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.:
WCRO-2022-02161

April 3, 2025

P. Allen Atkins
Chief, Regulatory Branch
Department of the Army
U.S. Army Corps of Engineers, Seattle District
4735 East Marginal Way South, Bldg 1202
Seattle, Washington 98134-2388

Re: Endangered Species Act Section 7(a)(2) Biological Opinion and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Response for the Simpson Bank Stabilization Project, Castle Rock, Cowlitz County, Washington, Toutle River Subwatershed, HUC 12 170800050702 (NWS-2021-0598)

Dear Mr. Atkins:

Thank you for your letter of March 28, 2022, 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 the Simpson Bank Stabilization Project.

Thank you also for your request for essential fish habitat (EFH) consultation. NMFS reviewed the proposed action for potential effects on EFH pursuant to section 305(b) of the Magnuson-Stevens Fishery Conservation and Management Act (MSA), implementing regulations at 50 CFR 600.920, and agency guidance for use of the ESA consultation process to complete EFH consultation. We have concluded that the action would adversely affect EFH designated under the Pacific Coast Salmon Fishery Management Plan. We are providing EFH conservation recommendations in the enclosed Biological Opinion.

We conclude that the USACE's proposed action to permit the Simpson Bank Stabilization Project is likely to adversely affect, but not likely to jeopardize the continuing existence of the Lower Columbia River (LCR) Chinook salmon, Columbia River (CR) chum salmon, LCR coho salmon, LCR steelhead, and Southern DPS eulachon. We also conclude that the proposed action is likely to adversely affect but not likely to adversely modify or destroy critical habitat for these species.

Please contact Amy Kocourek of the Washington Coast and Lower Columbia Branch office in Lacey, Washington, at amy.kocourek@noaa.gov if you have any questions concerning this consultation, or if you require additional information.

Sincerely,

Kathleen Wells
Assistant Regional Administrator
Oregon Washington Coastal Office

cc: Danette Guy, U.S. Army Corps of Engineers

Endangered Species Act Section 7(a)(2) Biological Opinion and Magnuson–Stevens Fishery Conservation and Management Act Essential Fish Habitat Response for the

Simpson Bank Stabilization Project
Castle Rock, Cowlitz County, Washington
Toutle River Subwatershed, HUC 12 170800050702 (NWS-2021-0598)

NMFS Consultation Number: WCRO-2022-002161

Action Agency: U.S. Army Corps of Engineers (USACE)

Affected Species and NMFS' 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?
Lower Columbia River Chinook salmon (*Oncorhynchus tshawytscha*)	Threatened	Yes	No	Yes	No
Lower Columbia River coho salmon (*Oncorhynchus kisutch*)	Threatened	Yes	No	Yes	No
Lower Columbia River steelhead (*Oncorhynchus mykiss*)	Threatened	Yes	No	Yes	No
Columbia River chum salmon (*Oncorhynchus keta*)	Threatened	Yes	No	Yes	No
Southern DPS eulachon (*Thaleichthys pacificus*) (Columbia River Smelt)	Threatened	Yes	No	Yes	No

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

Consultation Conducted By: National Marine Fisheries Service
West Coast Region

Issued By:

Kathleen Wells
Assistant Regional Administrator
Oregon Washington Coastal Office

Date: April 3, 2025

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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 (ITS) portions of this document in accordance with section 7(b) of the Endangered Species Act (ESA) of 1973 (16 U.S.C. 1531 et seq.), as amended, and implementing regulations at 50 CFR part 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 part 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 (DQA) (section 515 of the Treasury and General Government Appropriations Act for Fiscal Year 2001, Public Law 106-554). The document will be available at the NOAA Library Institutional Repository [https://repository.library.noaa.gov/welcome]. A complete record of this consultation is on file at the Washington Coast and Lower Columbia River branch office in Lacey, Washington.

1.2. Consultation History

Updates to the regulations governing interagency consultation (50 CFR part 402) were effective on May 6, 2024 (89 Fed. Reg. 24268). We are applying the updated regulations to this consultation. The 2024 regulatory changes, like those from 2019, were intended to improve and clarify the consultation process, and, with one exception from 2024 (offsetting reasonable and prudent measures), were not intended to result in changes to the Services' existing practice in implementing section 7(a)(2) of the Act. 89 Fed. Reg. at 24268; 84 Fed. Reg. at 45015. We have considered the prior rules and affirm that the substantive analysis and conclusions articulated in this biological opinion and incidental take statement would not have been any different under the 2019 regulations or pre-2019 regulations.

On September 7, 2022, NMFS received a request for informal consultation on the Simpson Bank Stabilization Project from the USACE. This project proposes to repair and lengthen a pre-existing revetment that has been in place for many decades. The biological evaluation concluded with a 'may effect, not likely to adversely affect' determination for Lower Columbia River (LCR) Chinook salmon, Columbia River (CR) chum salmon, LCR coho salmon, LCR steelhead, Southern DPS eulachon, and critical habitat for these five species. The biological evaluation concluded that the project will not adversely affect essential fish habitat. In their request for consultation, the USACE concurred with the effects to listed species and critical habitat as described in the biological evaluation.

The NMFS reviewed the submitted materials (biological evaluation, mitigation plan, and geotechnical report) and noted that bank armoring constrains habitat forming processes and provides less habitat value for juvenile salmonids. We reached out to the USACE on November 29, 2022 communicating our observation and requesting that they reconsider their effects determination. USACE responded on November 30, 2022 requesting formal consultation but did not specify the species and critical habitats for which they were requesting formal consultation.

The NMFS requested additional information from the USACE on April 5, 2023, regarding the tree trunks with root wads to be installed in the new portion of the revetment. Details regarding the dimensions and number of trees with root wads were inconsistent throughout the biological evaluation, engineering plan drawing, and mitigation plan. The USACE responded via email on April 9, 2024 with clarifications from the applicant regarding number, species, and dimensions of large wood to be included in the revetment. On April 9, 2024, we requested additional information on the USACE's effects determination to clarify the species and critical habitats for which they were requesting formal consultation. On April 29, 2024, the USACE responded electronically specifying that they are requesting formal consultation given their may affect, likely to adversely affect determination for LCR Chinook salmon, CR chum salmon, LCR coho salmon, LCR steelhead, Southern DPS eulachon, and critical habitat for these five species. Additionally, the USACE requested that we update their determination of effects to essential fish habitat to "likely to adversely affect" essential fish habitat. With these clarifications, we initiated formal consultation on April 29, 2024.

Updates to the regulations governing interagency consultation (50 CFR part 402) were effective on May 6, 2024 (89 Fed. Reg. 24268). We are applying the updated regulations to this consultation. The 2024 regulatory changes, like those from 2019, were intended to improve and clarify the consultation process, and, with one exception from 2024 (offsetting reasonable and prudent measures), were not intended to result in changes to the Services' existing practice in implementing section 7(a)(2) of the Act. 89 Fed. Reg. at 24268; 84 Fed. Reg. at 45015. We have considered the prior rules and affirm that the substantive analysis and conclusions articulated in this biological opinion and incidental take statement would not have been any different under the 2019 regulations or pre-2019 regulations.

1.3. Proposed Federal Action

Under the ESA, "action" means all activities or programs of any kind authorized, funded, or carried out, in whole or in part, by federal agencies (see 50 CFR 402.02). The proposed action is USACE's authorization of a Section 404 permit to place fill into the Waters of the United States to protect a single-family home and associated structures at 232 Riverview Drive, Castle Rock in Cowlitz County, Washington (Parcel WG1920027). The site is adjacent to the Toutle River at River Mile (RM) 6 (Simpson 2022, Sheets 1 through 3).

The purpose of the project is to repair and lengthen an existing revetment. Rocks in the current revetment have been slipping downward, exposing erodible soils. The landowner proposes to hire a contractor to repair the existing revetment (approximately 60 linear feet) and extend the existing revetment upstream, adding a new portion also approximately 60 linear feet in length. This will enhance the stability of the existing revetment, protect the upstream (east) end of the property from continuing erosion, and avoid exposing the property owner's garage and septic system to potential damage that could be caused by continuing erosion. This project will extend the lifespan of the existing revetment and create a new revetment area to further protect the applicant's property from erosion.

The proposed project would take place within the WDFW-recommended in-water work window for this area: July 16-August 15. However, no in-water work is proposed. The project will take place when the river is typically low, and the work will be carried out using heavy equipment operating from the top of the river bank. Per the applicant, all construction will occur "in the dry" as the river level is typically below the proposed project footprint during the in-water work window. No stream isolation or fish capture efforts are proposed.

The contractor would bring heavy equipment to the site and first clear a small area next to the existing revetment from which to operate the equipment. Preparing this area will require removing two large (18" and 36" diameter at breast height (DBH)) Douglas fir trees and relocating about 10 cubic yards of soil. The two Douglas fir trees will be removed with root balls intact and trunks cut at 10 to 15 feet (D. Guy, pers. comm. April 4, 2024). These trees, along with 6 cedar logs (4-8" DBH) with root wads and 10-foot-long trunks, will be incorporated into the revetment extension to provide fish habitat (D. Guy, pers. comm. April 4, 2024).

To repair and extend the existing revetment, an experienced contractor will use a chain saw, excavator, and hand tools to perform the following construction sequence (Simpson 2022, page 3):

- Above the OHWM, remove two Douglas fir trees for equipment access and cut 10-foot-long logs with rootwads to incorporate into a bioengineered structure.
- Above the OHWM, widen an existing dirt ramp from its current width, which ranges from five to ten feet wide, to 10-feet wide over a 20-foot length to allow equipment access. This requires removing the existing rock retaining wall, removing about 10 cubic yards of soil, and then replacing rocks on the new surface.
- Above the OHWM, remove any soil to the elevation where the heavy equipment can reach the work area. This soil will be stockpiled on the lawn area until it can be replaced to the existing elevation on the ramp area after construction. This soil will be used for providing planting areas in the interstitial spaces in the new revetment section above the OHWM.
- With an excavator, place the two Douglas fir rootwads and 6 cedar logs with rootwads (at 4 to 8 inches DBH), as well as smaller trees and branches; anchor with rocks as designed. (Rocks 3 to 4 feet wide will be used in the expanded area of the revetment, with a transitional area at the base of the revetment that will include rocks 4 to 12 inches wide.)
- Place rocks on the existing revetment to create the 1.5:1 slope.
- Replace removed soil stockpiled on the lawn onto the landing area to the original elevation.
- Soil from widening the ramp will be used to fill the interstitial spaces between the new revetment section above the OHWM to provide planting areas for the proposed mitigation plantings.
- Replace rocks on the retaining wall above the ramp.
- Reseed any areas of soil disturbance on the earthen ramp.

The applicant has committed to the following impact avoidance and minimization measures:

- Meet the requirements of all environmental permits from local, state, and federal agencies.
- Work will be conducted within the WDFW in-water work window: July 16 through August 15 (WDFW 2018).
- No equipment will be driven through the stream.
- The excavator will use vegetable-based hydraulic fluid.
- Refuel and maintain construction equipment offsite or on the gravel driveway.
- Check for fuel leaks at the beginning of each construction day.
- Construction will occur in-the-dry.
- Stabilize disturbed areas with hydroseeding.
- A design was selected to provide as much bioengineering as possible in this high-energy river reach, and a transition zone of smaller river rocks will be placed at the base of the larger rocks to avoid and minimize larger voids between the rocks that provide structural integrity.
- Incorporate eight conifer logs with rootwads into the design for fish habitat.

The applicant has committed to the following conservation measures:

- Planting native shrubs in the interstitial spaces between the large rocks above OHWM, offsetting approximately 241 square feet of aquatic impacts of the new revetment construction.
- Enhancing 280 square feet of stream buffer that is currently residential lawn by planting 8 native Douglas fir and grand fir on an approximate 10-foot spacing.
- Incorporating 8 conifer logs with rootwads with 10- to 15-foot-long trunks (6 cedars ranging from 4-8”-DBH, one Douglas fir 18” DBH, and one Douglas fir 36” DBH) into the new portion of the revetment to provide fish habitat.
- Avoiding the creation of large voids between larger rocks in the new portion of the revetment by filling voids with smaller (4-12” diameter) rounded river rocks. This will avoid creating areas where predator fish could hide and ambush smaller fish.

We considered, under the ESA, whether or not the proposed action would cause any other activities and determined that it would not. Under the MSA, “federal action” means any action authorized, funded, or undertaken, or proposed to be authorized, funded, or undertaken by a federal agency (50 CFR 600.910).

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 to 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 provide 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 reasonable and prudent measures (RPMs) and terms and conditions to minimize such impacts.

The USACE determined the proposed action is likely to adversely affect LCR Chinook salmon, CR chum, LCR coho, LCR steelhead, Southern DPS eulachon, and critical habitat for these five species.

2.1. Analytical Approach

This biological opinion includes both a jeopardy analysis and an adverse modification analysis. The jeopardy analysis relies upon the regulatory definition of "jeopardize the continued existence of" a listed species, which is "to engage in an action that reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species" (50 CFR 402.02). Therefore, the jeopardy analysis considers both survival and recovery of the species.

This biological opinion also relies on the regulatory definition of "destruction or adverse modification," which "means a direct or indirect alteration that appreciably diminishes the value of critical habitat as a whole for the conservation of a listed species" (50 CFR 402.02).

The designations of critical habitat for LCR Chinook salmon (*Oncorhynchus tshawytscha*), CR chum salmon (*Oncorhynchus keta*), LCR coho salmon (*Oncorhynchus kisutch*), LCR steelhead (*Oncorhynchus mykiss*), and Southern DPS eulachon (*Thaleichthys pacificus*) use the term primary constituent element (PCE) or essential features. The 2016 final rule (81 FR 7414; February 11, 2016) that revised the critical habitat regulations (50 CFR 424.12) replaced 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.

The ESA Section 7 implementing regulations define effects of the action using the term "consequences" (50 CFR 402.02). As explained in the preamble to the final rule revising the definition and adding this term (84 FR 44976, 44977; August 27, 2019), that revision does not change the scope of our analysis, and in this opinion, we use the terms "effects" and "consequences" interchangeably.

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

- Evaluate the rangewide status of the species and critical habitat expected to be adversely affected by the proposed action.

- Evaluate the environmental baseline of the species and critical habitat.
- Evaluate the effects of the proposed action on species and their critical habitat using an exposure–response approach.
- Evaluate cumulative effects.
- In the integration and synthesis, add the effects of the action and cumulative effects to the environmental baseline, and, in light of the status of the species and critical habitat, analyze whether the proposed action is likely to: (1) directly or indirectly 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; or (2) directly or indirectly result in an alteration that appreciably diminishes the value of critical habitat as a whole for the conservation of a listed species.
- If necessary, suggest a reasonable and prudent alternative to the proposed action.

2.2. Rangewide Status of the Species and Critical Habitat

This opinion examines the status of each species that is likely to 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' "reproduction, numbers, or distribution" for the jeopardy analysis. The opinion also examines the condition of designated critical habitat, evaluates the conservation value of the various watersheds and coastal and marine environments that make up the designated critical habitat, and discusses the function of the PBFs that are essential for the species' conservation.

One factor affecting the status of ESA-listed species considered in this opinion, and aquatic habitat at large, is climate change. Climate change is likely to play an increasingly important role in determining the abundance and distribution of ESA-listed species, and the conservation value of designated critical habitats, in the Pacific Northwest. These changes will not be spatially homogeneous across the Pacific Northwest. Major ecological realignments are already occurring in response to climate change (IPCC WGII, 2022). Long-term trends in warming have continued at global, national and regional scales. Global surface temperatures in the last decade (2010s) were estimated to be 1.09 °C higher than the 1850-1900 baseline period, with larger increases over land ~1.6 °C compared to oceans ~0.88 (IPCC WGI, 2021). The vast majority of this warming has been attributed to anthropogenic releases of greenhouse gases (IPCC WGI, 2021). Globally, 2014-2018 were the 5 warmest years on record both on land and in the ocean (2018 was the 4th warmest) (NOAA NCEI 2022). Events such as the 2013-2016 marine heatwave (Jacox et al. 2018) have been attributed directly to anthropogenic warming in the annual special issue of Bulletin of the American Meteorological Society on extreme events (Herring et al. 2018). Global warming and anthropogenic loss of biodiversity represent profound threats to ecosystem functionality (IPCC WGII 2022). These two factors are often examined in isolation, but likely have interacting effects on ecosystem function.

Updated projections of climate change are similar to or greater than previous projections (IPCC WGI, 2021). NMFS is increasingly confident in our projections of changes to freshwater and marine systems because every year brings stronger validation of previous predictions in both physical and biological realms. Retaining and restoring habitat complexity, access to climate refuges (both flow and temperature) and improving growth opportunity in both freshwater and marine environments are strongly advocated in the recent literature (Siegel and Crozier 2020). Climate change is systemic, influencing freshwater, estuarine, and marine conditions. Other systems are also being influenced by changing climatic conditions. Literature reviews on the impacts of climate change on Pacific salmon (Crozier 2015, 2016, 2017, Crozier and Siegel 2018, Siegel and Crozier 2019, 2020) have collected hundreds of papers documenting the major themes relevant for salmon. Here we describe habitat changes relevant to Pacific salmon and steelhead, prior to describing how these changes result in the varied specific mechanisms impacting these species in subsequent sections.

Forests

Climate change will impact forests of the western U.S., which dominate the landscape of many watersheds in the region. Forests are already showing evidence of increased drought severity, forest fire, and insect outbreak (Halofsky et al. 2020). Additionally, climate change will affect tree reproduction, growth, and phenology, which will lead to spatial shifts in vegetation. Halofsky et al. (2018) projected that the largest changes will occur at low- and high-elevation forests, with expansion of low-elevation dry forests and diminishing high-elevation cold forests and subalpine habitats.

Forest fires affect salmon streams by altering sediment load, channel structure, and stream temperature through the removal of canopy. Holden et al. (2018) examined environmental factors contributing to observed increases in the extent of forest fires throughout the western U.S. They found strong correlations between the number of dry-season rainy days and the annual extent of forest fires, as well as a significant decline in the number of dry-season rainy days over the study period (1984-2015). Consequently, predicted decreases in dry-season precipitation, combined with increases in air temperature, will likely contribute to the existing trend toward more extensive and severe forest fires and the continued expansion of fires into higher elevation and wetter forests (Alizedeh 2021).

Agne et al. (2018) reviewed literature on insect outbreaks and other pathogens affecting coastal Douglas-fir forests in the Pacific Northwest and examined how future climate change may influence disturbance ecology. They suggest that Douglas-fir beetle and black stain root disease could become more prevalent with climate change, while other pathogens will be more affected by management practices. Agne et al. (2018) also suggested that due to complex interacting effects of disturbance and disease, climate impacts will differ by region and forest type.

Freshwater Environments

The following is excerpted from Siegel and Crozier (2019), who present a review of recent scientific literature evaluating effects of climate change, describing the projected impacts of climate change on instream flows:

Cooper et al. (2018) examined whether the magnitude of low river flows in the western U.S., which generally occur in September or October, are driven more by summer conditions or the prior winter’s precipitation. They found that while low flows were more sensitive to summer evaporative demand than to winter precipitation, interannual variability in winter precipitation was greater. Malek et al. (2018), predicted that summer evapotranspiration is likely to increase in conjunction with declines in snowpack and increased variability in winter precipitation. Their results suggest that low summer flows are likely to become lower, more variable, and less predictable.

The effect of climate change on ground water availability is likely to be uneven. Sridhar et al. (2018) coupled a surface-flow model with a ground-flow model to improve predictions of surface water availability with climate change in the Snake River Basin. Projections using RCP 4.5 and 8.5 emission scenarios suggested an increase in water table heights in downstream areas of the basin and a decrease in upstream areas.

As cited in Siegel and Crozier (2019), Isaak et al. (2018), examined recent trends in stream temperature across the Western U.S. using a large regional dataset. Stream warming trends paralleled changes in air temperature and were pervasive during the low-water warm seasons of 1996-2015 (0.18-0.35°C/decade) and 1976-2015 (0.14-0.27°C/decade). Their results show how continued warming will likely affect the cumulative temperature exposure of migrating sockeye salmon O. nerka and the availability of suitable habitat for brown trout Salmo trutta and rainbow trout O. mykiss. Isaak et al. (2018) concluded that most stream habitats will likely remain suitable for salmonids in the near future, with some becoming too warm. However, in cases where habitat access is currently restricted by dams and other barriers salmon and steelhead will be confined to downstream reaches typically most at risk of rising temperatures unless passage is restored (FitzGerald et al. 2020, Myers et al. 2018).

Streams with intact riparian corridors and that lie in mountainous terrain are likely to be more resilient to changes in air temperature. These areas may provide refuge from climate change for a number of species, including Pacific salmon. Krosby et al. (2018), identified potential stream refugia throughout the Pacific Northwest based on a suite of features thought to reflect the ability of streams to serve as such refuges. Analyzed features include large temperature gradients, high canopy cover, large relative stream width, low exposure to solar radiation, and low levels of human modification. They created an index of refuge potential for all streams in the region, with mountain area streams scoring highest. Flat lowland areas, which commonly contain migration corridors, were generally scored lowest, and thus were prioritized for conservation and restoration. However, forest fires can increase stream temperatures dramatically in short time-spans by removing riparian cover (Koontz et al. 2018), and streams that lose their snowpack with climate change may see the largest increases in stream temperature due to the removal of temperature buffering (Yan et al. 2021). These processes may threaten some habitats that are currently considered refugia.

Marine and Estuarine Environments
Along with warming stream temperatures and concerns about sufficient groundwater to recharge streams, a recent study projects nearly complete loss of existing tidal wetlands along the U.S. West Coast, due to sea level rise (Thorne et al. 2018). California and Oregon showed the greatest threat to tidal wetlands (100%), while 68% of Washington tidal wetlands are expected to be submerged. Coastal development and steep topography prevent horizontal migration of most wetlands, causing the net contraction of this crucial habitat.

Rising ocean temperatures, stratification, ocean acidity, hypoxia, algal toxins, and other oceanographic processes will alter the composition and abundance of a vast array of oceanic species. In particular, there will be dramatic changes in both predators and prey of Pacific salmon, salmon life history traits and relative abundance. Siegel and Crozier (2019) observe that changes in marine temperature are likely to have a number of physiological consequences on fishes themselves. For example, in a study of small planktivorous fish, Gliwicz et al. (2018) found that higher ambient temperatures increased the distance at which fish reacted to prey. Numerous fish species (including many tuna and sharks) demonstrate regional endothermy, which in many cases augments eyesight by warming the retinas. However, Gliwicz et al. (2018) suggest that ambient temperatures can have a similar effect on fish that do not demonstrate this trait. Climate change is likely to reduce the availability of biologically essential omega-3 fatty acids produced by phytoplankton in marine ecosystems. Loss of these lipids may induce cascading trophic effects, with distinct impacts on different species depending on compensatory mechanisms (Gourtay et al. 2018). Reproduction rates of many marine fish species are also likely to be altered with temperature (Veilleux et al. 2018). The ecological consequences of these effects and their interactions add complexity to predictions of climate change impacts in marine ecosystems.

Perhaps the most dramatic change in physical ocean conditions will occur through ocean acidification and deoxygenation. It is unclear how sensitive salmon and steelhead might be to the direct effects of ocean acidification because of their tolerance of a wide pH range in freshwater (although see Ou et al. 2015 and Williams et al. 2019), however, impacts of ocean acidification and hypoxia on sensitive species (e.g., plankton, crabs, rockfish, groundfish) will likely affect salmon indirectly through their interactions as predators and prey. Similarly, increasing frequency and duration of harmful algal blooms may affect salmon directly, depending on the toxin (e.g., saxitoxin vs domoic acid), but will also affect their predators (seabirds and mammals). The full effects of these ecosystem dynamics are not known but will be complex. Within the historical range of climate variability, less suitable conditions for salmonids (e.g., warmer temperatures, lower streamflows) have been associated with detectable declines in many of these listed units, highlighting how sensitive they are to climate drivers (Ford 2022, Lindley et al. 2009, Williams et al. 2016, Ward et al. 2015). In some cases, the combined and potentially additive effects of poorer climate conditions for fish and intense anthropogenic impacts caused the population declines that led to these population groups being listed under the ESA (Crozier et al. 2019).

Climate change effects on salmon and steelhead

In freshwater, year-round increases in stream temperature and changes in flow will affect physiological, behavioral, and demographic processes in salmon, and change the species with which they interact. For example, as stream temperatures increase, many native salmonids face increased competition with more warm-water tolerant invasive species. Changing freshwater temperatures are likely to affect incubation and emergence timing for eggs, and in locations where the greatest warming occurs may affect egg survival, although several factors impact intergravel temperature and oxygen (e.g., groundwater influence) as well as sensitivity of eggs to thermal stress (Crozier et al. 2020). Changes in temperature and flow regimes may alter the amount of habitat and food available for juvenile rearing, and this in turn could lead to a restriction in the distribution of juveniles, further decreasing productivity through density dependence. For migrating adults, predicted changes in freshwater flows and temperatures will likely increase exposure to stressful temperatures for many salmon and steelhead populations, and alter migration travel times and increase thermal stress accumulation for ESUs or DPSs with early-returning (i.e., spring- and summer-run) phenotypes associated with longer freshwater holding times (Crozier et al. 2020, FitzGerald et al. 2020). Rising river temperatures increase the energetic cost of migration and the risk of en route or pre-spawning mortality of adults with long freshwater migrations, although populations of some ESA-listed salmon and steelhead may be able to make use of cool-water refuges and run-timing plasticity to reduce thermal exposure (Keefer et al. 2018, Barnett et al. 2020).

Marine survival of salmonids is affected by a complex array of factors including prey abundance, predator interactions, the physical condition of salmon within the marine environment, and carryover effects from the freshwater experience (Holsman et al. 2012, Burke et al. 2013). It is generally accepted that salmon marine survival is size-dependent, and thus larger and faster growing fish are more likely to survive (Gosselin et al. 2021). Furthermore, early arrival timing in the marine environment is generally considered advantageous for populations migrating through the Columbia River. However, the optimal day of arrival varies across years, depending on the seasonal development of productivity in the California Current, which affects prey available to salmon and the risk of predation (Chasco et al. 2021). Siegel and Crozier (2019) point out the concern that for some salmon populations, climate change may drive mismatches between juvenile arrival timing and prey availability in the marine environment. However, phenological diversity can contribute to metapopulation-level resilience by reducing the risk of a complete mismatch. Carr-Harris et al. (2018), explored phenological diversity of marine migration timing in relation to zooplankton prey for sockeye salmon O. nerka from the Skeena River of Canada. They found that sockeye migrated over a period of more than 50 days, and populations from higher elevation and further inland streams arrived in the estuary later, with different populations encountering distinct prey fields. Carr-Harris et al. (2018) recommended that managers maintain and augment such life-history diversity.

Synchrony between terrestrial and marine environmental conditions (e.g., coastal upwelling, precipitation and river discharge) has increased in spatial scale causing the highest levels of synchrony in the last 250 years (Black et al. 2018). A more synchronized climate combined with simplified habitats and reduced genetic diversity may be leading to more synchrony in the productivity of populations across the range of salmon (Braun et al. 2016). For example, salmon productivity (recruits/spawner) has also become more synchronized across Chinook populations from Oregon to the Yukon (Dorner et al. 2018, Kilduff et al. 2014). In addition, Chinook salmon have become smaller and younger at maturation across their range (Ohlberger 2018). Other Pacific salmon species (Stachura et al. 2014) and Atlantic salmon (Olmos et al. 2020) also have demonstrated synchrony in productivity across a broad latitudinal range.

At the individual scale, climate impacts on salmon in one life stage generally affect body size or timing in the next life stage and negative impacts can accumulate across multiple life stages (Healey 2011; Wainwright and Weitkamp 2013, Gosselin et al. 2021). Changes in winter precipitation will likely affect incubation and/or rearing stages of most populations. Changes in the intensity of cool season precipitation, snow accumulation, and runoff could influence migration cues for fall, winter and spring adult migrants, such as coho and steelhead. Egg survival rates may suffer from more intense flooding that scours or buries redds. Changes in hydrological regime, such as a shift from mostly snow to more rain, could drive changes in life history, potentially threatening diversity within an ESU (Beechie et al. 2006). Changes in summer temperature and flow will affect both juvenile and adult stages in some populations, especially those with yearling life histories and summer migration patterns (Crozier and Zabel 2006; Crozier et al. 2010, Crozier et al. 2019).

At the population level, the ability of organisms to genetically adapt to climate change depends on how much genetic variation currently exists within salmon populations, as well as how selection on multiple traits interact, and whether those traits are linked genetically. While genetic diversity may help populations respond to climate change, the remaining genetic diversity of many populations is highly reduced compared to historic levels. For example, Johnson et al. (2018), compared genetic variation in Chinook salmon from the Columbia River Basin between contemporary and ancient samples. A total of 84 samples determined to be Chinook salmon were collected from vertebrae found in ancient middens and compared to 379 contemporary samples. Results suggest a decline in genetic diversity, as demonstrated by a loss of mitochondrial haplotypes as well as reductions in haplotype and nucleotide diversity. Genetic losses in this comparison appeared larger for Chinook from the mid-Columbia than those from the Snake River Basin. In addition to other stressors, modified habitats and flow regimes may create unnatural selection pressures that reduce the diversity of functional behaviors (Sturrock et al. 2020). Managing to conserve and augment existing genetic diversity may be increasingly important with more extreme environmental change (Anderson et al. 2015), though the low levels of remaining diversity present challenges to this effort (Freshwater 2019). Salmon historically maintained relatively consistent returns across variation in annual weather through the portfolio effect (Schindler et al. 2015), in which different populations are sensitive to different climate drivers. Applying this concept to climate change, Anderson et al (2015) emphasized the additional need for populations with different physiological tolerances. Loss of the portfolio increases volatility in fisheries, as well as ecological systems, as demonstrated for Fraser River and Sacramento River stock complexes (Freshwater et al. 2019, Munsch et al. 2022).

2.2.1. Status of the Critical Habitat

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

A summary of the status of critical habitats considered in this opinion is provided in Table 1, below.

Table 1. Critical habitat, designation date, federal register citation, and status summary for critical habitat considered in this opinion.

Species	Designation Date and Federal Register Citation	Critical Habitat Status Summary
Lower Columbia River Chinook salmon	9/02/05 70 FR 52630	Critical habitat encompasses 10 subbasins in Oregon and Washington containing 47 occupied watersheds, as well as the lower Columbia River rearing/migration corridor. Most HUC5 watersheds with PCEs for salmon are in fair-to-poor or fair-to-good condition (NMFS 2005). However, most of these watersheds have some, or high potential for improvement. We rated conservation value of HUC5 watersheds as high for 30 watersheds, medium for 13 watersheds, and low for four watersheds.
Columbia River chum salmon	9/02/05 70 FR 52630	Critical habitat encompasses six subbasins in Oregon and Washington containing 19 occupied watersheds, as well as the lower Columbia River rearing/migration corridor. Most HUC5 watersheds with PCEs for salmon are in fair-to-poor or fair-to-good condition (NMFS 2005). However, most of these watersheds have some or a high potential for improvement. We rated conservation value of HUC5 watersheds as high for 16 watersheds, and medium for three watersheds.
Lower Columbia River coho salmon	2/24/16 81 FR 9252	Critical habitat encompasses 10 subbasins in Oregon and Washington containing 55 occupied watersheds, as well as the lower Columbia River and estuary rearing/migration corridor. Most HUC5 watersheds with PCEs for salmon are in fair-to-poor or fair-to-good condition (NMFS 2005). However, most of these watersheds have some or a high potential for improvement. We rated conservation value of HUC5 watersheds as high for 34 watersheds, medium for 18 watersheds, and low for three watersheds.
Lower Columbia River steelhead	9/02/05 70 FR 52630	Critical habitat encompasses nine subbasins in Oregon and Washington containing 41 occupied watersheds, as well as the lower Columbia River rearing/migration corridor. Most HUC5 watersheds with PCEs for salmon are in fair-to-poor or fair-to-good condition (NMFS 2005). However, most of these watersheds have some or a high potential for improvement. We rated conservation value of HUC5 watersheds as high for 28 watersheds, medium for 11 watersheds, and low for two watersheds.
Southern DPS eulachon	10/20/11 76 FR 65324	Critical habitat for eulachon includes portions of 16 rivers and streams in California, Oregon, and Washington. All of these areas are designated as migration and spawning habitat for this species. In Oregon, we designated 24.2 miles of the lower Umpqua River, 12.4 miles of the lower Sandy River, and 0.2 miles of Tenmile Creek. We also designated the mainstem Columbia River from the mouth to the base of Bonneville Dam, a distance of 143.2 miles. Dams and water diversions are moderate threats to eulachon in the Columbia and Klamath rivers where hydropower generation and flood control are major activities. Degraded water quality is common in some areas occupied by southern DPS eulachon. In the Columbia and Klamath river basins, large-scale impoundment of water has increased winter water temperatures, potentially altering the water temperature during eulachon spawning periods. Numerous chemical contaminants are also present in spawning rivers, but the exact effect these compounds have on spawning and egg development is unknown. Dredging is a low to moderate threat to eulachon in the Columbia River. Dredging during eulachon spawning would be particularly detrimental.

For most salmon and steelhead, NMFS's critical habitat analytical review teams (CHARTs) ranked watersheds within designated critical habitat at the scale of the fifth-field hydrologic unit code (HUC5) in terms of the conservation value they provide to each ESA-listed species that they support (NMFS 2005). The conservation rankings were high, medium, or low. To determine the conservation value of each watershed to species viability, the CHARTs evaluated the quantity and quality of habitat features, the relationship of the area compared to other areas within the species' range, and the significance to the species of the population occupying that area. Even if a location had poor habitat quality, it could be ranked with a high conservation value if it were essential due to factors such as limited availability, a unique contribution of the population it served, or is serving another important role.

The CHART for each recovery domain assessed biological information pertaining to areas occupied by listed salmon and steelhead. They determined whether those areas contained PCEs essential for the conservation of those species and whether unoccupied areas existed within the historical range of the listed salmon and steelhead that are also essential for conservation. The CHARTs assigned a 0 to 3-point score for the PCEs in each HUC5 watershed for six factors: (1) quantity, (2) quality (current condition), (3) quality (potential condition), (4) support of rarity importance, (5) support of abundant populations, and (6) support of spawning/earing. Thus, the quality of habitat in a given watershed was characterized by the scores for Factor 2 (quality – current condition), which considers the existing condition of the quality of PCEs in the HUC5 watershed; and Factor 3 (quality – potential condition), which considers the likelihood of achieving PCE potential in the HUC5 watershed, either naturally or through active conservation/restoration, given known limiting factors, likely biophysical responses, and feasibility.

The physical or biological features of freshwater spawning and incubation sites include water flow, quality, and temperature conditions and suitable substrate for spawning and incubation, as well as migratory access for adults and juveniles (Table 2). These features are essential to conservation because without them the species cannot successfully spawn and produce offspring. The physical or biological features of freshwater migration corridors associated with spawning and incubation sites include water flow, quality and temperature conditions supporting larval and adult mobility, abundant prey items supporting larval feeding after yolk sac depletion, and free passage (no obstructions) for adults and juveniles. These features are essential to conservation because they allow adult fish to swim upstream to reach spawning areas and they allow larval fish to proceed downstream and reach the ocean.

Table 2. Primary constituent elements (PCEs) of critical habitats designated for ESA-listed salmon and steelhead species considered in this Opinion and corresponding species life history events.

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

Eulachon

Critical habitat for eulachon includes portions of 16 rivers and streams in California, Oregon, and Washington (USDC 2011). All of these areas are designated as migration and spawning habitat for this species. In Oregon, 24.2 miles of the lower Umpqua River, 12.4 miles of the lower Sandy River, and 0.2 miles of Tenmile Creek have been designated. The mainstem Columbia River from the mouth to the base of Bonneville Dam, a distance of 143.2 miles, is also designated as critical habitat. Critical habitat for eulachon extends up the lower reaches of several main tributaries to the lower Columbia River, including the Cowlitz River. In the Cowlitz River, critical habitat for eulachon extends from the river mouth upstream to the Cowlitz Falls Dam. Critical habitat also extends from the confluence of the Cowlitz and Toutle Rivers and goes several miles up the lower Toutle River. Table 3 describes the physical or biological features of critical habitat for eulachon.

Table 3. Physical or biological features of critical habitats designated for eulachon and corresponding species life history events.

Site Type	Site Attribute	Species Life History Event
Freshwater spawning and incubation	Flow Water quality Water temperature Substrate	Adult spawning Incubation
Freshwater migration	Flow Water quality Water temperature Food	Adult and larval mobility Larval feeding

The range of eulachon in the Pacific Northwest completely overlaps with the range of several ESA-listed stocks of salmon and steelhead as well as green sturgeon. Although the habitat requirements of these fishes differ somewhat from eulachon, efforts to protect habitat generally focus on the maintenance of watershed processes that would be expected to benefit eulachon. The BRT identified dams and water diversions as moderate threats to eulachon in the Columbia and Klamath rivers where hydropower generation and flood control are major activities. Degraded water quality is common in some areas occupied by southern DPS eulachon. In the Columbia and Klamath systems, large-scale impoundment of water has increased winter water temperatures, potentially altering the water temperature during eulachon spawning periods (Gustafson et al. 2010). Numerous chemical contaminants are also present in spawning rivers, but the exact effect these compounds have on spawning and egg development is unknown (Gustafson et al. 2010). The BRT identified dredging as a low to moderate threat to eulachon in the Columbia River. Dredging during eulachon spawning would be particularly detrimental.

The lower Columbia River mainstem provides spawning and incubation sites, and a large migratory corridor to spawning areas in the tributaries. Prior to the construction of Bonneville Dam, eulachon ascended the Columbia River as far as Hood River, Oregon. Major tributaries that support spawning runs include the Grays, Skamokawa, Elochoman, Kalama, Lewis and Sandy rivers.

2.2.2. Status of ESA-Listed Species

Table 4, below, provides a summary of listing and recovery plan information, status summaries and limiting factors for the species addressed in this opinion. More information can be found in recovery plans and status reviews for these species. Acronyms appearing in the table include DPS (Distinct Population Segment), ESU (Evolutionarily Significant Unit), ICTRT (Interior Columbia Technical Recovery Team), MPG (Major Population Group), NWFSC (Northwest Fisheries Science Center), TRT (Technical Recovery Team), and VSP (Viable Salmonid Population).

Table 4. Listing classification and date, recovery plan reference, most recent status review, status summary, and limiting factors for each species considered in this opinion.

Species	Listing Classification and Date	Recovery Plan Reference	Most Recent Status Review	Status Summary	Limiting Factors
Lower Columbia River Chinook salmon	Threatened 6/28/05	NMFS 2013	NMFS 2022	This ESU comprises 32 independent populations. Twenty-seven populations are at very high risk, 2 populations are at high risk, one population is at moderate risk, and 2 populations are at very low risk. Overall, there was little change since the last status review in the biological status of this ESU, although there are some positive trends. Increases in abundance were noted in about 70% of the fall-run populations and decreases in hatchery contribution were noted for several populations. Relative to baseline VSP levels identified in the recovery plan, there has been an overall improvement in the status of a number of fall-run populations, although most are still far from the recovery plan goals.	• Reduced access to spawning and rearing habitat • Hatchery-related effects • Harvest-related effects on fall Chinook salmon • An altered flow regime and Columbia River plume • Reduced access to off-channel rearing habitat • Reduced productivity resulting from sediment and nutrient-related changes in the estuary • Contaminant
Columbia River chum salmon	Threatened 6/28/05	NMFS 2013	NMFS 2022	Overall, the status of most chum salmon populations is unchanged from the baseline VSP scores estimated in the recovery plan. A total of 3 of 17 populations are at or near their recovery viability goals, although under the recovery plan scenario these populations have very low recovery goals of 0. The remaining populations generally require a higher level of viability and most require substantial improvements to reach their viability goals. Even with the improvements observed during the last five years, the majority of populations in this ESU remain at a high or very high-risk category and considerable progress remains to be made to achieve the recovery goals.	• Degraded estuarine and nearshore marine habitat • Degraded freshwater habitat • Degraded stream flow as a result of hydropower and water supply operations • Reduced water quality • Current or potential predation • An altered flow regime and Columbia River plume • Reduced access to off-channel rearing habitat in the lower Columbia River • Reduced productivity resulting from sediment and nutrient-related changes in the estuary • Juvenile fish wake strandings • Contaminants

Species	Listing Classification and Date	Recovery Plan Reference	Most Recent Status Review	Status Summary	Limiting Factors
Lower Columbia River coho salmon	Threatened 6/28/05	NMFS 2013	NMFS 2022	Of the 24 populations that make up this ESU, 21 populations are at very high risk, 1 population is at high risk, and 2 populations are at moderate risk. Recent recovery efforts may have contributed to the observed natural production, but in the absence of longer-term data sets it is not possible to parse out these effects. Populations with longer term data sets exhibit stable or slightly positive abundance trends. Some trap and haul programs appear to be operating at or near replacement, although other programs still are far from that threshold and require supplementation with additional hatchery-origin spawners. Initiation of or improvement in the downstream juvenile facilities at Cowlitz Falls, Merwin, and North Fork Dam are likely to further improve the status of the associated upstream populations. While these and other recovery efforts have likely improved the status of a number of coho salmon populations, abundances are still at low levels and the majority of the populations remain at moderate or high risk. For the Lower Columbia River region land development and increasing human population pressures will likely continue to degrade habitat, especially in lowland areas. Although populations in this ESU have generally improved, especially in the 2013/14 and 2014/15 return years, recent poor ocean conditions suggest that population declines might occur in the upcoming return years	• Degraded estuarine and near-shore marine habitat • Fish passage barriers • Degraded freshwater habitat: Hatchery-related effects • Harvest-related effects • An altered flow regime and Columbia River plume • Reduced access to off-channel rearing habitat in the lower Columbia River • Reduced productivity resulting from sediment and nutrient-related changes in the estuary • Juvenile fish wake stranding • Contaminants

Species	Listing Classification and Date	Recovery Plan Reference	Most Recent Status Review	Status Summary	Limiting Factors
Lower Columbia River steelhead	Threatened 1/5/06	NMFS 2013	NMFS 2022	This DPS comprises 23 historical populations, 17 winter-run populations and six summer-run populations. Nine populations are at very high risk, 7 populations are at high risk, 6 populations are at moderate risk, and 1 population is at low risk. The majority of winter-run steelhead populations in this DPS continue to persist at low abundances. Hatchery interactions remain a concern in select basins, but the overall situation is somewhat improved compared to prior reviews. Summer-run steelhead populations were similarly stable, but at low abundance levels. The decline in the Wind River summer-run population is a source of concern, given that this population has been considered one of the healthiest of the summer-runs; however, the most recent abundance estimates suggest that the decline was a single year aberration. Passage programs in the Cowlitz and Lewis basins have the potential to provide considerable improvements in abundance and spatial structure, but have not produced self-sustaining populations to date. Even with modest improvements in the status of several winter-run DIPs, none of the populations appear to be at fully viable status, and similarly none of the MPGs meet the criteria for viability.	• Degraded estuarine and nearshore marine habitat • Degraded freshwater habitat • Reduced access to spawning and rearing habitat • Avian and marine mammal predation • Hatchery-related effects • An altered flow regime and Columbia River plume • Reduced access to off-channel rearing habitat in the lower Columbia River • Reduced productivity resulting from sediment and nutrient-related changes in the estuary • Juvenile fish wake stranding • Contaminants

Species	Listing Classification and Date	Recovery Plan Reference	Most Recent Status Review	Status Summary	Limiting Factors
Southern DPS of eulachon	Threatened 3/18/10	NMFS 2017	NMFS 2022a	The Southern DPS of eulachon includes all naturally-spawned populations that occur in rivers south of the Nass River in British Columbia to the Mad River in California. Sub populations for this species include the Fraser River, Columbia River, British Columbia and the Klamath River. In the early 1990s, there was an abrupt decline in the abundance of eulachon returning to the Columbia River. Despite a brief period of improved returns in 2001-2003, the returns and associated commercial landings eventually declined to the low levels observed in the mid-1990s. Although eulachon abundance in monitored rivers has generally improved, especially in the 2013-2015 return years, recent poor ocean conditions and the likelihood that these conditions will persist into the near future suggest that population declines may be widespread in the upcoming return years.	• Changes in ocean conditions due to climate change, particularly in the southern portion of the species' range where ocean warming trends may be the most pronounced and may alter prey, spawning, and rearing success. • Climate-induced change to freshwater habitats • Bycatch of eulachon in commercial fisheries • Adverse effects related to dams and water diversions • Water quality, • Shoreline construction • Over harvest • Predation

2.3. Environmental Baseline

The "environmental baseline" refers to the condition of the listed species or its designated critical habitat in the action area, without the consequences to the listed species or designated critical habitat caused by the proposed action. 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 consultations, and the impact of State or private actions which are contemporaneous with the consultation in process. The impacts to listed species or designated critical habitat from federal agency activities or existing federal agency facilities that are not within the agency's discretion to modify are part of the environmental baseline (50 CFR 402.02).

The complex life cycles exhibited by salmon and steelhead give rise to complex habitat needs, particularly during the freshwater phase (Spence et al. 1996). Spawning gravels must be a certain size and free of sediment to allow successful incubation of the eggs. Eggs also require cool, clean, and well-oxygenated waters for proper development. Juveniles need abundant food sources, including insects, crustaceans, and other small fish. They need places to hide from predators (mostly birds and bigger fish), such as under logs, root wads, and boulders in the stream, as well as beneath overhanging vegetation. They also need places to seek refuge from periodic high flows (side channels and off-channel areas) and from warm summer water temperatures (cold water springs and deep pools). Returning adults generally do not feed in fresh water, but instead rely on limited energy stores to migrate, mature, and spawn. Like juveniles, they also require cool water and places to rest and hide from predators. They also need migratory corridors with adequate passage conditions (safe passage with respect to barriers, water quality, and water quantity) to allow access to the various habitats required to complete their life cycle.

Eulachon are anadromous but spend 95% of their lives at sea, coming into coastal rivers like the Columbia River (and their tributaries, including the Cowlitz River) to spawn. The spawning migration typically begins when river temperatures are between 0 and 10º C, which usually occurs between December and June. Documented eulachon river entry or spawn timing in the Cowlitz River is December through early April, with peak occurrence January through March (Gustafson et al. 2010). Most eulachon are semelparous. Females release 17,000-60,000 eggs approximately 1mm in diameter. The eggs hatch in 3-8 weeks depending on temperature and the river flow carries the newly hatched larvae (4-8mm length) downriver to estuaries. Habitat needs during the freshwater phase of the eulachon life cycle include cold water temperatures, suitable sand or coarse gravel substrate in spawning areas, and migratory corridors with adequate passage conditions (safe passage with respect to barriers, water quality, and water quantity).

Aquatic habitat quality and quantity has declined in the Toutle River over the past century and particularly since the eruption of Mt St. Helens in 1980. The eruption changed the entire nature of the river. The mudflow that was conveyed down the Toutle River and into the Cowlitz River raised the bottom depth by up to 15 feet in some areas and greatly reducing the flood-carrying capacity (Lombard et al. 1981). Since the eruption, the Toutle River has continued the downstream movement of sediment-laden water into the Cowlitz and Columbia Rivers which require periodic dredging to maintain navigability by boat traffic. In 1989, the USACE completed a sediment retention structure which functions to retain some of the sediment that continues flowing from the slopes of Mt. St. Helens. This sediment retention structure is on the North Fork Toutle River, upstream of the action area and about 30.5 miles from the confluence of the Toutle and Cowlitz rivers.

The action area is located along the northern edge of the applicant's property, where the property abuts the Toutle River. The property consists of a single-family home, garage, driveway, and lawn. The south, east, and west property lines have narrow plantings of native Douglas fir, western red cedar, and ornamental cedars with a native shrub understory. Habitat in the surrounding area includes a strip of residential homes along the north bank of the Toutle River, and immature, industrial forest north of the homes. West of the project also consists of immature, industrial forest.

The Toutle River is a Type S stream (shoreline of the state; Simpson 2022 p. 4). During the summer low flow, the wetted width is about 106 feet, and the distance between OHWMs is about 170 feet. The river gradient is fairly flat at the project site, forming glide habitat. However, at a revetment upstream of the site, the river is narrower, the substrate has larger rocks, the gradient is steeper, and there is riffle habitat. During the past four years of observation, and as shown on aerial photographs, the bedload area across the river has been building in elevation during high-water events, and the thalweg has been moving south toward the subject property. Two properties in this reach have existing revetments, and residents have observed in the past two winters that the revetments have been shifting downward one to two feet, indicating toe scour. The subject property is about 20 feet higher than the OHWM and is protected from bank erosion by bedrock on the west half of the property where the bank is nearly vertical. This bedrock extends into the river. East of the bedrock is an existing rock revetment that is mostly vertical, with the exception of rocks 3 feet to 6 feet in diameter that have tumbled into the river.

The parcel property line is at the upstream (east) end of the existing revetment, which is essentially vertical on its east side. The two parcels to the east are camping lots that do not have bank protection, and the parcel east of the camping lot has an existing rock revetment for bank protection. The camping lots to the east have a patch of two Douglas firs with native shrubs near the property line and bank, and a large lawn area along the eroding bank. Between the lawn and Riverview Drive is a strip of mature, native Douglas fir and western red cedar.

Unprotected parcels between the revetments have undergone significant bank erosion because the banks in this area consist of sand and cobbles with very little silt and clay to bind the soil together. This bank has continued to erode near the property line of the project site, causing concern that future erosion could threaten the garage foundation that is approximately 20 feet from the bank.

River substrate at the camping lot consists of cobbles at the foot of the bank, and during summer low flow there is a sandy beach extending into the river. This area between the revetments has been eroding to form an alcove. There are no undercut banks near the project site. One large cedar tree (about 18 inches DBH and 80 feet long) washed into the alcove and revetment rocks during a high-water event in January 2021.

Critical habitat for all species considered in this Opinion occurs in the action area. Numerous Pacific Coast Salmon Recovery Funding funded (PCSRF) habitat improvement projects have taken place in the North Fork Toutle and South Fork Toutle, upriver of the action area, but no PCSRF-funded habitat improvement projects have taken place in or near the action area.

Numerous hatchery programs are ongoing in the Cowlitz Basin. These programs produce Chinook salmon, coho salmon, and steelhead that are part of their respective listed ESU or DPS. There is also a summer-run steelhead hatchery program in the Cowlitz; these fish are not part of the listed steelhead ESU. Chum salmon are not produced in any Cowlitz Basin hatchery program.

Nine populations of listed species occur in the action area:

LCR Evolutionarily Significant Unit (ESU) Chinook salmon (2 populations)
•Chinook salmon spring-run Toutle River population
•Chinook salmon fall-run Toutle River population ("Tule") population

LCR ESU Coho (2 populations)
•Coho early and late-run South Fork Toutle River population
•Coho early and late-run North Fork Toutle River population

LCR Distinct Population Segment (DPS) Steelhead (2 populations)
•Steelhead winter-run South Fork Toutle River population
•Steelhead winter-run North Fork Toutle River population

Columbia River (CR) ESU Chum (2 populations)
•Chum fall-run Cowlitz River population
•Chum summer-run Cowlitz River population

Eulachon (1 population)
•Southern distinct population segment (DPS) eulachon

Each listed salmon or steelhead population present in the action area plays a unique role in species' recovery and is essential for the species' survival. Most of these populations are faring poorly relative to their abundance recovery target. Extinction risks are significant for all of these populations and most have not progressed significantly towards recovery. Table 5, below, highlights the role of each salmonid population in recovery of the listed entity (core population, genetic legacy population, primary population, or stabilizing population), the most recent abundance estimates for each salmonid population (Ford 2022), and recovery target abundance numbers (NMFS 2013).

In order to meet recovery goals, abundance for almost all listed salmon and steelhead populations in the action area must increase substantially. Both populations of Chinook salmon present in the action area are at ten percent or less of their recovery target. Both coho salmon populations are faring moderately, with one population at about 56% and the other at about 43% of their recovery target. The South Fork Toutle River steelhead population has slightly surpassed its recovery target while the North Fork Toutle River steelhead is at about 68% of its recovery target. Both chum salmon populations are in a precarious state and are presumed to be near zero abundance (Ford 2022). Recovery targets are an abundance metric integral to biological viability criteria. Achieving recovery targets at the population level is the first step towards achieving recovery scenarios at the stratum level, which builds towards achieving recovery at the ESU or DPS level. In addition to achieving biological viability criteria, achieving recovery at the ESU or DPS level requires the amelioration of threats identified during the listing process.

Eulachon in the action area are part of the listed southern DPS of eulachon. The listed entity is comprised of one population segment. Eulachon occur in the Cowlitz River and in some years the run supports a recreational fishery. During the 2024 smelt opener on the Cowlitz River, an estimated 8,600 people harvested nearly 54,000 pounds during the five-hour fishery. The action area is very close the furthest extent of the species' critical habitat in the Toutle River and individuals present in the action area are be part of the Cowlitz river run. Eulachon occasionally migrate up the Toutle River (Robert Anderson, NMFS, pers. comm. June 24, 2024) so may be present in the action area.

Table 5. Federally listed salmon and steelhead population present in the Simpson Bank Stabilization Project action area, their recovery role, and recent status, where "*" denotes abundance for North and South Fork Toutle populations given as one number, and "**" denotes high uncertainty regarding whether a population is meeting their abundance targets.

Population	Core or genetic legacy population	Contribution to Recovery**	Net Baseline persistence probability**	Target Persistence Probability**	Historical abundance	Baseline abundance^	Target	Current abundance. 2015-2019 Five-year geometric mean of raw natural-origin spawner abundance, with 5-year geometric mean of raw total spawner counts (including hatchery origin fish) in parenthesis. Colors indicate the relative proportion of the recovery target currently obtained: red = <10%, orange = 10% > x < 50%, yellow = 50% > x < 100%), green = >100%.
Lower Columbia River ESU Chinook salmon spring-run Toutle River population		Contributing	VL	M	3,100	100	1,100	n/a
Lower Columbia River ESU Chinook salmon fall-run Toutle River population ("Tule")	Core	Primary	VL	H+	11,000	<50	4,000	280
Lower Columbia River DPS coho early- and late-run South Fork Toutle River population		Primary	VL	H	27,000	<50	1,900	1,075
Lower Columbia River DPS coho early- and late-run North Fork Toutle River population		Primary	VL	H	*	<50	1,900	819
Lower Columbia River DPS steelhead winter-run South Fork Toutle River population		Primary	M	H+	3,600	350	600	(660)**
Lower Columbia River DPS steelhead winter-run North Fork Toutle River population	Core	Primary	VL	H	*	120	600	(409)**
Columbia River ESU chum fall-run Cowlitz River population	Core	Contributing	VL	M	195,000	<300	900	n/a
Columbia River ESU chum summer-run Cowlitz River population	Core	Contributing	VL	M	no data	no data	900	n/a

2.3.1. Importance of LCR Salmonid Populations in the Action Area to Species Survival

The Chinook, chum, and coho salmon, and steelhead populations under consideration in this Opinion are all part of the Cascade Major Population Group.

Chinook

Spring Chinook salmon

LCR spring Chinook salmon spawn primarily in upstream, higher elevation portions of large subbasins. They are a "stream-type" salmon, meaning that juveniles typically rear in fresh water for a full year. Adults enter the lower Columbia River from March through June, well in advance of spawning (NMFS 2013). Their migration into tributary headwaters requires several months as they typically hold in deep pools or under dense cover until just prior to spawning. They spawn in early autumn and their eggs incubate one to two months (LCFRB 2010). Fry emergence and early rearing takes place approximately October through January. Rearing in streams and rivers continues until the following year. Most stream-type juveniles emigrate from fresh water as yearlings, typically in the spring of their second year. However, some juveniles from Lower Columbia River spring Chinook salmon populations migrate downstream from their natal tributaries in the fall and early winter into larger rivers, including the mainstem Columbia River, where they are believed to over-winter before outmigrating the next spring as yearling smolts (NMFS 2013).

Spring Chinook salmon from the Toutle River population are present in the action area. In the Recovery Plan, this population of spring Chinook salmon is designated as a contributing population with an abundance recovery target of 1,100 adult natural origin spawners (NMFS 2013). An abundance estimate for this population was not available for the most recent 5-year review but this population is assumed to be at less than ten percent of its abundance recovery target (Ford 2022). WDFW does not recognize the continued existence of this population and adult spawner surveys are not conducted (Ford 2022).

Fall Chinook salmon

Fall Chinook salmon ("tule" stock) spawn in moderate-sized streams and large river mainstems, including most tributaries of the lower Columbia River. Most LCR fall Chinook salmon enter freshwater from August to September and spawn from late September to November, with peak spawning activity in mid-October (NMFS 2013). These fish display an "ocean-type" life history. Juveniles typically begin emigrating downstream as subyearlings at 1 to 4 months of age and enter salt water in late summer or autumn. Juvenile trapping indicates that individual populations display different combinations of two basic temporal patterns: an early fry outmigration downstream into intertidal areas in the early spring, followed by a component that rears for a longer period in natal tributary habitat and out-migrate in late spring/early summer (NMFS 2013; Cooney and Holzer 2011).

Fall Chinook salmon from the Toutle River population are present in the action area. In the Recovery Plan, this population is designated as a core and primary population with an abundance recovery target of 4,000 adult natural-origin spawners (NMFS 2013). This population is currently at less than ten percent of its abundance recovery target with a recent abundance of only 280 (Ford 2022)

Coho salmon
LCR coho salmon (*Oncorhynchus kisutch*) are typically categorized into early- and late-returning stocks (NMFS 2013). Early-returning (Type S) adult coho salmon enter the Columbia River in mid-August and begin entering tributaries in early September, with peak spawning from mid-October to early November. Late-returning (Type N) coho salmon pass through the lower Columbia from late September through December and enter tributaries from October through January. Most spawning occurs from November to January, but some occurs as late as March (LCFRB 2010).

Coho salmon construct redds in gravel and small cobble substrate in pool tailouts, riffles, and glides, with sufficient flow depth for spawning activity (NMFS 2013). Eggs incubate over late fall and winter for about 45 to 140 days, depending on water temperature, with longer incubation in colder water. Fry may thus emerge from early spring to early summer. Juveniles typically rear in freshwater for about a year. After emergence, coho salmon fry move to shallow, low-velocity rearing areas, primarily along stream edges and side channels. Juvenile coho salmon favor pool habitat and often congregate in quiet backwaters, side channels, and small creeks with riparian cover and woody debris. Side-channel rearing areas are particularly critical for overwinter survival, which is a key regulator of freshwater productivity (LCFRB 2010, Solazzi et al. 2000).

Coho present in the action area originate from the early and late-run South Fork Toutle and North Fork Toutle populations. In the Recovery Plan, both are identified as primary populations for recovery (NMFS 2013). Each of these populations has an abundance recovery target of 1,900 adult natural-origin spawners (NMFS 2013). While recent abundance data suggests that these two populations are faring moderately (Table 5), Ford 2022 reports that the ESU's abundance has declined during the last five years.

Steelhead
Most winter-run steelhead enter or re-enter freshwater as sexually mature fish between December and May. Peak spawning for winter-run steelhead occurs in late April and early May (NMFS 2013). Steelhead may enter streams and arrive at spawning grounds weeks or even months before spawning (NMFS 2013). Rates of iteroparity (repeat spawning) for winter steelhead in the Columbia Basin are reported as high as 8 to 17 percent (NMFS 2013).

Steelhead fry emerge from March into July with peak emergence time generally in April and May (NMFS 2013). Steelhead typically rear in streams for two years (range 1 – 4 years), with smolts migrating rapidly to the ocean after their freshwater residency (NMFS 2013). In the lower Columbia River, outmigration of steelhead smolts (of both summer and winter life-history types) generally occurs from March to June, with peak migration usually in April or May.

Steelhead present in the action area originate from the winter-run South Fork Toutle River and winter-run North Fork Toutle River populations. In the Recovery Plan, both are identified as primary populations for recovery. Additionally, the winter-run North Fork Toutle River population is identified as a core population (NMFS 2013). Most winter-run steelhead populations in the Cascade MPG had strongly negative annual productivity estimates in the 2015-2019 period, however both the winter-run North Fork Toutle River and winter-run South Fork Toutle River populations showed increases over the previous estimate (Ford 2022).

Chum salmon

Adult chum spawn in low-gradient, low-elevation reaches and side channels (LCFRB 2010) and enter fresh water close to the time of spawning. Adult fall-run chum salmon returning to the Columbia River and its tributaries enter fresh water from mid-October through November and spawn from early November to late December (NMFS 2013). Fall-run chum salmon fry emerge from March through May, typically at night, and migrate promptly downstream to the estuary for rearing (NMFS 2013). Their small size at emigration makes them susceptible to predation during this life stage (NMFS 2013).

The CR chum salmon ESU has 17 demographically independent populations. Detectable numbers of chum salmon persist in only four of the 17 DIPS. Three of these four populations are currently meeting recovery goals and the remaining 14 populations are assumed to have very low current abundances and are unlikely to be at more than 10% of the established recovery goals (Ford 2022). Chum salmon present in the action area originate from two populations: fall-run Cowlitz River chum salmon and summer-run Cowlitz River chum salmon. In the Recovery Plan, both are identified as core and contributing populations for recovery (NMFS 2013). Both populations are faring poorly with current abundance estimates not known or not available, and assumed to be at less than ten percent of the recovery target abundance numbers (Ford 2022).

The summer-run chum population in the Cowlitz watershed is particularly important for genetic diversity. Of the 17 demographically independent populations in the ESU, 16 are fall-run. The sole summer-run population in the ESU is the Cowlitz River summer-run chum population. Extremely low abundance and the unique genetic and life history strategy of this population create a high risk of extirpation from stochastic events and rapid changes from climate change. Extinction of this summer-run chum population would impose a high risk to recovery of the ESU.

Little is known about chum salmon in the Cowlitz River watershed. WDFW distribution data document chum salmon in the Cowlitz River up to Riffe Lake (G. Fornes, pers. comm. March 17, 2023). There have been recurring observations of summer-run chum salmon at the Cowlitz Salmon Hatchery trap (Ford 2022). Chum salmon are not among the Utility Settlement Agreement species, so there has been limited in-basin funding allocated by the Utilities for chum salmon (J. Holowatz, pers. comm. June 29, 2023). Chum salmon presence has been confirmed by anglers fishing in the Castle Rock area (J. Holowatz, pers. comm. June 29, 2023) and by chum salmon encounters during WDFW monitoring assessments for other species (A.B. Garner, pers. comm. June 29, 2023). Historically, chum salmon habitat in the Cowlitz River Basin may have been limited to below the Toutle River confluence (J. Holowatz pers. comm. June 29, 2023). This habitat has been altered or degraded by a variety of causes. Poor visibility below the Toutle River due to suspended sediments greatly diminishes WDFW’s ability to monitor chum salmon in the mainstem Cowlitz River below the Toutle River (J. Holowatz pers. comm. June 29, 2023). Fall- and summer-run chum salmon may be present in the action area and may spawn upriver of the action area, so juvenile chum salmon from both the fall- and summer-run populations may out-migrate through the action area.

2.3.2. Threats and Limiting Factors Affecting LCR Salmonids

A variety of threats and limiting factors have contributed to the current status of the LCR Chinook salmon, CR chum salmon, LCR coho salmon, and LCR steelhead. Many of these factors occur at the landscape scale, affect all four listed salmonids considered in this Opinion, and contribute to the current status of the listed populations present in the action area. The recent 5-year status review provided an update on these factors: habitat, overutilization, disease and predation, inadequacy of regulatory mechanisms, and other factors (NMFS 2022).

Habitat restoration work has occurred throughout the range of these four listed species; however, the risk to species persistence from habitat degradation is slightly increasing for all populations in the action area. Systemic habitat conditions are not improving sufficiently to fully support recovery. Additional and aggressive habitat restoration work is still needed.

Since the previous status review, ocean fisheries management and implementation of selective freshwater fisheries have continued to reduce overall harvest impacts on most populations of LCR Chinook salmon, CR chum salmon, LCR coho salmon, and LCR steelhead (Ford 2022). Exceptions to this are the tule and bright fall-run components of the LCR Chinook salmon ESU, for which harvest rates have modestly trended upward in recent years (Ford 2022). Risk to species persistence for LCR Chinook salmon is increasing due to this modest upward trend in incidental harvest impacts.

Risk to species persistence because of disease and predation has increased slightly since the previous review (Ford 2022). Disease has not resulted in notable levels of injury or mortality within the last 5-year period, but it is reasonable to assume that warming trends have increased the risk of predation and disease/parasites (including *Ceratonova. shasta*) to ESU or DPS viability (J. Myers, NWFSC, personal communication, December 20, 2021). Avian and pinniped predation continues to negatively affect salmon survival within the lower Columbia River. Spring sea lion abundance at the Bonneville Dam increased steadily from 2002 to 2010, and these sea lions were observed consuming an estimated mean of 2.6% of adult salmonids counted at the dam (Keefer et al. 2012). Spring-run Chinook salmon survival was observed to decrease an estimated 32% for every additional 467 sea lions present within the Columbia River (Wargo Rub et al. 2019). Avian predation continues to negatively affect juvenile salmon and steelhead survival rates in the LCR, largely associated with breeding colonies of Caspian terns (*Hydroprogne caspia*) and double-crested cormorants (*Nannopterum auritum*) in the Columbia River estuary (Adkins et al. 2014). Studies have shown that these nesting colonies consume significant quantities of salmonid smolts. Roby et al. determined that Caspian terns nesting on Rice Island in the Columbia River estuary consumed between 8.1 and 2.4 million Chinook salmon, coho salmon, sockeye salmon, and steelhead smolts annually (Roby et al. 2003). Double-crested cormorants nesting on East Sand Island in the Columbia River estuary consumed between 2.4 and 15 million salmonid smolts annually (Lyons 2010). Recently, abundances of American white pelicans (*Pelecanus erythrorhynchos*) have increased in the lower Columbia River and they may also be contributing to predation pressure on salmonids.

Several regulatory mechanisms have resulted in adequate or improved protection since the last 5-year review. Highlights include changes to the Oregon Forest Practices Regulations yielding wider stream buffers in the context of timber harvest management and the continuation of harvest management regulated primarily through the Pacific Fishery Management Council and the U.S. v. Oregon court proceeding. A new fisheries management plan approved by the parties and the court and the 2018-2027 U.S. v. Oregon Management Agreement now guides fisheries management in the Columbia River. These improvements have somewhat reduced risk to species' persistence, but concerns still remain regarding other regulatory mechanisms influencing habitat conditions such as water quality in the mainstem lower Columbia River, forest cover, and high-head dam passage. Therefore, for LCR Chinook salmon, CR chum salmon, LCR coho salmon, and LCR steelhead, the risk to species persistence from inadequate regulatory mechanisms is increasing (NMFS 2022)

Other natural and man-made factors affecting the persistence of these four listed species appear to be increasing because of climate change. The effects of climate change extend to every habitat and every life history phase of listed LCR salmonids. Effects range from decreasing the predictability of annual events such as the timing and magnitude of spring freshets and patterns of prey abundance, to increasing stream and ocean temperatures, and increased competition and predation from warm water-adapted non-native species. These challenges amplify and exacerbate other threats experienced by listed LCR salmonids and are expected to increase in magnitude as climate change progresses (NMFS 2022). Listed salmonids may be less resilient to rapid environmental changes caused by climate change due to diminished population sizes, spatial diversity, and genetic diversity.

2.3.3. <u>Importance of Eulachon in the Action Area to Species Survival</u>

Eulachon are native to the northeast Pacific Ocean, occurring from southern Alaska to Northern California. Eulachon in more northern areas tend to spawn in in glacially-fed rivers and are considered stable (Gilroy et al. 2021) and are not part of the listed entity. In 2010, the southern distinct population segment (DPS) of eulachon was listed as threatened under the Endangered Species Act. The listed, southern DPS of eulachon is comprised of fish that spawn in glacial, snow, or rain-fed rivers from the Skeena River in northern British Columbia south to (and including) the Mad River in northern California (Gilroy et al. 2021).

The 2010 status review concluded that the southern DPS of eulachon experienced an abrupt decline in abundance throughout their range, beginning in the mid-1990s (Gustafson et al. 2010). More recently, state agencies reported progressively increasing levels of eulachon southern DPS larval outflow during 2019-2023 (WDFW and ODFW 2024). Improvements in ocean conditions in the northern California Current, beginning in 2020, suggested that the southern DPS of eulachon would rebound in numbers in the near future, and recent stock reports indicate progressively increasing levels of larval outflow from 2019-2023 (WDFW and ODFW 2024). Ocean conditions continue to be the primary driver of eulachon abundance (Gustafson et al. 2022). The 2022 ESA 5-year review concluded that eulachon abundance in monitored populations has decreased for the Columbia River subpopulation but the near-term outlook for eulachon productivity in the California Current Ecosystem is positive based on ocean conditions (Anderson 2022).

Eulachon present in the action area are part of the Columbia River subpopulation of the southern DPS of eulachon. This subpopulation spawns in the Columbia River mainstem as well as the Cowlitz River (most years), including the Toutle River (Gustafson et al. 2022). In addition, this subpopulation spawns in the following lower Columbia River tributaries: Grays River (common use), Skamokawa Creek (infrequent use), Elochoman River (periodic use), Kalama River (common use), Lewis River (common use), and Sandy River (common use in large run years; Gustafson et al. 2010). Threats to this subpopulation include climate change impacts on ocean conditions and by-catch (high threats) and dams, water diversions, climate change impacts on freshwater habitat, predation, water quality, shoreline construction, and dredging (moderate threats) (Anderson 2022).

The recovery scenario for the southern DPS of eulachon gives abundance and demographic targets for each subpopulation. To achieve recovery, both targets for each subpopulation must be met within a 30-year timeframe (Anderson 2022). Eulachon in the action area contribute to the following targets:

> For the Columbia River subpopulation, the abundance targets are:
> HIGH – a minimum of 229,500,000 spawners for 24 out of 30 years.
> LOW – a minimum of 66,500,000 spawners for 6 out of 30 years.
>
> For the Columbia River subpopulation, the demographic recovery criteria are:
> 229,500,00 spawners 24 out of 30 years, and 66,500,00 spawners for 6 out of 30 years,
> PLUS presence/absence surveys in the Cowlitz River with presence 27 out of 30 years,
> PLUS presence/absence surveys in the Grays River with presence 21 out of 30 years,
> PLUS presence/absence surveys in the Sandy River with presence 10 out of 30 years,
> PLUS presence/absence surveys in the Lewis River with presence 15 out of 30 years.

2.3.4. Threats and Limiting Factors Affecting Eulachon

A variety of threats and limiting factors have contributed to the current status of the southern DPS eulachon and influence the status of eulachon in the action area. The recent 5-year status review provided an update on these factors. Since the previous review, many salmon and steelhead habitat restoration projects in the Pacific Northwest have provided incremental improvements in habitat (e.g., nutrient influx) for eulachon (Anderson 2022). Overutilization and harvest impacts have remained relatively unchanged. Pinnipeds consume a large number of eulachon in the Columbia River Basin, and since the last review, new information has confirmed the adverse effect pinnipeds pose on eulachon recovery (Anderson 2022). Since the previous review, the risk to eulachon persistence because of bycatch in the West Coast groundfish fishery and the ocean shrimp trawl fishery has slightly decreased (Anderson 2022). The recent 5-year review concluded that the collective risk to the persistence of eulachon has not changed significantly since the final listing determination in 2010 (Anderson 2022).

2.4. Effects of the Action

Under the ESA, "effects of the action" are all consequences to listed species or critical habitat that are caused by the proposed action, including the consequences of other activities that are caused by the proposed action but that are not part of the action. A consequence is caused by the proposed action if it would not occur but for the proposed action and it is reasonably certain to occur. Effects of the action may occur later in time and may include consequences occurring outside the immediate area involved in the action (see 50 CFR 402.02).

The proposed action will affect the critical habitats and listed species considered in this opinion by causing physical, chemical, and biological changes to the environment, and through direct effects to individual fish. Effects include:

- a short-term reduction in water quality from increased suspended sediment following the proposed action;
- an enduring loss of benthic invertebrates due to the placement of armoring below OHW;
- an enduring reduction in the quality of habitat due to armor placement above and below OHW; and
- removal of riparian vegetation.

There is also a chance of accidental contaminant release from construction equipment or activities, however any release would likely be small and quickly contained due to the implementation of a spill prevention, control, and containment plan. Some post-construction effects will be beneficial, such as an improved riparian area from native planting maintained over time.

The effects of the proposed action on listed species and critical habitat are described in detail below.

2.4.1. Effects on Listed Species

Effects of the proposed action on listed species are based, in part, on habitat effects, as described in detail below. The in-water work window has been designed to minimize exposure of ESA-listed salmonids at their more vulnerable juvenile life stage, but these effects are still likely. Because habitat conditions are generally poor at the project site, we do not expect significant presence (high numbers) of any of these species during excavation and armoring. Individuals would be exposed to the effects listed below directly and via effects to habitat.

Effects of Rock Armor Placement

Armoring used in streambank stabilization projects has deleterious effects to the functioning stream environment. Negative impacts from armoring to the stream environment include hardening the streambank, resulting in halted channel migration; disconnecting the stream from the floodplain; creating a smooth surface along the streambank thereby increasing water velocities (Sedell et al. 1990); changes in hydrology, morphology, and water quality of a stream (Bolton and Schellberg 2001); increased potential for downstream erosion and erosion at the revetment/streambank interface (USFWS 2004); decreases in large wood recruitment to the stream; inhibition of the development of streamside vegetation (Schmetterling et al. 2001; Fischenich 2003); disruption of invertebrate communities; and simplifying the stream and reducing fish habitat complexity. Potential increased sediment inputs from erosion and inhibited development of streamside vegetation may degrade the area’s function as a spawning and rearing habitat for salmonids, and spawning and larval emigration habitat for eulachon.

The proposed action includes positioning the root wad and lower trunks of two larger Douglas fir trees (one 18” DBH Douglas fir and one 36” DBH Douglas fir) and six smaller cedars (4-8” DBH) into the new portion of the structure. This will partially offset riparian habitat loss by providing limited in-stream habitat complexity along the new portion of the structure; however, no offsets, minimization, or mitigation is proposed for extending the useful life of the existing portion of the structure.

Effects on the Prey Base

Shoreline armoring below OHW will permanently reduce the prey base for salmonids and eulachon. The existing structure (about 60 feet long) is 50 years old. Rehabilitating this structure will renew its useful life, extending the duration of reduced prey availability for another approximately 50 years. Additionally, the applicant will extend the length of the structure by approximately 60 feet, yielding a total of about 120 linear feet of shoreline where the prey base will be reduced. Larval eulachon, which are planktivorous, and juvenile salmonids, which feed primarily on zooplankton, may experience diminished foraging opportunities as a result.

Bank armoring structures reduce salmon habitat by simplifying edge habitat complexity, degrading riparian functions, and preventing the development of side channels and off-channel habitats in the floodplain. Hayman et al. (1996), Beamer et al. (2005), and Beechie et al. (2005) found that juvenile Chinook salmon strongly preferred natural bank margins and backwaters to rocked armoring banks. Similarly, Beamer and Henderson (1998) found that the density of juvenile Chinook salmon along unmodified shorelines was five times greater than armored shoreline and observed that juvenile coho salmon used natural shorelines at a density four times higher than armored banks. Where rootwads were present at their study sites, the density of juvenile coho salmon was almost 18 times higher than rip rap shorelines (Beamer and Henderson 1998). Complex natural edge habitat along mainstem river channels provides important foraging and refugia opportunities for juvenile Chinook and coho salmon as well as other species.

The proposed action includes two measures that will somewhat moderate the adverse effects of the armored structure on prey base for juvenile salmonids. As previously described, the proposed action includes placement of rootwads with attached 10-15' long tree trunks into the extended armoring. Two large Douglas fir trees (18" and 36" DBH) and six small (6-8" DBH) cedar trees will be incorporated into the extension, adding limited habitat complexity to the structure. However, these trees would be removed from within the action area where they currently benefit the riparian habitat by shading the river and providing nutrient inputs and terrestrial invertebrate prey into the river. These benefits will be lost, but the rootwads and attached trunks incorporated into the new portion of the structure will partially offset this loss until the rootwads and trunks have fully decomposed or are washed downstream. The proposed armoring structure is likely to outlast the rootwads and trunks, so the beneficial effects of wood placement will be short-term relative to the lifespan of the bank stabilization structure. Second, the applicant will plant native shrubs in the interstitial spaces between large rocks above the OHWM and enhance 280 square feet of what is currently lawn by planting a total of 8 Douglas fir and Grand fir trees. Once established, this vegetation will add nutrient inputs (leaves, sticks) and terrestrially derived invertebrate prey into the river, partially alleviating negative impacts of the revetment structure on the prey base. Nevertheless, after considering the benefits of adding wood to the rip rap structure, the replacement and additional shoreline armoring will degrade habitat and reduce prey production resulting in harm to juvenile salmonids and eulachon.

Effects of Suspended Sediment

Exposure of fish to fine sediment and turbidity is not anticipated during construction, other than possible small events of rocks and other materials falling into the river during repair and construction causing brief releases of elevated fine sediment. In such an event, we anticipate that turbidity would dissipate within an hour or two. Construction would take place in the summer while the water level is low. No in-water activities are proposed. However, when the river level rises in the fall or winter following the proposed action there will be a short-term sediment release event when sediment from the exposed construction area will be suspended and carried downstream. The anticipated short-term event of elevated turbidity is likely to occur over a relatively small area, and should dissipate over hours to days.

Elevated turbidity has been reported to cause physiological stress, reduce growth, and adversely affect survival. Although fish that remain in turbid waters can experience a reduction in predation from piscivorous fish and birds (Gregory and Levings 1998), chronic exposure can cause physiological stress responses that can increase maintenance energy and reduce feeding and growth (Lloyd et al. 1987; Redding et al. 1987; Servizi and Martens 1991).

Adult and juvenile salmonids are likely to be present during the proposed construction. The density of juveniles, especially juvenile coho salmon and Chinook salmon, is likely to be high. Adult and juvenile salmonids may relocate to avoid elevated suspended sediment. More vulnerable life history phases (eggs, alevins) are unlikely to be present. During the summer, juvenile salmonids in the action area are primarily zooplankton feeders and their ability to feed declines in turbid waters. Depending on the concentrations of suspended solids, salmonids will either seek refuge in adjacent areas with less turbidity, or remain in the area, taking advantage of the additional cover. Behavioral effects are likely to occur and would include decreased foraging behaviors in the affected area, reducing juvenile growth and fitness in a small number of fish. Although juvenile salmonids are unlikely to experience mortality, individual fish are likely to experience harm from the direct effects of gill abrasion and the indirect effects associated with reduced foraging success.

There is a low likelihood of eulachon presence during the proposed construction. The timing of adult eulachon presence and spawning in the Cowlitz River (December through early April, with peak occurrence January through March; Gustafson et al. 2010) and the three to eight-week incubation period suggests that larval eulachon will likely have hatched by mid-June at the latest and have drifted downstream through the action area prior to the planned construction (July 15-August 16). Eulachon would not be present during the anticipated one-time pulse of sediment during the first fall or winter following construction. The effects to eulachon from increased turbidity is discountable.

2.4.2. <u>Effects on Critical Habitat</u>

The action area contains designated critical habitat for Chinook salmon, coho salmon, steelhead, chum salmon, and eulachon. The four salmon and steelhead species have the same critical habitat attributes so effects on their critical habitat are evaluated collectively. For the salmon and steelhead, the proposed action will affect attributes of a freshwater rearing and freshwater migration site. For eulachon, the proposed action will affect attributes of freshwater spawning and incubation and freshwater migration. The proposed action will have a suite of short-term, construction-related effects from repairing and extending the structure and a suite of enduring effects from the structure's long-term presence.

Salmon and steelhead freshwater rearing and freshwater migration
Floodplain connectivity. The proposed project would cause decreased floodplain connectivity from the placement of armoring on the bank. Shoreline armoring has a primary and intentional function of retaining floodwater within a constrained channel, increasing conveyance velocity, and inhibiting erosion and channel migration. Each of these prevents habitat forming processes and limits floodplain connectivity, a PBF of salmonid freshwater rearing habitat. The proposed repair and rehabilitation of the armoring will ensure that the floodplain remains disconnected from the stream channel at the project site.

The proposed project would incorporate large wood with rootwads into the armoring design. Thus, while most aspects of the project will continue to cause adverse effects on critical habitat PBFs, most notably floodplain connectivity, the project will provide limited contemporaneous beneficial effects on the same PBFs. The project will create limited areas for refugia during floods as the large wood will create habitat complexity by creating roughness, slow water areas, increased cover, and increased sources of prey. However, the habitat value of these wood structures is small and will diminish as they deteriorate over time. The bank armoring will reduce rearing habitat for juvenile salmonids immediately after construction and this effect will remain over decadal time frames.

Forage. The proposed project would cause a decrease in terrestrial-based and benthic macroinvertebrate prey. Terrestrial-based prey would be reduced when trees and other riparian vegetation is cleared at the project site, as this vegetation provides both terrestrial-based prey and a source of detrital inputs supporting macroinvertebrate prey. As the proposed action includes planting native vegetation, terrestrial-based prey would increase over years to decades as the new riparian plantings mature and begin to re-establish a tree canopy.

As described above, bank armoring with rip rap will reduce prey availability. Benthic prey communities are likely to re-establish in the weeks or months post-construction from upstream or adjacent habitat sources. However, the long-term diminishment prey as a consequence of shoreline will diminish the function of critical habitat for juvenile salmonid and eulachon growth, development, or survival. Juvenile salmonids are known to occupy armored banks far less than what is available in the environmental baseline. This effect on the forage PBF is expected to reduce the quality of critical habitat for juvenile salmonids and eulachon in the action area.

Free of artificial obstruction. The proposed project would have no effect on the free of artificial obstruction PBF for salmon and steelhead freshwater migration.

Natural cover. The proposed project would cause a brief, temporary increase in cover due to suspended sediment when the river level rises in the fall or winter following construction. It would also cause an enduring reduction in natural cover from the removal of large trees on the bank, combined with design of the structure which would prohibit large trees from growing close to the bank and falling into the river, where they could provide natural cover. This effect will be partially offset by the inclusion of several rootwads with attached 10'-15' tree trunks into the revetment extension, but the revetment will likely outlast these beneficial habitat elements.

Water quality. Increased turbidity and sedimentation would temporarily degrade the water quality PBF for salmon and steelhead freshwater rearing and freshwater migration. The proposed project would cause increased suspended sediment for a brief period associated with the one-time sediment release event when the river level rises in the fall or winter following construction. A turbidity plume extending up to 300 meters downstream from the project site is possible. The proposed project may also cause small, brief pulses of increased suspended sediment during construction should rock or debris tumble into the river. The NMFS anticipates that elevated turbidity levels would be episodic and short-lived because once activities that disturb the bottom sediments cease, suspended sediments will settle out, with heavier material falling out more quickly and nearer to the source of disruption, and lighter sediments transporting further downstream. The turbidity levels would return to background levels in several hours, making the adverse water quality reduction unlikely to alter the conservation role of the critical habitat in the action area for rearing or migration values. Sediment, as it deposits, could also slightly alter benthic conditions and temporarily reduce prey levels for LCR Chinook and coho salmon, CR chum salmon, and steelhead. In summary, the proposed actions would temporarily degrade the water quality PBF.

Water quantity. The proposed project would have no effect on water quantity.

In summary, the positive and negative effects on floodplain connectivity, forage, natural cover, and water quality influence the critical habitat quality for salmonid rearing and migration. Replacing and installing new bank armoring means that areas with natural features which normally contribute to salmonid survival, growth, and fitness would remain inaccessible and create new areas of degraded rearing habitat within the action area. This degrades critical habitat in the action area reducing support for rearing and migrating salmonids, and impairs both abundance and productivity of the affected populations.

We expect that many individual juvenile LCR Chinook and coho salmon, CR chum salmon, and LCR steelhead from all future foreseeable cohorts of the Toutle River populations would be exposed to these constraints on habitat refugia and complexity. Given that the project provides for long-term riparian growth and incorporates some limited large wood into the bank armoring design, we consider that the conservation role of floodplain connectivity as a PBF of critical habitat for rearing and migration values in the action area will be degraded as a result of the proposed action.

Eulachon freshwater spawning and incubation, and freshwater migration
Flow. The proposed project would have no effect on flow.

Forage. The proposed project may cause a minor reduction in food availability. Larval eulachon are planktivorous and the repaired/ extended armored shoreline represents an area with reduced ecological function, slightly diminishing food resource availability.

Water quality. The proposed project would cause increased suspended sediment for a brief period when the river level rises in the fall or winter following construction, but suspended sediment will not impair this PBF for eulachon.

Water temperature. The proposed project could cause a minor, localized increase in water temperature due to the removal of large trees on the south bank of the river. Riparian plantings will replace the function of these trees, in part, as the new vegetation matures.

Substrate. The proposed project would cause no effect on substrate.

For eulachon, the proposed action is likely to cause minor, but enduring degradation of critical habitat attributes for food. Critical habitat in the action area will retain function as a eulachon spawning and incubation sites and eulachon freshwater migration corridor.

2.5. Cumulative Effects

"Cumulative effects" are those effects of future state or private activities, not involving federal activities, that are reasonably certain to occur within the action area of the federal action subject to consultation [50 CFR 402.02]. Future federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the ESA. Cumulative effects upstream and downstream of the action area include urban development, agriculture, and timber management in accordance with the Washington State Forest Practices Act (including harvest) on state and private forest lands. These effects are likely to occur over time. A large area of state-managed and private forest land lies upriver of the action area, spanning between the north and south forks of the Toutle River.

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 earlier in the discussion of environmental baseline (Section 2.4).

However, it is reasonably certain that over the additional service life of the project, climate effects such as modified water temperatures, altered river hydrograph, and shifting salinity will all exert more influence on the habitat quality and related carrying capacity. NMFS expects that State and private activities near and upriver from the proposed action will contribute to cumulative effects in the action area. Therefore, our analysis considers 1) effects caused by specific future non-federal activities in the action area; and 2) effects in the action area caused by future non-federal activities in the Columbia basin.

Future upland development activities lacking a federal nexus are expected to result in increased pollution-generating impervious surface, runoff, and non-point source discharges. Population growth in Lewis and Cowlitz counties is likely to continue, which will require greater development to support and sustain this trend. State, county, and city regulations should minimize and mitigate for the adverse effects of this development so that the overall environmental quality of the action area remains constant, albeit degraded relative to its restored condition.

The legacy of resource-based industries (e.g., agriculture, hydropower facilities, timber harvest, fishing, and metal and gravel mining) have caused long-lasting environmental changes that harmed ESA-listed species and their critical habitats. Stream channel morphology, roughness, and cover, estuarine rearing habitats, wetlands, floodplains, riparian areas, water quality, fish passage, and habitat refugia have been degraded throughout the LCR basin. Those changes reduce the ability of populations of ESA-listed species to sustain themselves in the natural environment by altering or interfering with their behavior in ways that reduce their survival throughout their life cycle.

While widespread degradation of aquatic habitat associated with intense natural resource extraction is no longer common, ongoing land management actions are likely to continue to adversely affect the estuary and delay natural recovery of aquatic habitat in the CR basin including the action area. This trend is somewhat countered by non-federal aquatic habitat restoration occurring in the LCR. The Lower Columbia River Estuary Partnership has over 100 regional partners in the LCR and has completed 284 projects totaling more than 35,000 acres (LCREP 2024). Projects include land acquisitions and conservation easements, adding large logs to streams to create fish habitat, planting trees to shade and cool streams, and removing barriers to fish passage.

For example, upriver of the action area, a number of state and private habitat improvement projects are planned or in progress which will improve water quality within the action area. The nearest upstream project is the Belfield Rock Creek Restoration project, approximately 2 miles upriver from the action area. This project is sponsored by the Cowlitz Conservation District and funded by the Conservation District and Washington State Regional Conservation Office. Approximately 2.3 acres of riparian habitat will be planted and restored, improving off-channel habitat for listed and unlisted fish species. Shading and nutrient inputs at the restoration site will improve habitat locally and have modest positive water quality and prey base improvements downstream at the action area. This project is in process and will be completed in 2027. Numerous additional similar projects are planned or in progress upstream of the action area and can be reviewed through the Salmon Recovery Portal. Still, when considered together, the net cumulative effects are likely to have an adverse effect on ESA-listed fish within the action area.

2.6. Integration and Synthesis

The Integration and Synthesis section is the final step in assessing the risk that the proposed action poses to species and critical habitat. In this section, we add the effects of the action (Section 2.5) to the environmental baseline (Section 2.3) and the cumulative effects (Section 2.6), taking into account the status of the species and critical habitat (Section 2.2), to formulate the agency's biological opinion as to whether the proposed action is likely to: (1) reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing its numbers, reproduction, or distribution; or (2) appreciably diminish the value of designated or proposed critical habitat as a whole for the conservation of the species.

The species considered in this opinion are listed as threatened or endangered with extinction due to declines in abundance, poor productivity, reduced spatial structure, and diminished diversity. Factors contributing to this status includes reduced quantity and/or quality of habitat, altered flow regimes, degraded water quality, and reduced nutrient inputs. Systemic anthropogenic detriments in estuarine and marine habitats are impairing populations of ESA-listed fishes within the LCR basin, and these are often described as limiting factors. The environmental baseline in the action area is significantly degraded due to over a century of timber harvest, overutilization, hatchery production, agricultural land use practices, and human development.

To this context of species status and baseline conditions, we add the effects of the proposed action, together with cumulative effects, in order to determine the effect of the project on the likelihood of species' survival and recovery. We also evaluate if the project's habitat effects would appreciably diminish the value of designated critical habitat for the conservation of the 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.

2.6.1. ESA Listed Species

As specified in the environmental baseline (Section 2.3), numerous populations of listed species will be present in the action area and experience short-term, construction-related effects and/or long-term effects of the proposed action. The environmental baseline includes developed urban areas and land use practices, degraded estuarine and nearshore habitat, degraded floodplain connectivity and function, altered streamflow and channel complexity, reduced large wood and substrate recruitment, harvest, competition with hatchery fish, predation and disease. The significance of the degradation is reflected in the limiting factors identified above including habitat access to floodplain and secondary channels, degraded habitat, loss of spawning and rearing habitat, pollution, wake stranding of juveniles, and increased predation, highlighting the importance of protecting current functioning habitat and limiting water quality degradation, minimizing entrainment, and reducing potential predation of ESA-listed fish.

All of the species considered in this opinion are federally listed as threatened. Their range and spatial structure are curtailed or modified. Multiple limiting factors prevent natural fish production from significantly increasing productivity, abundance, and diversity. The most recent Biological Viability Assessment concluded that the four salmonid ESU/ DPSs considered in this Opinion remain at "moderate" risk of extinction, though the status and trends of distinct individual populations comprising the four ESU/DPSs varies (Ford 2022). In order to meet recovery goals, abundance for almost all listed salmon and steelhead populations in the action area must increase substantially. For the eight salmonid populations occurring within the action area, recent abundance data indicates that half of the populations are at ten percent or less of the Recovery target abundance (Table 5; Ford 2022, NMFS 2013): the spring-run Toutle River population of Chinook salmon, the fall-run Toutle River population of Chinook salmon, the fall-run Cowlitz River population of chum salmon, and the summer-run Cowlitz River population of chum salmon. Two additional populations are between 10 and 50% of their recovery target abundance: the early and late-run North Fork Toutle River population of coho salmon, and the winter-run North Fork Toutle River population of steelhead. The remaining two salmonid populations are the early and late-run South Fork Toutle River population of coho salmon, at between 50 and 100% of the recovery abundance target, and the winter-run South Fork Toutle River population of steelhead at more than 100% of the recovery abundance. While the two steelhead populations appear robust, Ford notes that abundance numbers for these populations represent total hatchery and natural-origin spawners and there is a high uncertainty regarding whether they are meeting their recovery targets (Ford 2022). Additionally, the summer-run chum is the lone summer-run population in the Columbia River ESU. This population plays an important role in the genetic diversity and resilience of the ESU, as timing of life history may be critical for persistence as habitats respond to current and future climate change.

Eulachon in the action area are part of the federally threatened southern DPS of eulachon, which is comprised of a single population. The southern DPS eulachon was found to be at "moderate" risk of extinction throughout its range at the time of its 2010 status review (Gustafson et al. 2010) and the most recent status review concluded that the biological risk category for this DPS has not changed (Anderson et al. 2022, Gustafson et al. 2022). Eulachon in the action area are part of the Columbia River subpopulation, and while abundance estimates for this subpopulation have fluctuated (sometimes positively) since the time of listing (Gustafson et al. 2022), the recent 5-year Review indicates that the Columbia River subpopulation has decreased (Anderson 2022).

To this poor status baseline for salmon, steelhead, and eulachon, and in consideration of future non-federal cumulative effects including climate change, we add effects of the proposed action. The effects on ESA listed species are largely minor and temporary or minor but enduring:

- A small reduction in the fitness of a small number of fish exposed briefly to increased turbidity causing gill abrasion, coughing, and stress;
- A small reduction in total abundance of listed fish from increased predation when fish relocate to avoid areas of higher turbidity;
- A small reduction in the fitness of juvenile rearing fish in the action area over the useful life of the structure (estimated at 50 years) due to reduced cover, nutrient inputs, floodplain connectivity, and woody debris caused by the armoring structure.

The action will add short-term sublethal, short-term lethal, and long-term sublethal effects to LCR Chinook salmon, LCR coho, CR chum, LCR steelhead, and sDPS eulachon, largely among juveniles from the nine geographically relevant populations that are part of these species. The most acute effects will occur when the river level rises in the fall or winter following construction and sediment is released from the structure. Timing of the proposed action is intended to minimize exposure of vulnerable life stages to acute effects, and we therefore conclude that fish injured or killed will be at levels low enough that the small reduction in abundance will not be discernible among returns of these cohorts i.e., productivity is unlikely to be appreciably affected. Therefore, even assuming that the proposed action would impact population viability parameters, at most this would consist of a small contribution to maintaining those parameters in their current state. Because the abundance and productivities of most of these population are below recovery targets, maintaining the existing parameters presumably delays reaching recovery targets. The contribution of the proposed action to that delay, if any, is extremely small for the reasons described above: the primarily sublethal nature of the effects and small percentage of individuals within the affected populations likely to be exposed to the effects of the proposed action. Because the effects of the proposed action are not expected to measurably affect population trends among the listed fish exposed to the action that contribute to the viability of the of these species, the overall effects of the action will not jeopardize the existence of LCR Chinook salmon, LCR coho, CR chum, LCR steelhead, or sDPS eulachon, or appreciably reduce the likelihood of both the survival and recovery of these ESUs and DPSs.

2.6.2. Critical Habitat

The action area contains designated critical habitat for LCR Chinook salmon, LCR coho, CR chum, LCR steelhead, and sDPS eulachon. Short-term project effects on PBFs of critical habitat for these species are temporary and when we add them to the baseline, because they shortly revert to baseline levels, the conservation values of the habitat for salmon and steelhead rearing and migration, eulachon spawning and migration, and eulachon freshwater migration, are not considered diminished. Long-term effects of the proposed action will degrade PBFs of critical habitat in a small proportion of the critical habitat available for these species in the Toutle River watershed. The baseline condition of critical habitat is impaired by degraded water quality, bank armoring, channelization, and loss of riparian cover. Considering future population growth and climate change, there will continue to be private and state actions that will produce cumulative effects associated with development (e.g., associated impervious surfaces, further reduced riparian cover as forest lands are transitioned into housing or agriculture). The effects of human population growth will place additional pressures on PBFs of critical habitat, but the precise effect of these pressures cannot be accurately predicted. Within the action area, the overall conservation value of the critical habitat is expected to be further degraded from its currently constrained condition when the consequences of the proposed action are added to the baseline condition. Given the small size of the action area relative to available critical habitat locally, within the Toutle River watershed, and within the species ranges, we do not expect the degraded condition of PBFs in the action area to diminish the conservation value of any PBFs or result in an adverse modification of critical habitat.

2.7. Conclusion

After reviewing and analyzing the current status of the listed species and critical habitat, the environmental baseline within the action area, the effects of the proposed action, the effects of other activities caused by the proposed action, and the cumulative effects, it is NMFS' biological opinion that the proposed action is not likely to jeopardize the continued existence of LCR Chinook salmon, LCR coho salmon, CR chum salmon, LCR steelhead, or sDPS eulachon or destroy or adversely modify their designated critical habitat.

2.8. Incidental Take Statement

Section 9 of the ESA and federal regulations pursuant to section 4(d) of the ESA prohibit the take of endangered and threatened species, respectively, without a special exemption. "Take" is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. "Harm" is further defined by regulation to include significant habitat modification or degradation that 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). "Harass" is further defined by guidance as to "create the likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt normal behavioral patterns which include, but are not limited to, breeding, feeding, or sheltering." "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 ITS.

2.8.1. Amount or Extent of Take

Take in the form of harm is often impossible to quantify as a number of individuals, because the presence of the individuals (exposure to the harmful conditions) is highly variable over time, and is influenced by factors that cannot be easily predicted. Additionally, the duration of exposure is highly variable based on species behavior patterns, and the wide variability in numbers exposed and duration of exposure create a range of responses, many of which cannot be observed without research and rigorous monitoring. In these circumstances, we describe an "extent" of take which is a measure of the harming condition spatially, temporally, or both. The extent of take is causally related to the amount of harm that will result, and each extent of take provided below is an observable metric for monitoring, compliance, and re-initiation purposes.

In the biological opinion, NMFS determined that incidental take is reasonably certain to occur as follows:

1. Harm to juvenile LCR Chinook salmon, LCR coho salmon, CR chum salmon, and LCR steelhead, associated with the short-term increase in suspended sediment and turbidity when river levels rise following construction. The extent of take for sediment release is the physical extent of the old and new revetment structures (120 linear feet). This surrogate is causally linked to incidental take because the potential for harm increases as the extent or intensity of turbidity increases.

2. Harm to juvenile LCR Chinook salmon, LCR coho salmon, CR chum salmon, LCR steelhead, and sDPS eulachon due to habitat degradation associated with the long-term presence of the old and new revetment structures. The extent of take for habitat degradation is the physical extent of the old and new revetment structures (120 linear feet). This surrogate is causally linked to incidental take because the linear extent of habitat degradation increases with the linear extent of the revetment structure.

2.8.2. Effect of the Take

In the biological opinion, NMFS determined that the amount or extent of anticipated take, coupled with other effects of the proposed action, is not likely to result in jeopardy to the species or destruction or adverse modification of critical habitat.

2.8.3. Reasonable and Prudent Measures

"Reasonable and prudent measures" refer to those actions the Director considers necessary or appropriate to minimize the impact of the incidental take on the species (50 CFR 402.02).

1. Ensure completion of a monitoring and reporting program to confirm that the take exemption for the proposed action is not exceeded, and that the terms and conditions in this incidental take statement are effective in minimizing incidental take. Prepare and provide monitoring reports to NMFS at projectreports.wcr@noaa.gov, refer to WCRO-2022-02161.

2. Minimize incidental take from turbidity by applying conditions to the proposed action that avoid or minimize adverse effects to water quality and the ecology of aquatic systems.

3. Ensure that equipment is thoroughly cleaned before being brought to the site. Use of vegetable based hydraulic fluid is preferred.

4. Ensure that the revetment contains no depressions or gaps that could strand fish during river level fluctuations.

2.8.4. Terms and Conditions

In order to be exempt from the prohibitions of section 9 of the ESA, the federal action agency must comply (or must ensure that any applicant complies) with the following terms and conditions. The USACE 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) The following terms and conditions implement reasonable and prudent measure 1 (monitoring):
   a) Reporting: USACE shall monitor or ensure that the applicant monitors and reports on the following items, at a minimum:
      i) Turbidity monitoring. Report the results from the turbidity monitoring (before, during, and after project construction), including monitoring location and time.
      ii) Dimensions of repaired existing revetment (length in feet) and completed revetment extension (length in feet).
      iii) Submit reports to NMFS addressing turbidity monitoring and dimensions of structures, no later than January 31 of the year following completion of the project.
      iv) Submit monitoring reports to NMFS through the following e-mail address: projectreports.wcr@noaa.gov, refer to WCRO-2022-02161.

2) The following terms and conditions implement reasonable and prudent measure 2 (minimize incidental take):
   a) To minimize effects to juvenile salmonids, the Corps shall require the applicant to limit all project activities conducted below ordinary high water to the in-water work window of July 16- August 15 (WDFW 2018).
   b) Notice to Contractors. Before beginning work, the Corps shall require the applicant to provide all contractors working on site with a complete list of USACE permit special

conditions, reasonable and prudent measures, and terms and conditions intended to minimize the amount and extent of take resulting from in-water work.
   c) Minimize Impact Area and Duration. The Corps shall require the applicant to confine construction impacts to the minimum area and duration necessary to complete the project.
   d) Conservation Measures. The Corps shall require the applicant to carry out all relevant conservation measures from the proposed action section of this opinion as described.
   e) Riparian Vegetation Maintenance. The Corps shall require the applicant to maintain the native shrub and tree plantings described in the proposed action and replace any plants that do not survive.

3) The following terms and conditions implement reasonable and prudent measure 3 (equipment):
   a) Ensure that equipment has been thoroughly cleaned prior to being brought to the site.
   b) When possible, ensure that vegetable-based hydraulic fluid is used in equipment used on the site.

4) The following terms and conditions implement reasonable and prudent measure 4 (revetment):
   a) Inspect revetment during construction to identify depressions or gaps where fish stranding could occur during future water level fluctuations.
   b) Ensure that any such depressions or gaps are filled with durable substrate such as small boulders or large cobbles prior to completion of construction.

2.9. Conservation Recommendations

Section 7(a)(1) of the ESA directs federal agencies to use their authorities to further the purposes of the ESA by carrying out conservation programs for the benefit of the threatened and endangered species. Specifically, “conservation recommendations” are suggestions regarding discretionary measures to minimize or avoid adverse effects of a proposed action on listed species or critical habitat or regarding the development of information (50 CFR 402.02).

- Protect and restore riparian areas to improve water quality, provide long-term supply of large wood to streams, and reduce impacts that alter other natural processes
- Improve or regrade and revegetate streambanks
- Restore instream habitat complexity, including large wood placement
- Remove invasive plant species from upland vegetation and plant native species

2.10. Reinitiation of Consultation

This concludes formal consultation for the Simpson Bank Stabilization Project.

Under 50 CFR 402.16(a): “Reinitiation of consultation is required and shall be requested by the federal agency, where discretionary federal involvement or control over the action has been retained or is authorized by law and: (1) If the amount or extent of taking specified in the incidental take statement is exceeded; (2) If new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not previously considered; (3) If the identified action is subsequently modified in a manner that causes an effect to the listed species or critical habitat that was not considered in the biological opinion or written concurrence; or (4) If a new species is listed or critical habitat designated that may be affected by the identified action."

3. MAGNUSON–STEVENS FISHERY CONSERVATION AND MANAGEMENT ACT ESSENTIAL FISH HABITAT RESPONSE

Section 305(b) of the MSA directs federal agencies to consult with NMFS on all actions or proposed actions that may adversely affect EFH. Under the MSA, this consultation is intended to promote the conservation of EFH as necessary to support sustainable fisheries and the managed species' contribution to a healthy ecosystem. For the purposes of the MSA, EFH means "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity", and includes the associated physical, chemical, and biological properties that are used by fish (50 CFR 600.10). 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 may result from actions occurring within EFH or outside of it and may include direct, indirect, site-specific or habitat-wide impacts, including individual, cumulative, or synergistic consequences of actions (50 CFR 600.810). Section 305(b) of the MSA also requires NMFS to recommend measures that can be taken by the action agency to conserve EFH. Such recommendations may include measures to avoid, minimize, mitigate, or otherwise offset the adverse effects of the action on EFH (50 CFR 600.905(b))].

3.1. EFH Affected by the Proposed Action

The proposed project occurs within EFH for various federally managed fish species within the Pacific Coast Salmon Fishery Management Plan.

3.2. Adverse Effects on EFH

The proposed action and action area are described in Section 1 of this document. NMFS determined the proposed action would adversely affect EFH as follows:

1. A short-term, one-time sediment release from the revetment structure when the river level rises following the proposed action, causing short-term increased turbidity at the site and extending downriver.
2. A long-term reduction in habitat values at the site by disrupting ecological processes, decreasing floodplain connectivity and decreasing natural cover.

These effects are described more fully in Section 2 of this document. All adverse effects would apply to salmon essential fish habitat. No habitat areas of particular concern were identified in the action area or would be affected by these adverse effects.

3.3. EFH Conservation Recommendations

NMFS determined that the following conservation recommendations are necessary to avoid, minimize, mitigate, or otherwise offset the adverse effects of the proposed action on EFH.

1. Minimize the use of materials containing fine sediments when filling interstitial spaces in the revetment extension to minimize sediment release from the structure.
2. Maintain native shrub and tree plantings to ensure their longevity and future contributions of plant matter and terrestrial insects to minimize the long-term reduction in habitat values caused by the structure.
3. Replace any planted trees or shrubs that die within the first two years after project completion to minimize the long-term reduction in habitat values caused by the structure. Replant with the same or similar native species.

3.4. Statutory Response Requirement

As required by section 305(b)(4)(B) of the MSA, USACE 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 the 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)).

3.5. Supplemental Consultation

The USACE 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 USACE. Other interested users could include the permit applicant and their contractor(s). Individual copies of this opinion were provided to USACE. The document will be available at the NOAA Library Institutional Repository [https://repository.library.noaa.gov/welcome]. The format and naming adhere 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 part 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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