wild by reducing its numbers, reproduction, or distribution; or (2) appreciably diminish the value of designated or proposed critical habitat for the conservation of the species.

As described in more detail above at section 2.4, climate change is likely to increasingly affect the abundance and distribution of the ESA-listed species considered in the Opinion. The exact effects of climate change are both uncertain, and unlikely to be spatially homogeneous. However, climate change is reasonably likely to cause reduced instream flows in some systems, and may impact water quality through elevated in-stream water temperatures and reduced DO, as well as by causing more frequent and more intense flooding events. It may also impact coastal waters through elevated surface water temperature, increased and variable acidity, increasing storm frequency and magnitude, and rising sea levels. The adaptive ability of listed-species is uncertain, but likely reduced due to reductions in population size, habitat quantity and diversity, and loss of behavioral and genetic variation. The proposed action will cause direct and indirect effects on the ESA-listed species considered in the Opinion well into the foreseeable future. However, the action's effects on water quality, substrate, and the biological environment are expected to be of such a small scale that no detectable effects on ESA-listed species through synergistic interactions with the impacts of climate change are expected.

Both of the species considered in this Opinion are listed as threatened, based on declines from historic levels of abundance and productivity, loss of spatial structure and diversity, and an array of limiting factors as a baseline habitat condition. Both species will be affected over time by cumulative effects, some positive – as recovery plan implementation and regulatory revisions increase habitat protections and restoration, and some negative – as climate change and unregulated or difficult to regulate sources of environmental degradation persist or increase. Overall, to the degree that habitat trends are negative, as described below, effects on viability parameters of each species are also likely to be negative. In this context we consider the effects of the proposed action's effect on individuals of the listed species at the population scale.

PS Chinook Salmon:

The PS Chinook salmon in the action areas are summer run fish from the Skykomish River MPG, and fall run fish from the Skykomish and Snohomish River MPGs. Both populations have slightly negative general trends, and a relatively large proportion of both populations' spawners are hatchery-origin fish. Reduced or eliminated accessibility to historically important habitat, combined with degraded conditions in available habitat due to land use activities appear to be the greatest threats to the recovery of PS Chinook salmon. Commercial and recreational fisheries also continue to impact this species. The environmental baseline within the action area has been degraded by the effects of past and on-going forestry, agriculture, residential and urban development, light industry, mining, road building and maintenance, and recreational activities.

The project site is located along the bank of the Snohomish River. The upstream 1,800 feet of the project area is within documented spawning habitat for summer-run Chinook salmon. The site also provides rearing habitat for juveniles, as well as migratory habitat for juveniles and adults. The planned work window overlaps with returning adults. It also slightly overlaps with the end of the outmigration season for ocean-type juveniles, and with the year-round presence of rearing stream-type juveniles.

Short-term construction-related impacts, and long-term structure-related impacts, are likely to cause a range of effects that both individually and collectively would cause altered behaviors, reduced fitness, and mortality in low numbers of exposed individuals for decades to come.

The annual number of juveniles that are likely to be injured or killed by action-related stressors is unknown. However, the numbers are expected to be very low, and to represent such a small fraction of any annual cohort that it would have no detectable effect on any of the characteristics of a viable salmon population (abundance, productivity, distribution, or genetic diversity) for either PS Chinook salmon population.

As compared to undisturbed habitats, the proposed action would slightly reduce the functional levels of habitat features within the river bends nearest to either end of the project reach. However, these impacts would not prevent the recovery of this species within the action area. Based on the best available information, the scale of the direct and indirect effects of the proposed action, when considered in combination with the degraded baseline, cumulative effects, and the impacts of climate change, would be too small to cause any population level impacts on

PS Chinook salmon. Therefore, the proposed action would not appreciably reduce the likelihood of survival and recovery of this listed species.

PS Steelhead:

The PS steelhead in the action area are summer-run steelhead from the North Fork Skykomish and Tolt River DIPs, and winter-run steelhead from the Pilchuck, Snohomish/Skykomish, and Snoqualmie River DIPs. For all 5 DIPs, the number of returning adults has fluctuated greatly over time, with the general trend being negative. The viability of the Pilchuck River DIP is considered low. The other 4 DIPs are considered moderate. Reduced or eliminated accessibility to historically important habitat, combined with degraded conditions in available habitat due to land use activities appear to be the greatest threats to the recovery of PS steelhead. Fisheries activities also continue to impact this species.

The environmental baseline within the action area has been degraded by the effects of past and on-going forestry, agriculture, residential and urban development, light industry, mining, road building and maintenance, and recreational activities. The project site is located along the right bank of the Snohomish River. The site provides rearing habitat for juveniles, as well as migratory habitat for juveniles and adults. The planned work window overlaps with returning adults, and with the year-round presence of rearing juveniles.

Short-term construction-related impacts, and long-term structure-related impacts, are likely to cause a range of effects that both individually and collectively would cause altered behaviors, reduced fitness, and mortality in low numbers of exposed individuals for decades to come.

The annual number of juveniles that are likely to be injured or killed by action-related stressors is unknown. However, the numbers are expected to be very low, and to represent such a small fraction of any annual cohort that it would have no detectable effect on any of the characteristics of a viable salmon population (abundance, productivity, distribution, or genetic diversity) for either PS Chinook salmon population.

As compared to undisturbed habitats, the proposed action would slightly reduce the functional levels of habitat features within the river bends nearest to either end of the project reach. However, these impacts would not prevent the recovery of this species within the action area. Based on the best available information, the scale of the direct and indirect effects of the proposed action, when considered in combination with the degraded baseline, cumulative effects, and the impacts of climate change, would be too small to cause any population level impacts on PS steelhead. Therefore, the proposed action would not appreciably reduce the likelihood of survival and recovery of this listed species.

Critical Habitat for PS Chinook Salmon and PS Steelhead:

As described above at Section 2.5, the proposed action is likely to adversely affect designated critical habitat for PS Chinook salmon and PS steelhead. Past and ongoing land and water use practices have degraded salmonid critical habitat throughout the Puget Sound basin. Hydropower and water management activities have reduced or eliminated access to significant portions of historic spawning habitat. Timber harvests, agriculture, industry, urbanization, and shoreline development have adversely altered floodplain and stream morphology in many watersheds, diminished the availability and quality of estuarine and nearshore marine habitats, and reduced water quality across the region.

Global climate change is expected to increase in-stream water temperatures and alter stream flows, possibly exacerbating impacts on baseline conditions in freshwater habitats across the region. Rising sea levels are expected to increase coastal erosion and alter the composition of nearshore habitats, which could further reduce the availability and quality of estuarine habitats. Increased ocean acidification may also reduce the quality of estuarine habitats. In the future, non-federal land and water use practices and climate change are likely to increase. The intensity of those influences on salmonid habitats is uncertain, as is the degree to which those impacts may be tempered by adoption of more environmentally acceptable land use practices, by the implementation of non-federal plans that are intended to benefit salmonids, and by efforts to address the effects of climate change.

The PBFs of salmonid critical habitat that would be affected by the proposed action are freshwater spawning site, rearing sites, and migration corridors free of obstruction and excessive predation. As described above, the proposed action would cause short- and long-term minor adverse effects on water quality, forage, and freedom from obstruction and excessive predation within about 300 feet of an embankment repair site. It would also cause short- and long-term minor adverse effects on substrate, floodplain connectivity, and natural cover, within the river bends nearest to the ends of the whole embankment.

Based on the best available information, the scale of the proposed action's effects, when considered in combination with the degraded baseline, cumulative effects, and the impacts of climate change, would be too small to measurably reduce the quality or functionality of the freshwater PBFs from their current levels. Therefore, the critical habitat would maintain its current level of functionality, and retain its current ability for PBF to become functionally established, to serve the intended conservation role for PS Chinook salmon and PS steelhead.

2.8 Conclusion

After reviewing and analyzing 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' opinion that the proposed action is not likely to jeopardize the continued existence of PS Chinook salmon or PS steelhead, nor is it likely to destroy or adversely modify designated critical habitat for either of these species.

2.9 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 actually kills or injures fish or wildlife by significantly impairing essential behavioral patterns, including breeding, spawning, rearing, migrating, feeding, or sheltering (50 CFR 222.102). "Incidental take" is defined by regulation as takings that result from, but are not the purpose of, carrying out an otherwise lawful activity conducted by the Federal agency or applicant (50 CFR 402.02). Section 7(b)(4) and section 7(o)(2) provide that taking that is incidental to an otherwise lawful agency action is not considered to be prohibited taking under the ESA if that action is performed in compliance with the terms and conditions of this incidental take statement (ITS).

2.9.1 Amount or Extent of Take

NMFS has determined that incidental take is reasonably certain to occur as follows:

Harm of juvenile Puget Sound Chinook salmon from

- exposure to construction-related noise and activity,
- exposure to embankment-related effects, and
- exposure to herbicides.

Harm of juvenile Puget Sound steelhead from

- exposure to construction-related noise and activity,
- exposure embankment-related effects, and
- exposure to herbicides.

NMFS cannot predict with meaningful accuracy the number of juvenile PS Chinook salmon and juvenile PS steelhead that are reasonably certain to be injured or killed by exposure to any of these stressors. 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.

Additionally, NMFS knows of no device or practicable technique that would yield reliable counts of individuals that experience these impacts. In such circumstances, NMFS uses the causal link established between the activity and the likely extent and duration of changes in habitat conditions to describe the extent of take as a numerical level of habitat disturbance. The most appropriate surrogates for take are action-related parameters that are directly related to the magnitude of the expected take.

For this action, the timing of work, and the length of the embankment repairs are the best available surrogates for the extent of take of juvenile PS Chinook salmon and PS steelhead from exposure to construction-related noise and activity. Timing of work is applicable because the planned work window was selected to minimize the potential for juvenile fish presence at the project sites. The length of the embankment repairs is applicable because the number of fish that are likely to be affected would increase as the length of impacted streambank habitat increases.

Therefore, working outside of the planned work window and/or impacting more streambank than anticipated would increase the number of fish likely to be exposed to construction-related noise and activity.

The length and design of the embankment repairs are the best available surrogates for the extent of take of juvenile PS Chinook salmon and PS steelhead due to structure-related effects. The length of the embankment repairs is applicable because the number of fish that are likely to be affected would increase as the size of impacted habitat increases, which directly related to the length of the embankment. The design of embankment repairs is applicable because the intensity of structure-related effects would increase as the embankment's design diverges from that of a natural streambank. Therefore, impacting more streambank than anticipated would increase the number of fish likely to be exposed to structure-related effects, and diverging from the planned design may increase the intensity of effects in the exposed fish.

The length of embankment repairs and the herbicides used are the best available surrogates for the extent of take of juvenile PS Chinook salmon and PS steelhead from exposure to herbicides. The length of the embankment repairs is applicable because the amount of herbicide that may reach the water is directly related to the amount of riverbank where herbicides would be applied. Additionally, the number of fish that are likely to be affected would increase as the length of herbicide-impacted streambank habitat increases. The herbicides used is applicable because the herbicides identified as part of the proposed action were selected for their efficacy and relative low toxicity in fish and other aquatic organisms. Other herbicides are reasonably likely to be more toxic than the planned herbicides. Therefore, increasing the length of embankment repairs would increase the number of fish likely to be exposed to herbicides, and use of different herbicides may increase the intensity of effects in the exposed fish.

In summary, the extent of take for this action is defined as:

Puget Sound Chinook salmon:

- Embankment repair work done annually from July 1 to October 3, 2019 through 2028.
- An annual maximum of 2,500 feet of embankment repair anywhere within the boundaries of the existing 2.8 mile embankment, and built as described in the proposed action section of this biological opinion.
- Application of aquatic glyphosate, imazapyr, and triclopyr TEA herbicides. Applied as needed at repair sites, and as described in the proposed action section of this biological opinion. Not to exceed 2,500 feet of riverbank the first year, or to increase annually by more than 2,500 feet, and limited to the boundaries of the existing 2.8 mile embankment identified in the project description.

Puget Sound steelhead:

- Embankment repair work done annually from July 1 to October 3, 2019 through 2028.
- An annual maximum of 2,500 feet of embankment repair anywhere within the boundaries of the existing 2.8 mile embankment, and built as described in the proposed action section of this biological opinion.
- Application of aquatic glyphosate, imazapyr, and triclopyr TEA herbicides. Applied as needed at repair sites, and as described in the proposed action section of this biological

opinion. Not to exceed 2,500 feet of riverbank the first year, or to increase annually by more than 2,500 feet, and limited to the boundaries of the existing 2.8 mile embankment identified in the project description.

Exceedance of any of the exposure limits described above would constitute an exceedance of authorized take that would trigger the need to reinitiate consultation.

Some of these take surrogates could be construed as partially coextensive with the proposed action but they nevertheless function as effective reinitiation triggers. These take surrogates will likely be monitored on a near-daily basis; thus any exceedance of the surrogates will be apparent in real-time and well before the project is completed. Further, if the size and configuration of the breakwater exceeds the proposal, it could still meaningfully trigger reinitiation because the COE has authority to conduct compliance inspections and to take actions to address non-compliance, including post-construction (33 CFR 326.4).

2.9.2 Effect of the Take

In the Opinion, NMFS determined that the amount or extent of anticipated take, coupled with other effects of the proposed action, is not likely to jeopardize the continued existence of PS Chinook salmon and PS steelhead, nor is it likely to destroy or adversely modify designated critical habitat for either of these species (Section 2.8).

2.9.3 Reasonable and Prudent Measures (RPM)

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

1. The COE shall minimize incidental take of PS Chinook salmon and PS steelhead from exposure to construction-related noise and activity.

2. The COE shall minimize incidental take of PS Chinook salmon and PS steelhead from exposure to embankment-related effects.

3. The applicant shall minimize incidental take of PS Chinook salmon and PS steelhead from exposure to herbicides.

4. The applicant shall implement monitoring and reporting to confirm that the take exemption for the proposed action is not exceeded.

2.9.4 Terms and Conditions

The terms and conditions described below are non-discretionary. The COE or any applicant must comply with them in order to implement the RPM (50 CFR 402.14). The COE 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 ITS (50 CFR 402.14). If the entity to whom a term and condition is directed does not comply with the following terms and conditions, protective coverage for the proposed action would likely lapse.

1. To implement RPM Number 1, Minimize incidental take from construction-related noise and activity, the COE shall require the applicant to:
   a. Require their contractors to limit riverbank work to July 1 to October 3, annually, and
   b. Require their contractors to limit embankment repairs to an annual maximum of 2,500 feet, and to remain within the boundaries of the existing 2.8 mile embankment identified in the project description of this opinion.

2. To implement RPM Number 2, Minimize incidental take from embankment-related effects, COE shall require the applicant to require their contractors to install repairs as summarized in the project description of this opinion. In particular, embankment repairs shall:
   a. Not exceed 2,500 feet in length annually;
   b. Incorporate no rip rap or intentionally exposed rock;
   c. Incorporate logs with root wads anchored along the length of the toe;
   d. Be sloped no steeper than 1:1 (45°); and
   e. Incorporate plantings of live native riparian trees and shrubs above the anchored logs.

3. To implement RPM Number 3, Minimize incidental take from exposure to herbicides, the applicant shall:
   a. Require their contractors to limit herbicide use to aquatic formulations of glyphosate, imazapyr, and triclopyr TEA;
   b. Require their contractors to comply with all manufacturer instructions;
   c. Require their contractors to limit herbicide application to spot application with hand-selective techniques and/or backpack sprayers;
   d. Require their contractors to limit backpack sprayer use to dry/non-windy days, with protective barriers placed to minimize drift and over-spray;
   e. Require their contractors to avoid spraying with imazapyr and triclopyr TEA within 15 feet of the waterline; and
   f. Require their contractors to limit herbicide application to embankment repair sites that shall not increase annually by more than 2,500 feet, and shall remain within the boundaries of the existing 2.8 mile embankment identified in the project description of this opinion.

4. To implement RPM Number 4, Implement monitoring and reporting to confirm that the take exemption for the proposed action is not exceeded, the applicant shall collect and report details about the take of listed fish. That plan shall:
   a. Require the contractor to maintain and submit construction logs. Minimally, the logs should include:
      i. The dates and descriptions for all embankment repair work;
      ii. The materials that are installed;
      iii. The linear extent and slope of repaired embankment; and
      iv. The type and numbers of riparian vegetation that is planted.

b. Require the contractor to maintain and submit herbicide application logs. Minimally, the logs should include:
   i. The identity (name, title, organization), qualification, and contact information of the person conducting the work;
   ii. The date(s) of application and the weather conditions;
   iii. The location(s) and length of affected riverbank, include closest distance to the river;
   iv. The herbicide(s) used. Specify brand and formulation, concentration, surfactant, and the volume applied;
   v. The method of application; and
   vi. Any conservation measures and BMP that are applied.
c. Establish procedures for the submission of construction logs and other materials to the appropriate COE office.
d. Submit electronic post-construction reports annually to NMFS within six months of the close of the work window. Send the reports to: projectreports.wcr@noaa.gov. Be sure to include the NMFS Tracking number for this project in the subject line: Attn: WCR-2018-10339.

2.10 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).

1. The COE should encourage the applicant to reduce the steepness of the embankment slopes wherever practicable along the project reach.

2. The COE should encourage the applicant minimize the use of herbicides in favor of mechanical means of vegetation control, and to use the lowest practicable herbicide concentrations.

2.11 Reinitiation of Consultation

This concludes formal consultation for the U.S. Army Corps of Engineers’ authorization of Snohomish County’s Riverview/Rivershore Road Embankment Repair Project in Snohomish County, Washington. As 50 CFR 402.16 states, 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 taking specified in the ITS 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 on 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

Section 305(b) of the MSA directs Federal agencies to consult with NMFS on all actions or proposed actions that may adversely affect essential fish habitat (EFH). The MSA (section 3) defines EFH as "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity." Adverse effect means any impact that reduces quality or quantity of EFH, and may include direct or indirect physical, chemical, or biological alteration of the waters or substrate and loss of (or injury to) benthic organisms, prey species and their habitat, and other ecosystem components, if such modifications reduce the quality or quantity of EFH. Adverse effects on EFH may result from actions occurring within EFH or outside 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. The analysis that follows is based, in part, on the description of EFH contained in the fishery management plans developed by the PFMC and approved by the Secretary of Commerce.

3.1 Essential Fish Habitat Affected by the Project

The waters and substrates of the Snohomish River action area is designated as freshwater EFH for Pacific Coast Salmon, which include Chinook, coho, and pink salmon. This EFH is identified and described in Appendix A to the Pacific Coast salmon fishery management plan (PFMC 2014), and is summarized below.

3.2 Adverse Effects on Essential Fish Habitat

The ESA portion of this document (Sections 1 and 2) describes the adverse effects of the proposed action on ESA-listed species and critical habitats, and is relevant to the effects on EFH for Pacific Coast Salmon. Based on the analysis of effects presented in Section 2.5, the proposed action will cause small scale long-term adverse effects on EFH for Pacific salmon through direct or indirect physical and chemical alteration of the water and substrate. It would also alter habitat conditions at the site in a manner that slightly alters migratory behaviors, and reduces natural cover and forage resources for juvenile salmonids.

3.3 Essential Fish Habitat Conservation Recommendations

The proposed action includes embankment design features that are expected to reduce impacts on the quantity and quality of PC salmon EFH. It also includes a comprehensive set of conservation measures and BMP to minimize construction-related effects. NMFS knows of no other reasonable measures to further reduce the level of these effects. Therefore, additional conservation recommendations pursuant to MSA (§305(b)(4)(A)) are not necessary.

3.4 Statutory Response Requirement

As required by section 305(b)(4)(B) of the MSA, the COE 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, minimizing, mitigating, or otherwise 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 COE 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 Data Quality Act (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 COE. Other users could include WDFW, Snohomish County, and the citizens of that county. Individual copies of this Opinion were provided to the COE. The format and naming adheres to conventional standards for style.

4.2 Integrity

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

4.3 Objectivity

Information Product Category: Natural Resource Plan

Standards: This consultation and supporting documents are clear, concise, complete, and unbiased; and were developed using commonly accepted scientific research methods. They adhere to published standards including the NMFS ESA Consultation Handbook, ESA regulations, 50 CFR 402.01 et seq., and the MSA implementing regulations regarding EFH, 50 CFR 600.

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

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