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

Refer to NMFS Consultation No.:
WCRO-2018-00282

July 1, 2019

Michelle Walker
Chief, Regulatory Branch
U.S. Army Corps of Engineers, Seattle District
CENSW-OD-RG
Post Office Box 3755
Seattle, Washington 98124-3755

Re: Endangered Species Act Section 7(a)(2) Biological Opinion, and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Response for the proposed Marks and Maione Shoreline Restoration and Bulkhead Replacement Project in Kitsap County, Washington (COE Reference No.: NWS-2018-690).

Dear Ms. Walker:

Thank you for your email dated November 13, 2018, 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 proposed Marks and Maione Shoreline Restoration and Bulkhead Replacement Project in Kitsap County, Washington.

The enclosed document contains a biological opinion (opinion) that analyzes the effects of your proposal to permit the proposed action under the Rivers and Harbors Act (Section 10) and Clean Water Act (Section 404). In this opinion, we conclude that the proposed action is not likely to jeopardize the continued existence of Puget Sound (PS) Chinook salmon (*Oncorhynchus tshawytscha*), PS steelhead (*O. mykiss*), Further, we conclude that the proposed action will not result in the destruction or adverse modification of their designated critical habitats.

As required by section 7 of the ESA, we are providing an incidental take statement with the opinion. The incidental take statement describes reasonable and prudent measures we consider necessary or appropriate to minimize incidental take associated with this action. The take statement sets forth nondiscretionary terms and conditions, including reporting requirements that the U.S. Army Corps of Engineers (COE) and any person who performs the action must comply with to carry out the reasonable and prudent measures. Incidental take from actions that meet these terms and conditions will be exempt from the ESA take prohibition.

This document also includes the results of our analysis of the action's likely effects on essential fish habitat (EFH) pursuant to section 305(b) of the Magnuson-Stevens Fishery Conservation and Management Act (MSA), and includes three conservation recommendations to avoid, minimize, or otherwise offset potential adverse effects on EFH.

These conservation recommendations are a subset of the ESA take statement's terms and conditions. Section 305(b) (4) (B) of the MSA requires Federal agencies to provide a detailed written response to NMFS within 30 days after receiving these recommendations.

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

Please contact Dr. Jeff Vanderpham, consulting biologist at the Oregon Washington Coastal Office (Jeff.Vanderpham@noaa.gov; 360-753-5834), if you have any questions concerning this consultation, or if you require additional information.

Sincerely,

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

cc: Daniel Krenz, COE

Endangered Species Act (ESA) Section 7(a)(2) Biological Opinion, Letter of Concurrence and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Consultation for the

Marks and Maione Shoreline Restoration and Bulkhead Replacement Project
Kitsap County, Washington
(COE Reference No.: NWS-2018-690)

NMFS Consultation Number: WCRO-2018-00282

Action Agency: U.S. Army Corps of Engineers, Seattle District

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?
Puget Sound steelhead (*Oncorhynchus mykiss*)	Threatened	Yes	No	No	No
Puget Sound Chinook salmon (*O. tshawytscha*)	Threatened	Yes	No	Yes	No
Puget Sound/Georgia Basin yelloweye rockfish (*Sebastes ruberrimus*)	Threatened	No	No	No	No
Puget Sound/Georgia Basin bocaccio (*S. paucispinis*)	Endangered	Yes	No	Yes	No
Southern resident killer whale (*Orcinus orca*)	Endangered	No	No	No	No
Mexico DPS humpback whale (*Megaptera novaeanglia*)	Threatened	No	No	No	N/A
Central America DPS humpback whale (*M. novaeanglia*)	Endangered	No	No	No	N/A

Note: N/A = not applicable, critical habitat not designated

Essential Fish Habitat and NMFS' Determinations:

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
Pacific Coast Groundfish	Yes	Yes

Consultation Conducted By: National Marine Fisheries Service, West Coast Region

Issued By:

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

Date: July 1, 2019

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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 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.), and implementing regulations at 50 CFR 402.

We also completed an essential fish habitat (EFH) consultation on the proposed action, in accordance with section 305(b)(2) of the Magnuson-Stevens Fishery Conservation and Management Act (MSA) (16 U.S.C. 1801 et seq.) and implementing regulations at 50 CFR 600.

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

1.2 Consultation History

NMFS received a request to initiate ESA Section 7 consultation from the United States Army Corps of Engineers (COE) on November 13, 2018. The initiation package included an ESA Section 7 consultation request letter; a Biological Evaluation (BE); and a set of project drawings. In response to our request for additional information on April 19, 2019, on May 3, 2019, the COE provided the Washington Department of Fish and Wildlife (WDFW) Hydraulic Project Approval (HPA) for the proposed action; preliminary design drawings; a site planting plan; and a September 12, 2018 letter from Aspect Consulting regarding site subsurface data for cultural resource assessment. The COE provided the requested Beach Enhancement Design Report on May 10, 2019. We determined that these materials provided all necessary information to complete Section 7 ESA consultation, and consultation was initiated on May 10, 2019.

The COE determined the action may affect and is 'not likely to adversely' (NLAA) affect Puget Sound (PS) Chinook salmon and their critical habitat, PS steelhead, PS/Georgia Basin (PS/GB) bocaccio and their critical habitat, PS/GB yelloweye rockfish and their critical habitat, southern resident (SR) killer whale and their critical habitat, and humpback whale. We determined that the proposed action is likely to adversely affect (LAA) PS Chinook salmon and their designated critical habitat, PS steelhead, and PS/GB bocaccio and their designated critical habitat.

NMFS agreed with the COE's determination of NLAAon PS/Georgia Basin (GB) bocaccio rockfish (*Sebastes paucispinis*), PS/GB yelloweye rockfish (*S. ruberrimus*), southern resident (SR) killer whale (*Orcinus orca*) and the Mexico DPS and Central America DPS of humpback whale (*Megaptera novaeanglia*).

1.3 Proposed Action

"Action" means all activities or programs of any kind authorized, funded, or carried out, in whole or in part, by Federal agencies (50 CFR 402.02). 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). "Interrelated actions" are those that are part of a larger action and depend on the larger action for their justification. "Interdependent actions" are those that have no independent utility apart from the action under consideration (50 CFR 402.02).

The COE is proposing to permit the removal of approximately 169 feet of an existing 300-foot long, 4 to 8-foot high, concrete bulkhead, and replacement of the other 131 feet with a new 2 to 4-man rock bulkhead in the existing footprint (no waterward expansion) to protect a proposed new home. The proposed project is located in Blakely Harbor on Bainbridge Island, Kitsap County, Washington (47.592895 N, -122.50325 W). Work would be completed between July 16 and February 15. If work occurs between July 16 and August 31, a WDFW-approved biologist would be required to document that no forage fish spawning is occurring at the project site before work could commence. All work would be completed in the dry during low tides over an approximately 2-month period, due to the time required for restoration activities.

The bulkhead removal includes the removal of several concrete groins and beach access stairs from the beach. The portion of shoreline where the bulkhead is proposed to be removed would be regraded to a more natural slope, with sand and gravel placement and planting of native vegetation, as described in the project BE, drawings and planting plan. The proposed shoreline restoration also includes a 5-year maintenance plan.

The Best Management Practices (BMPs), impact minimization and conservation measures proposed for this project, in addition to the bulkhead removal and shoreline restoration, include the following, as well as all provisions required by the HPA (Permit Number: 2019-6-78+02):

- All work on the bulkhead would be completed by equipment operating upland of mean higher high water (MHHW). Little to no beach access would be required.
- Access, staging, stockpiling and laydown areas would be located so as not to disturb any native vegetation or habitat.
- Heavy equipment including excavators, loaders and dump trucks would be brought to the site on existing roads.
- Work to remove a bulkhead section would not be started if a storm is expected.
- Backfilling all trenches, depressions, or holes created waterward of MHHW prior to tidal inundation would be standard operating procedure as the tide returns during each work session.
- Clean-up and mitigation actions would consist of regrading the beach as needed to restore pre-existing contours and eliminate all significant evidence of work activity.
- All work below the MHHW would be completed with clean equipment in good condition with no evidence of petroleum product leakage. All equipment to be used below the MHHW line would be inspected, serviced and cleaned in an upland site as necessary to prevent leakage or any contamination of the beach or water.

- Emergency spill response and clean-up equipment would be available on site during all work activities.
- No areas of native vegetation on the upland site would be disturbed. The existing native trees along the property boundaries would be protected and preserved.
- Keep the use of equipment on the beach to a minimum, confined to a single access point, and limited to a 25-foot work corridor waterward of the base rocks.

"Interrelated actions" are those that are part of a larger action and depend on the larger action for their justification. "Interdependent actions" are those that have no independent utility apart from the action under consideration (50 CFR 402.02). Interrelated actions include the proposed residential development in the upland portion of the site. A new house would be built outside of the 75-foot shoreline setback on the site. Other proposed residential work in the upland includes planting of the site with native vegetation and regrading of the site to a more natural, undulating condition.

1.4 Action Area

"Action area" means all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action (50 CFR 402.02). "Indirect effects" are those effects that are caused by or will result from the proposed action and are later in time, but are still reasonably certain to occur (50 CFR 402.02). The action area is defined by both temporary effects associated with construction-related impacts and long-term effects associated with the replacement bulkhead on habitat function, as described below.

The action area is determined by the greatest extent of physical, chemical and biological effects stemming from the project. For the proposed action, there are both short-term construction-related effects and long-term permanent structure-related effects. The greatest extent of physical, chemical or biological effects stemming from the proposed action is associated with likely impacts of permanent structures on forage fish populations. We anticipate that the proposed replacement bulkhead would have long-term impacts on forage fish populations, particularly surf smelt (no documented Pacific herring or sand lance spawning within Blakely Harbor), by causing reductions in suitable spawning substrate (i.e. substrate coarsening), reductions in shallow water-habitat for rearing and spawning, and reductions in forage (i.e. decreased primary productivity). These effects would be long-term and are considered permanent, for the life of the structure. For this assessment we consider the life of the proposed structures to be 50 years. These impacts on nearshore and intertidal habitat and function are discussed in detail in the Effects of the Action section (2.4). ESA listed species in the action area include PS Chinook salmon, PS steelhead, PS/GB boccacio, PS/GB yelloweye rockfish, SR killer whale and Mexico DPS and Central America DPC humpback whale (but all effects on PS/GB yelloweye rockfish, are determined to be insignificant; Section 2.11). The area is also critical habitat for PS Chinook salmon and SR killer whale, and EFH for multiple species (see Section 3.1).

Forage fish are an important prey source of PS Chinook salmon and PS steelhead, and those that occur near the project areas may contribute to forage fish populations throughout the PS. Therefore, we have defined the action area as the marine area (below HAT) within Blakely Harbor, defined by a line from Restoration Point at the southern end of the Harbor to the northern point at the eastern edge of the Harbor (47.597151 N, -122.497542 W), to account for the range of movement of forage fish that may be effected by habitat alterations of the proposed action. Although individual forage fish that occur in the project area may have a wider range than this, we anticipate that beyond these boundaries, there would be no detectable impact to their populations.

The extent of short-term, construction-related effects of the proposed action is within the action area defined by long-term, structure-related effects (i.e. Blakely Harbor). The greatest extent of effects associated with proposed construction activities is the extent of elevated turbidity levels. The size of this area is estimated to be a 150-foot radius surrounding all proposed in-water activity to account for the point of compliance for aquatic life turbidity criteria set forth in the Washington State Water Quality Standards for marine waters (173-201A-210 Washington Administrative Code).

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, Federal agencies must ensure that their actions are not likely to jeopardize the continued existence of endangered or threatened species, or adversely modify or destroy their designated critical habitat. Per the requirements of the ESA, Federal action agencies consult with NMFS and section 7(b)(3) requires that, at the conclusion of consultation, NMFS provides an opinion stating how the agency's actions would affect listed species and their critical habitat. If incidental take is expected, section 7(b)(4) requires NMFS to provide an incidental take statement (ITS) that specifies the impact of any incidental taking and includes non-discretionary reasonable and prudent measures and terms and conditions to minimize such impacts.

The COE determined that the proposed action NLAA PS/GB yelloweye rockfish and their critical habitat, SR killer whale and their critical habitat, and humpback whale (Mexico DPS and Central America DPS). Our concurrence with these NLAA findings is provided in Section 2.11 (Species and Critical Habitat Not Likely to be Adversely Affected).

2.1 Analytical Approach

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

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

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

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

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

2.2 Rangewide Status of the Critical Habitat and Species

This opinion examines the status of each species that would be adversely affected by the proposed action. The status is determined by the level of extinction risk that the listed species face, based on parameters considered in documents such as recovery plans, status reviews, and listing decisions. This informs the description of the species’ likelihood of both survival and recovery. The species status section also helps to inform the description of the species’ current “reproduction, numbers, or distribution” as described in 50 CFR 402.02. The opinion also examines the condition of critical habitat throughout the designated area, evaluates the conservation value of the various watersheds and coastal and marine environments that make up the designated area, and discusses the current function of the essential PBFs that help to form that conservation value.

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. The largest hydrologic responses are expected to occur in basins with significant snow accumulation, where warming decreases snow pack, increases winter flows, and advances the timing of spring melt (Mote et al. 2014, Mote et al. 2016). Rain-dominated watersheds and those with significant contributions from groundwater may be less sensitive to predicted changes in climate (Tague et al. 2013, Mote et al. 2014).

During the last century, average regional air temperatures in the Pacific Northwest increased by 1-1.4°F as an annual average, and up to 2°F in some seasons (based on average linear increase per decade; Abatzoglou et al. 2014; Kunkel et al. 2013). Warming is likely to continue during the next century as average temperatures are projected to increase another 3 to 10°F, with the largest increases predicted to occur in the summer (Mote et al. 2014). Decreases in summer precipitation of as much as 30 percent by the end of the century are consistently predicted across climate models (Mote et al. 2014). Precipitation is more likely to occur during October through March, less during summer months, and more winter precipitation will be rain than snow (ISAB 2007; Mote et al. 2013; Mote et al. 2014). Earlier snowmelt will cause lower stream flows in late spring, summer, and fall, and water temperatures will be warmer (ISAB 2007; Mote et al. 2014). Models consistently predict increases in the frequency of severe winter precipitation events (i.e., 20-year and 50-year events), in the western United States (Dominguez et al. 2012). The largest increases in winter flood frequency and magnitude are predicted in mixed rain-snow watersheds (Mote et al. 2014).

Overall, about one-third of the current cold-water salmonid habitat in the Pacific Northwest is likely to exceed key water temperature thresholds by the end of this century (Mantua et al. 2009). Higher temperatures will reduce the quality of available salmonid habitat for most freshwater life stages (ISAB 2007). Reduced flows will make it more difficult for migrating fish to pass physical and thermal obstructions, limiting their access to available habitat (Mantua et al. 2010; Isaak et al. 2012). Temperature increases shift timing of key life cycle events for salmonids and species forming the base of their aquatic foodwebs (Crozier et al. 2011; Tillmann and Siemann 2011; Winder and Schindler 2004). Higher stream temperatures will also cause decreases in dissolved oxygen and may also cause earlier onset of stratification and reduced mixing between layers in lakes and reservoirs, which can also result in reduced oxygen (Meyer et al. 1999; Winder and Schindler 2004; Raymondi et al. 2013). Higher temperatures are likely to cause several species to become more susceptible to parasites, disease, and higher predation rates (Crozier et al. 2008; Wainwright and Weitkamp 2013; Raymondi et al. 2013).

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

In addition to changes in freshwater conditions, predicted changes for coastal waters in the Pacific Northwest as a result of climate change include increasing surface water temperature, increasing but highly variable acidity, and increasing storm frequency and magnitude (Mote et al. 2014). Elevated ocean temperatures already documented for the Pacific Northwest are expected to be 1.0-3.7^{o}C higher by the end of the century (IPCC 2014). Habitat loss, shifts in species' ranges and abundances, and altered marine food webs could have substantial consequences to anadromous, coastal, and marine species in the Pacific Northwest (Tillmann and Siemann 2011; Reeder et al. 2013).

Moreover, as atmospheric carbon emissions increase, increasing levels of carbon are absorbed by the oceans, changing the pH of the water. Acidification also impacts sensitive estuary habitats, where organic matter and nutrient inputs further reduce pH and produce conditions more corrosive than those in offshore waters (Feely et al. 2012, Sunda and Cai 2012).

Global sea levels are expected to continue rising throughout this century, reaching likely predicted increases of 10-32 inches by 2081-2100 (IPCC 2014). These changes will likely result in increased erosion and more frequent and severe coastal flooding, and shifts in the composition of nearshore habitats (Tillmann and Siemann 2011; Reeder et al. 2013). Estuarine-dependent salmonids such as chum and Chinook salmon are predicted to be impacted by significant reductions in rearing habitat in some Pacific Northwest coastal areas (Glick et al. 2007).

Historically, warm periods in the coastal Pacific Ocean have coincided with relatively low abundances of salmon and steelhead, while cooler ocean periods have coincided with relatively high abundances, and therefore these species are predicted to fare poorly in warming ocean conditions (Scheuerell and Williams 2005; Zabel et al. 2006). This is supported by the recent observation that anomalously warm sea surface temperatures off the coast of Washington from 2013 to 2016 resulted in poor coho and Chinook salmon body condition for juveniles caught in those waters (NWFSC 2015). Changes to estuarine and coastal conditions, as well as the timing of seasonal shifts in these habitats, have the potential to impact a wide range of listed aquatic species (Tillmann and Siemann 2011; Reeder et al. 2013).

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

2.2.1 Status of the Species

Status of PS Steelhead

PS steelhead was listed as threatened on May 11, 2007 (72 FR 26722), with a status review completed in 2015 (NWFSC 2015). A proposed recovery plan for the species was completed in 2018 (NMFS 2018). The PS Steelhead TRT produced viability criteria, including population viability analyses (PVAs), for 20 of 32 demographically independent populations (DIPs) and three major population groups (MPGs) in the DPS (Hard 2015). It also completed a report identifying historical populations of the DPS (Myers et al. 2015). The DIPs are based on genetic, environmental, and life history characteristics. Populations display winter, summer, or summer/winter run timing (Myers et al. 2015). The TRT concludes that the DPS is currently at "very low" viability, with most of the 32 DIPs and all three MPGs at "low" viability.

The designation of the DPS as "threatened" is based upon the extinction risk of the component populations. Hard (2015), identifies several criteria for the viability of the DPS, including that a minimum of 40 percent of summer-run and 40 percent of winter-run populations historically present within each of the MPGs must be considered viable using the VSP-based criteria. For a DIP to be considered viable, it must have at least an 85 percent probability of meeting the viability criteria, as calculated by Hard (2015).

On December 13, 2018, we published a proposed recovery plan for PS steelhead (83 FR 64110) (NMFS 2018). The proposed plan indicates that within each of the three MPGs, at least fifty percent of the populations must achieve viability, *and* specific DIPs must also be viable:

> Central and South Puget Sound MPG: Green River Winter-Run; Nisqually River Winter-Run; Puyallup/Carbon Rivers Winter-Run, or the White River Winter-Run; and At least one additional DIP from this MPG: Cedar River, North Lake Washington/Sammamish Tributaries, South Puget Sound Tributaries, or East Kitsap Peninsula Tributaries.
>
> Hood Canal and Strait of Juan de Fuca MPG: Elwha River Winter/Summer-Run; Skokomish River Winter-Run; One from the remaining Hood Canal populations: West Hood Canal Tributaries WinterRun, East Hood Canal Tributaries Winter-Run, or South Hood Canal Tributaries WinterRun; and One from the remaining Strait of Juan de Fuca populations: Dungeness Winter-Run, Strait of Juan de Fuca Tributaries Winter-Run, or Sequim/Discovery Bay Tributaries Winter-Run.
>
> North Cascades MPG: Of the eleven DIPs with winter or winter/summer runs, five must be viable: One from the Nooksack River Winter-Run; One from the Stillaguamish River Winter-Run; One from the Skagit River (either the Skagit River Summer-Run and Winter-Run or the Sauk River Summer-Run and Winter-Run); One from the Snohomish River watershed (Pilchuck, Snoqualmie, or Snohomish/Skykomish River Winter-Run); and One other winter or summer/winter run from the MPG at large.
>
> Of the five summer-run DIPs in this MPG, three must be viable representing in each of the three major watersheds containing summer-run populations (Nooksack, Stillaguamish, Snohomish Rivers); South Fork Nooksack River Summer-Run; One DIP from the Stillaguamish River (Deer Creek Summer-Run or Canyon Creek Summer-Run); and One DIP from the Snohomish River (Tolt River Summer-Run or North Fork Skykomish River Summer-Run)

Spatial Structure and Diversity**.** The PS steelhead DPS is the anadromous form of O. mykiss that occur in rivers, below natural barriers to migration, in northwestern Washington State that drain to Puget Sound, Hood Canal, and the Strait of Juan de Fuca between the U.S./Canada border and the Elwha River, inclusive. The DPS also includes six hatchery stocks that are considered no more than moderately diverged from their associated natural-origin counterparts: Green River natural winter-run; Hamma Hamma winter-run; White River winter-run; Dewatto River winter-run; Duckabush River winter-run; and Elwha River native winter-run (USDC 2014). Steelhead are the anadromous form of *Oncorhynchus mykiss* that occur in rivers, below natural barriers to migration, in northwestern Washington State (Ford 2011). Non-anadromous ‘‘resident’’ *O. mykiss* occur within the range of PS steelhead but are not part of the DPS due to marked differences in physical, physiological, ecological, and behavioral characteristics (Hard et al. 2007).

DIPs can include summer steelhead only, winter steelhead only, or a combination of summer and winter run timing (e.g., winter run, summer run or summer/winter run). Most DIPs have low viability criteria scores for diversity and spatial structure, largely because of extensive hatchery influence, low breeding population sizes, and freshwater habitat fragmentation or loss (Hard et al. 2007). In the Central and South Puget Sound and Hood Canal and Strait of Juan de Fuca MPGs, nearly all DIPs are not viable (Hard 2015). More information on PS steelhead spatial structure and diversity can be found in NMFS' technical report (Hard 2015).

Abundance and Productivity. Abundance of adult steelhead returning to nearly all PS rivers has fallen substantially since estimates began for many populations in the late 1970s and early 1980s. Smoothed trends in abundance indicate modest increases since 2009 for 13 of the 22 DIPs. Between the two most recent five-year periods (2005-2009 and 2010-2014), the geometric mean of estimated abundance increased by an average of 5.4 percent. For seven populations in the Northern Cascades MPG, the increase was 3 percent; for five populations in the Central & South Puget Sound MPG, the increase was 10 percent; and for six populations in the Hood Canal & Strait of Juan de Fuca MPG, the increase was 4.5 percent. However, several of these upward trends are not statistically different from neutral, and most populations remain small. Inspection of geometric means of total spawner abundance from 2010 to 2014 indicates that 9 of 20 populations evaluated had geometric mean abundances fewer than 250 adults and 12 of 20 had fewer than 500 adults. Between the most recent two five-year periods (2005-2009 and 2010-2014), several populations showed increases in abundance between 10 and 100 percent, but about half have remained in decline. Long-term (15-year) trends in natural spawners are predominantly negative (NWFSC 2015).

There are some signs of modest improvement in steelhead productivity since the 2011 review, at least for some populations, especially in the Hood Canal & Strait of Juan de Fuca MPG. However, these modest changes must be sustained for a longer period (at least two generations) to lend sufficient confidence to any conclusion that productivity is improving over larger scales across the DPS. Moreover, several populations are still showing dismal productivity, especially those in the Central & South Puget Sound MPG (NWFSC 2015).

Little or no data is available on summer-run populations to evaluate extinction risk or abundance trends. Because of their small population size and the complexity of monitoring fish in headwater holding areas, summer steelhead have not been broadly monitored.

Limiting factors. In our 2013 proposed rule designating critical habitat for this species (USDC 2013), we noted that the following factors for decline for PS steelhead persist as limiting factors:

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

Status of PS Chinook salmon

PS Chinook salmon were listed as threatened on June 28, 2005 (70 FR 37160), and a status review was completed in 2015 (NWFSC 2015). The recovery plan for this species was adopted by NMFS in 2007 (SSDC 2007). The recovery plan consists of two documents: the Puget Sound salmon recovery plan (SSDC 2007) and a supplement by NMFS (2006). The recovery plan adopts ESU and population level viability criteria recommended by the Puget Sound Technical Recovery Team (PSTRT) (Ruckelshaus et al. 2002). The PSTRT's biological recovery criteria will be met when all of the following conditions are achieved:

- The viability status of all populations in the ESU is improved from current conditions, and when considered in the aggregate, persistence of the ESU is assured;
- Two to four Chinook salmon populations in each of the five biogeographical regions of the ESU (Table 6) achieve viability, depending on the historical biological characteristics and acceptable risk levels for populations within each region;
- At least one population from each major genetic and life history group historically present within each of the five biogeographical regions is viable;
- Tributaries to Puget Sound not identified as primary freshwater habitat for any of the 22 identified populations are functioning in a manner that is sufficient to support an ESU-wide recovery scenario; Production of Chinook salmon from tributaries to Puget Sound not identified as primary freshwater habitat for any of the 22 identified populations occurs in a manner consistent with ESU recovery; and
- Populations that do not meet the viability criteria for all VSP parameters are sustained to provide ecological functions and preserve options for ESU recovery.

<u>Spatial Structure and Diversity.</u> The Puget Sound Chinook salmon ESU includes all naturally spawning populations of Chinook salmon from rivers and streams flowing into Puget Sound including the Straits of Juan De Fuca from the Elwha River, eastward, including rivers and

streams flowing into Hood Canal, South Sound, North Sound and the Strait of Georgia in Washington. The ESU also includes the progeny of numerous artificial propagation programs (NWFSC 2015). The PSTRT identified 22 extant populations, grouped into five major geographic regions, based on consideration of historical distribution, geographic isolation, dispersal rates, genetic data, life history information, population dynamics, and environmental and ecological diversity. The PSTRT distributed the 22 populations among five major biogeographical regions, or major population groups (MPG), that are based on similarities in hydrographic, biogeographic, and geologic characteristics (Table 1).

Between 1990 and 2014, the proportion of natural-origin spawners has trended downward across the ESU, with the Whidbey Basin the only MPG with consistently high fractions of natural-origin spawner abundance. All other MPG have either variable or declining spawning populations with high proportions of hatchery-origin spawners (NWFSC 2015).Overall, the new information on abundance, productivity, spatial structure and diversity since the 2010 status review supports no change in the biological risk category (NWFSC 2015).

Table 1. Extant PS Chinook salmon populations in each biogeographic region (Ruckelshaus et al. 2002, NWFSC 2015)

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

Abundance and Productivity. Available data on total abundance since 1980 indicate that although abundance trends have fluctuated between positive and negative for individual populations, there are widespread negative trends in natural-origin Chinook salmon spawner abundance across the ESU (NWFSC 2015). Productivity remains low in most populations, and hatchery-origin spawners are present in high fractions in most populations outside of the Skagit watershed. Available data now shows that most populations have declined in abundance over the past 7 to 10 years. Further, escapement levels for all populations remain well below the TRT planning ranges for recovery, and most populations are consistently below the spawner-recruit levels identified by the TRT as consistent with recovery (NWFSC 2015).

Limiting Factors. Limiting factors for this species include:

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

Status of PS/GB bocaccio

PS/GB bocaccio was listed as endangered on April 28, 2010 (75 FR 22276), with a status review completed in 2016 (NMFS 2016a), and a recovery plan adopted on October 13, 2017. A "downlisting" criterion of the recovery plan is: "Nearshore nursery habitats are protected from adverse development and are determined to be of sufficient size and quality to provide adequate food, shelter, and other essential requirements for juvenile bocaccio."

Spatial Structure and Diversity. Most bocaccio within the DPS may have been historically spatially limited to several basins within the DPS. The apparent reduction of populations of bocaccio in the Main Basin and South Sound represents a further reduction in the historically spatially limited distribution of bocaccio, and adds significant risk to the viability of the DPS.

Size-frequency distributions for bocaccio in the 1970s indicate a wide range of sizes, with recreationally caught individuals from 9.8 to 33.5 inches (25 to 85 cm) (Figure 7). This broad size distribution suggests a spread of ages, with some successful recruitment over many years. A similar range of sizes is also evident in the 1980s catch data (Palsson et al. 2009; Drake et al. 2010). The temporal trend in size distributions for bocaccio also suggests size truncation of the population, with larger fish becoming less common over time. By the 2000s, no size distribution data for bocaccio were available. The potential loss of diversity in the bocaccio DPS, in combination with their relatively low productivity, may result in a mismatch with habitat conditions and further reduce population viability (Drake et al. 2010, in NMFS 2017).

Abundance and Productivity. There is no single, reliable historical or contemporary abundance estimate for bocaccio DPSs in the Puget Sound/Georgia Basin (Drake et al. 2010). Despite this limitation, there is clear evidence that each species' abundance has declined dramatically (Drake et al. 2010, in NMFS 2017). Though bocaccio were never a predominant segment of the multi-species rockfish population within the PS/GB, their present-day abundance is likely a fraction of their pre-contemporary fishery abundance. They were apparently historically most abundant in the Central and South Sound with no documented occurrences in the San Juan Basin until 2008.

NMFS 2017 notes that Tolimieri and Levin (2005) found the bocaccio population growth rate is around 1.01, indicating a very low intrinsic growth rate for this species. This species demonstrates some of the highest recruitment variability among rockfish species, with many years of poor recruitment being the norm (Tolimieri and Levin 2005) and an estimated natural mortality of 8 percent (Palsson et al 2009). Given their severely reduced abundance, Allee effects could be particularly acute for bocaccio, even considering the propensity of some individuals to move long distances and potentially find mates, though the extent of these effects are yet unknown.

Limiting factors. Factors limiting productivity identified for PS/GB bocaccio include over-harvest, water pollution, climate-induced changes to rockfish habitat and small population dynamics.

2.2.2 Status of the Critical Habitats

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

Salmon and Steelhead

For salmon and steelhead, NMFS ranked watersheds within designated critical habitat at the scale of the fifth-field hydrologic unit code (HUC_5) in terms of the conservation value they provide to each listed species they support.[1] The conservation rankings are high, medium, or low. To determine the conservation value of each watershed to species viability, NMFS's critical habitat analytical review teams (CHARTs) evaluated the quantity and quality of habitat features (for example, spawning gravels, wood and water condition, side channels), the relationship of the area compared to other areas within the species' range, and the significance to the species of the population occupying that area (NOAA 2005). Thus, even a location that has poor quality of habitat could be ranked with a high conservation value if it were essential due to factors such as limited availability (e.g., one of a very few spawning areas), a unique contribution of the population it served (e.g., a population at the extreme end of geographic distribution), or if it serves another important role (e.g., obligate area for migration to upstream spawning areas).

The physical or biological features of freshwater spawning and incubation sites, include water flow, quality and temperature conditions and suitable substrate for spawning and incubation, as well as migratory access for adults and juveniles (Tables 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

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

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 the opinion, and corresponding species life history events.

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

CHART Salmon and Steelhead Critical Habitat Assessments

The CHART for each recovery domain assessed biological information pertaining to occupied by listed salmon and steelhead, determine whether those areas contained PCEs essential for the conservation of those species and whether unoccupied areas existed within the historical range of the listed salmon and steelhead that are also essential for conservation. The CHARTs assigned a 0 to 3 point score for the PCEs in each HUC_5 watershed for:

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

Thus, the quality of habitat in a given watershed was characterized by the scores for Factor 2 (quality – current condition), which considers the existing condition of the quality of PCEs in the HUC_5 watershed; and Factor 3 (quality – potential condition), which considers the likelihood of achieving PCE potential in the HUC_5 watershed, either naturally or through active conservation/restoration, given known limiting factors, likely biophysical responses, and feasibility.

PS Steelhead

Critical habitat for PS steelhead was designated on February 24, 2016 (81 FR 9251). Critical habitat includes 1,683 miles of streams, 41 square mile of lakes, and 2,182 miles of nearshore marine habitat in Puget Sounds. The Puget Sound Chinook salmon ESU has 61 freshwater and 19 marine areas within its range. Of the freshwater watersheds, 41 are rated high conservation value, 12 low conservation value, and eight received a medium rating. Of the marine areas, all 19 are ranked with high conservation value.

PS Chinook salmon

Critical habitat for PS Chinook salmon was designated on February 24, 2016 (81 FR 9252). Critical habitat includes 2,031 stream miles. Nearshore and offshore marine waters were not designated for this species. There are 66 watersheds within the range of this DPS. Nine watersheds received a low conservation value rating, 16 received a medium rating, and 41 received a high rating to the DPS.

Puget Sound Recovery Domain

Critical habitat has been designated in Puget Sound for PS Chinook salmon, PS steelhead and HCSR chum. Major tributary river basins in the Puget Sound basin include the Nooksack, Samish, Skagit, Sauk, Stillaguamish, Snohomish, Lake Washington, Cedar, Sammamish, Green, Duwamish, Puyallup, White, Carbon, Nisqually, Deschutes, Skokomish, Duckabush, Dosewallips, Big Quilcene, Elwha, and Dungeness rivers and Soos Creek.

Landslides can occur naturally in steep, forested lands, but inappropriate land use practices likely have accelerated their frequency and the amount of sediment delivered to streams. Fine sediment from unpaved roads has also contributed to stream sedimentation. Unpaved roads are widespread on forested lands in the Puget Sound basin, and to a lesser extent, in rural residential areas. Historical logging removed most of the riparian trees near stream channels. Subsequent agricultural and urban conversion permanently altered riparian vegetation in the river valleys, leaving either no trees, or a thin band of trees. The riparian zones along many agricultural areas are now dominated by alder, invasive canary grass and blackberries, and provide substantially reduced stream shade and large wood recruitment (SSDC 2007).

Diking, agriculture, revetments, railroads and roads in lower stream reaches have caused significant loss of secondary channels in major valley floodplains in this region. Confined main channels create high-energy peak flows that remove smaller substrate particles and large wood. The loss of side-channels, oxbow lakes, and backwater habitats has resulted in a significant loss of juvenile salmonid rearing and refuge habitat. When the water level of Lake Washington was lowered 9 feet in the 1910s, thousands of acres of wetlands along the shoreline of Lake Washington, Lake Sammamish and the Sammamish River corridor were drained and converted to agricultural and urban uses. Wetlands play an important role in hydrologic processes, as they store water which ameliorates high and low flows. The interchange of surface and groundwater in complex stream and wetland systems helps to moderate stream temperatures. Forest wetlands are estimated to have diminished by one-third in Washington State (FEMAT 1993; Spence et al. 1996; SSDC 2007).

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

Peak stream flows have increased over time due to paving (roads and parking areas), reduced percolation through surface soils on residential and agricultural lands, simplified and extended drainage networks, loss of wetlands, and rain-on-snow events in higher elevation clear cuts (SSDC 2007). In urbanized Puget Sound, there is a strong association between land use and land cover attributes and rates of coho spawner mortality likely due to runoff containing contaminants emitted from motor vehicles (Feist et al. 1996).

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

Juvenile mortality occurs in unscreened or inadequately screened diversions. Water diversion ditches resemble side channels in which juvenile salmonids normally find refuge. When diversion headgates are shut, access back to the main channel is cut off and the channel goes dry. Mortality can also occur with inadequately screened diversions from impingement on the screen, or mutilation in pumps where gaps or oversized screen openings allow juveniles to get into the system (WDFW 2009). Blockages by dams, water diversions, and shifts in flow regime due to hydroelectric development and flood control projects are major habitat problems in many Puget Sound tributary basins (SSDC 2007).

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

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

Effects associated with logging depended on stream size, gradient, and time elapsed. In high-energy coast streams, landslides and debris torrents often modify steep slope tributaries and the mainstem of creeks. Bank erosion also alters stream channels on alluvial floodplains. These effects are additive in the system and reduced the quality of spawning and rearing habitat for juvenile salmonids (Hartman *et al.* 1996). Lower gradient streams typically have an accumulation of sediment. Second-growth logged sections (12-35 years after logging), re-shaded by deciduous forest canopy, have lower biomass of trout and fewer predator taxa than old-growth sites (Murphy and Hall 1981).

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

The PS recovery domain CHART (NOAA Fisheries 2005) determined that only a few watersheds with PCEs for Chinook salmon in the Whidbey Basin (Skagit River/Gorge Lake, Cascade River, Upper Sauk River, and the Tye and Beckler rivers) are in good-to-excellent condition with no potential for improvement. Most HUC_5 watersheds are in fair-to-poor or fair-to-good condition. However, most of these watersheds have some or a high potential for improvement (Table 3).

Table 3. Puget Sound Recovery Domain: Current and potential quality of HUC5 watersheds identified as supporting historically independent populations of ESA-listed Chinook salmon (NOAA Fisheries 2005).

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

Watershed Name(s) and HUC5 Code(s)	Current Quality	Restoration Potential
Strait of Georgia and Whidbey Basin #1711000xxx		
Skagit River/Gorge Lake (504), Cascade (506) & Upper Sauk (601) rivers, Tye & Beckler rivers (901)	3	3
Skykomish River Forks (902)	3	1
Skagit River/Diobsud (505), Illabot (507), & Middle Skagit/Finney Creek (701) creeks; & Sultan River (904)	2	3
Skykomish River/Wallace River (903) & Skykomish River/Woods Creek (905)	2	2
Upper (602) & Lower (603) Suiattle rivers, Lower Sauk (604), & South Fork Stillaguamish (802) rivers	2	1
Samish River (202), Upper North (401), Middle (402), South (403), Lower North (404), Nooksack River; Nooksack River (405), Lower Skagit/Nookachamps Creek (702) & North Fork (801) & Lower (803) Stillaguamish River	1	2
Bellingham (201) & Birch (204) bays & Baker River (508)	1	1
Whidbey Basin and Central/South Basin #1711001xxx		
Lower Snoqualmie River (004), Snohomish (102), Upper White (401) & Carbon (403) rivers	2	2
Middle Fork Snoqualmie (003) & Cedar rivers (201), Lake Sammamish (202), Middle Green River (302) & Lowland Nisqually (503)	2	1
Pilchuck (101), Upper Green (301), Lower White (402), & Upper Puyallup River (404) rivers, & Mashel/Ohop(502)	1	2
Lake Washington (203), Sammamish (204) & Lower Green (303) rivers	1	1
Puyallup River (405)	0	2
Hood Canal #1711001xxx		
Dosewallips River (805)	2	1/2
Kitsap – Kennedy/Goldsborough (900)	2	1
Hamma Hamma River (803)	½	1/2
Lower West Hood Canal Frontal (802)	0/2	0/1
Skokomish River (701)	1/0	2/1
Duckabush River (804)	1	2
Upper West Hood Canal Frontal (807)	1	2
Big Quilcene River (806)	1	1/2
Deschutes Prairie-1 (601) & Prairie-2 (602)	1	1
West Kitsap (808)	1	1
Kitsap – Prairie-3 (902)	1	1
Port Ludlow/Chimacum Creek (908)	1	1
Kitsap – Puget (901)	0	1
Kitsap – Puget Sound/East Passage (904)	0	0
Strait of Juan de Fuca Olympic #1711002xxx		

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

Watershed Name(s) and HUC$_5$ Code(s)	Current Quality	Restoration Potential
Dungeness River (003)	2/1	1/2
Discovery Bay (001) & Sequim Bay (002)	1	2
Elwha River (007)	1	2
Port Angeles Harbor (004)	1	1

Rockfish

PS/GB Bocaccio

PS/GB bocaccio critical habitat was designated on February 11, 2015 (79 FR 68041). It includes 590.4 square miles of nearshore habitat and 414.1 square miles of deepwater habitat. Critical habitat is not designated in areas outside of United States jurisdiction; therefore, although waters in Canada are part of the DPSs' ranges for all three species, critical habitat was not designated in that area. Based on the natural history of bocaccio and their habitat needs, NMFS identified two physical or biological features, essential for their conservation: 1) Deepwater sites (>30 meters) that support growth, survival, reproduction, and feeding opportunities; 2) Nearshore juvenile rearing sites with sand, rock and/or cobbles to support forage and refuge. Habitat threats include degradation of rocky habitat, loss of eelgrass and kelp, introduction of non-native species that modify habitat, and degradation of water quality as specific threats to rockfish habitat in the Georgia Basin.

2.4 Environmental Baseline

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

The action area is located in, and therefore influenced by, the general conditions found in the central PS. The PS is one of the largest estuaries in the United States, having over 2,400 miles of shoreline, more than 2 million acres of marine waters and estuarine environment, and a watershed of more than 8.3 million acres. In 1987, PS was given priority status in the National Estuary Program. This established it as an estuary of national significance under an amendment to the Clean Water Act. In 2006, the Center for Biological Diversity (CBD) recognized the Puget Sound Basin as a biological hotspot with over 7,000 species of organisms that relay on the wide variety of habitats provided by Puget Sound (CBD 2006).

The State of the Sound biannual report produced by the Puget Sound Partnership (PSP) (PSP 2017) summarizes how different indicators of health of the PS ecosystem are changing[2]. Their assessment can be summarized to a few key points: (1) development pressure continues to impact habitat in the marine and freshwater portion of the range; (2) improvements in human use patterns are slow at best; and (3) few of the 2020 improvement targets identified by the PSP will be reached. While this report refers to all of Puget Sound, the key points also apply to the action area. In more detail, this most recent report points out the following with regard to habitat, species and water vital sign indicators:

- Indicators of habitat restoration in estuaries, floodplains, riparian, and shoreline areas have made modest gains. Such areas are important to many key species, including Chinook salmon.
- Forest habitats, particularly those deemed as having high ecological value, continue to be lost.
- Sound-wide, eelgrass habitat area is holding steady, though local gains have been made. This habitat is important to small fish, shellfish, and other marine organisms. Species • The spawning population sizes of Chinook salmon are dangerously below federal recovery goals and are not improving.
- As of September 2017, the Southern Resident killer whale population has only 76 individuals; recovery depends on increasing its main prey, Chinook salmon; reducing the load of toxins entering Puget Sound; and minimizing the impacts and risks of vessel traffic.
- Pacific herring (small schooling fish that are important prey for salmon, birds, and mammals) and marbled murrelets continue to show signs of decline.
- The health of the populations of small marine animals that live in the sediment at the bottom of Puget Sound shows signs of decline.
- In certain local areas of Puget Sound, harmful bacteria and viruses declined to the point where shellfish beds were reopened to harvest. Other shellfish beds, however, were closed to harvest because of increased bacteria and viruses. On balance, harvest areas increased. •
- Overall marine water quality continues to decline, particularly in the last 3 years, when the temperature of the ocean's surface was unusually high.
- Contaminants in Pacific herring and English sole (a bottom fish species) surpass levels considered safe for fish in some areas, though other areas are getting better.

Over the last 150+ years, 4.5 million people have settled in the PS region. There are a suite of impacts of human development on aquatic habitat conditions in the PS, including water quality effects of stormwater runoff, industrial pollutants and boats, in-water noise from boats and construction activities, and fishing pressure (see SSDC 2007; PSP 2017). With the level of infrastructure development associated with population growth, the PS nearshore has been altered significantly. Major physical changes documented in the PS include the simplification of river deltas, the elimination of small coastal bays, the reduction in sediment supply to the foreshore due to beach armoring, and the loss of tidally influenced wetlands and salt marsh (Fresh et al. 2011).

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[2] The Puget Sound Partnership tracks 25 metrics (vital sign indicators) to measure progress toward different PS recovery goals. The recovery goals most relevant for this Opinion include: Thriving species and food webs, Protected and Restored Habitat, Healthy Water Quality and Quantity.

The Puget Sound Nearshore Ecosystem Restoration Project (PSNERP), an investigation project between the Corps and the state of Washington, reviewed the historical changes to Puget Sound's shoreline environment between 1850-1880, and 2000-2006, and found the most pervasive change to Puget Sound to be the simplification of the shoreline and reduction in natural shoreline length (Simenstad et al. 2011). Only 31.3 percent of the length of the PS's shoreline has not been modified (Simenstad et al. 2011). Simplification of the largest river deltas in the PS has caused a 27 percent decline in shoreline length compared to historical conditions, and 27 percent of all PS shorelines are armored (Simenstad et al. 2011). The loss of tidal wetlands in the largest deltas averages 26 percent (Fresh et al. 2011).

Effects of shoreline armoring on nearshore and intertidal habitat function include diminished sediment supply, diminished organic material (e.g., woody debris and beach wrack) deposition, diminished over-water (riparian) and nearshore in-water vegetation (SAV), diminished prey availability, diminished aquatic habitat availability, diminished invertebrate colonization, and diminished forage fish populations (see Toft et al. 2007; Shipman et al. 2010; Sobocinski et al. 2010; Morley et al. 2012; Toft et al. 2013; Munsch et al. 2014; Dethier et al. 2016; Munsch et al. 2017). Shoreline armoring often results in increased beach erosion waterward of the armoring, which, in turn, leads to beach lowering, coarsening of substrates, increases in sediment temperature, and reductions in invertebrate density (Fresh et al. 2011; Morley et al. 2012; Dethier et al. 2016).

The reductions to shallow water habitat, as well as reduced forage potential resulting from shoreline armoring may cause juvenile PS Chinook salmon and steelhead, and juvenile PS/GB bocaccio to temporarily use deeper habitat, thereby exposing them to increased piscivorous predation. Typical piscivorous juvenile salmonid and bocaccio predators, such as flatfish, sculpin, and larger juvenile salmonids, being larger than their prey, generally avoid the shallowest nearshore waters that outmigrant juvenile salmonids and juvenile bocaccio prefer. When juvenile fish temporarily leave the relative safety of the shallow water, their risk to being preyed upon by other fish increases. This has been shown in the marine environment where juvenile salmonid consumption by piscivorous predators increased fivefold when juvenile salmon were forced to leave the shallow nearshore (Willette 2001).

New shoreline armoring continues to reduce suitable habitat for Pacific sand lance and surf smelt spawning and may reduce their numbers. Bulkheads may alter habitat conditions and directly, and permanently (for the life of the structure), eliminate intertidal habitat for forage species, particularly for sand lance, an obligate upper intertidal spawner (see Whitman et al. 2014). As stated in Fresh et al. (2011) "we can only surmise how much forage fish spawning habitat we have lost because we lack comprehensive historical data on spawning areas." Considering that these forage fish are an essential food source for salmon, the beach armoring has multiple negative effects on salmon including reductions in prey and reductions in access to shallow water rearing habitat and refuge.

The effect bulkheads on intertidal and nearshore habitat conditions and availability is likely to be compounded by sea-level rise associated with climate change. As the sea level rises, the elevation of the intertidal zone will also rise, and where shoreline armoring prevents beach formation at these higher elevations, the width of intertidal zones will be reduced. This will diminish habitat for intertidal beach spawners, like surf smelt and sand lance (Krueger et al. 2010), and reduce shallow water habitat for juvenile salmonids, including PS Chinook salmon and PS steelhead. At the project site during the estimated 50-year life of the proposed bulkhead, according to Washington Coastal Hazards Resilience Network data, sea level is likely (probability of exceedance 83-17 percent) to rise from between 0.7 feet and 1.6 feet by the year 2070 (Miller et al. 2018; WCHRN 2019).

In addition to beach armoring, other shoreline changes, such overwater structures (i.e. piers, ramps and floats) reduce habitat quantity and quality, and impact fish migrations. The South Central PS sub-basin in which the action area is located has the highest number (2,040), density (4 per km), and area of OWS (6.8 km^2) of all sub-basins. More than one-third (67) of marinas in PS are in the South Central sub-basin, and they cover over 3 square kilometers, which is nearly half of the total PS area covered by marinas (Schlenger et al. 2011). More than 1 percent of the nearshore zone area of the South Central PS sub-basin is covered by marinas. Because of the known negative effects of OWS on juvenile salmonid, such as delayed migration and increased predation risk (Heiser and Finn, 1970; Able et al. 1998; Simenstad, 1988; Nightingale and Simenstad 2001; Willette 2001; Southard et al. 2006; Toft et al. 2013; Ono 2010), and shading effects on salmonid forage through reductions to SAV and primary productivity (Mumford 2007; Haas et al. 2002), OWS in the PS has resulted in broad negative impacts to these PS Chinook salmon and steelhead, and designated critical habitat. The Biological Opinion completed by NMFS on Regional General Permit 6 (RGP6) for structures in the Puget Sound (NMFS 2016b) provides a detailed summary of the effects of OWS on ESA-listed species and designated critical habitat in Puget Sound.

Within the action area low to moderate levels of human development have altered habitat conditions. Land use of the shoreline in the action area includes primarily low-density residential development. The historic and current existence of shoreline armoring and other disturbance, such as reduced riparian cover and placement of impervious surfaces (e.g., roads and homes), has resulted in a degraded baseline throughout much of the action area. The project site is located in a section of shoreline that is 81 to 100 percent modified (e.g., bulkheads) according to the Washington State Coastal Atlas Map (Ecology 2019). Adjacent shorelines are generally less modified. With multiple factors reducing the survival and productivity (e.g., reduced rearing habitat) along the shoreline of the action area, local populations of salmon and steelhead experience high levels of human impacts to habitat and impairment to recovery.

The subject property is located within a pocket estuary (Blakely Harbor) in an area of shoreline with mapped eelgrass (continuous fringe) (Ecology 2019). The western portion of the action area also provides a moderate-sized area of salt marsh habitat at the western end of Blakely Harbor. Two small streams discharge into the salt marsh that have documented salmonid presence (Coho salmon and resident coastal cutthroat trout) (WDFW 2019a). The nearest known PS Chinook salmon natal spawning stream is outside of the action area in the Green/Duwamish River, approximately 7 miles east of the project site (NOAA 2006). The nearest known PS steelhead natal spawning streams are also outside of the action area in Curley Creek, approximately 6.5 miles southwest of the project site, and the Green/Duwamish River (NOAA 2015a).

The action area is generally shallow (less than 100 feet relative to mean lower low water; MLLW), with deeper areas (159 feet relative to MLLW) along the eastern edge of Blakely Harbor (NOAA 2015b). Depths within a quarter mile of the project are less than 100 feet. The project site is at approximately the middle of an over 6,000-foot long drift cell that is oriented from left to right, originating near the western end of Blakely Harbor and terminating at a divergent zone approximately 3,000 feet southeast of the project site (Ecology 2019). Existing bulkheads in the drift cell, including the one at the site of the proposed action, currently prevent deposition of sediment from landward of the bulkhead to the beach, and thus also reduce available fine material from each bulkhead location to the eastern end of the cell. According to the BE, substrate waterward of the existing bulkhead are dominated by cobble with some medium to large gravel and underlying sand.

According to the Washington State Forage Fish Spawning Map (WDFW 2019b) there is documented forage fish (surf smelt) spawning habitat along much of the shoreline of the action area, the closest to the project site approximately 0.25 miles to the northwest. There is no documented Pacific herring or sand lance spawning within the action area.

Riparian vegetation in the action area is limited because of development along the shoreline. As a result of the historical commercial and residential development of the subject property, only grasses and herbs occur along the landward side of the bulkhead, with the exception of native trees and shrubs at the east and west property boundary. This provides little vegetation overhanging the beach. Eelgrass fringe is documented along most of the southern side of Blakely Harbor, including continuous fringe at the proposed project site (Ecology 2019). There is also documented kelp (patchy fringe) along most of the northern shoreline of Blakely Harbor, and along a short length of the southern shoreline near Restoration Point, but not along the project shoreline.

2.4 Effects of the Action

Under the ESA, “effects of the action” means the direct and indirect effects of an action on the species or critical habitat, together with the effects of other activities that are interrelated or interdependent with that action, that will be added to the environmental baseline (50 CFR 402.02). Indirect effects are those that are caused by the proposed action and are later in time, but still are reasonably certain to occur. Interrelated actions are part of a larger action and depend on the larger action for their justification. There are no anticipated interrelated actions associated with the proposed action.

After the application of all minimization and conservation measures described in Section 1.0 of this document, the proposed action would still have some adverse effects that cannot be avoided, which we analyze here. Likely effects from the proposed action are associated with short-term construction impacts, and long-term impacts of the proposed structural changes.

Temporary effects associated with demolition and construction that are reasonably certain to occur include 1) localized water quality reduction from elevated levels of turbidity; and 2) localized benthic disturbance and forage reduction. Long-term effects of the project (50 years; estimated life of structure) are 1) degraded intertidal and nearshore habitat conditions caused by the shoreline stabilization structure (bulkhead); and 2) permanent (not time-limited) improved intertidal and nearshore habitat function from the removal of a section of existing bulkhead and restoration of the intertidal and riparian area. Effects of the proposed bulkhead structure are assessed in this biological opinion based on an expected life of the structure of 50 years. Therefore, we have not assessed effects of the proposed action beyond 50 years, and any activity (e.g., maintenance or repair) that extends the life of the structure beyond this is not included in our assessment of effects.

The only interrelated residential development in the upland portion of the site could potentially have nearshore water quality effects. The new house would create additional impervious surfaces, resulting in increased stormwater runoff. Proposed site designs would manage stormwater and minimize runoff to the shore and marine waters. The planting of native vegetation and the regrading of the upland areas to a more natural, undulating condition would create lower areas that would help trap and filter stormwater runoff. The location of the house outside of the 75-foot shoreline setback on the site would also reduce potential delivery of stormwater to the nearshore. Water is expected to infiltrate the groundwater or evaporate. Any excess water would be tight-lined to a dispersion system buried in drain rock behind the new rockery bulkhead where it would trickle through the rock onto the beach. Given the small amount of un-filtered stormwater runoff expected to reach the beach area, we expect only localized, extremely minor effects on water quality with no diminishment of the action area's conservation value for PS Chinook salmon, PS steelhead or PS/GB bocaccio.

2.4.1 Effects on Critical Habitat

The temporary and permanent effects would alter conditions of the shoreline, intertidal and nearshore environments within the action area. The construction-related effects and long-term effects of placement of the permanent structure (bulkhead) influence the condition of PBFs of designated critical habitat of PS Chinook salmon and PS/GB bocaccio.

For the project site, the extreme high tide (highest astronomical tide – the highest astronomical tide expected over the 19-year National Tidal Datum Epoch; HAT) at the Seattle tidal station (closest tidal station with HAT determination) is 13.26 feet, which is 1.9 feet above MHHW at this station. Accordingly, NMFS has assessed potential effects on designated critical habitat separate from the COE's choice of MHHW for asserting jurisdiction under the Clean Water Act. In this case, the bulkhead proposed for replacement and removal is located waterward of both MHHW and HAT.

The PBFs of critical habitat for PS Chinook salmon in the action area include:

- Estuarine areas free of obstruction and excessive predation with:
    - Water quality, water quantity, and salinity conditions supporting juvenile and adult physiological transitions between fresh- and saltwater;
    - Natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, side channels; and
    - Juvenile and adult forage, including aquatic invertebrates and fishes, supporting growth and maturation.

- Nearshore marine areas free of obstruction and excessive predation with:
    - Water quality and quantity conditions and forage, including aquatic invertebrates and fishes, supporting growth and maturation; and
    - Natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, and side channels.

The PBFs for PS/GB bocaccio critical habitat in the action area include:

- Juvenile settlement habitats located in the nearshore with substrates such as sand, rock and/or cobble compositions that also support kelp with the following attributes;
    - Quantity, quality, and availability of prey species to support individual growth, survival, reproduction, and feeding opportunities; and
    - Water quality and sufficient levels of dissolved oxygen to support growth, survival, reproduction, and feeding opportunities.

- Adult benthic habitat or sites deeper than 30 meters (98 feet) that possess or are adjacent to areas of complex bathymetry consisting of rock and/or highly rugose habitat with the following attributes:
    - Quantity, quality, and availability of prey species to support individual growth, survival, reproduction, and feeding opportunities;
    - Water quality and sufficient levels of dissolved oxygen to support growth, survival, reproduction, and feeding opportunities; and
    - The type and amount of structure and rugosity that supports feeding opportunities and predator avoidance.

Temporary Effects

Temporary, localized impacts to critical habitat of the proposed action may result from the removal of the existing structure and construction of the new bulkhead.

Water quality

The generation of suspended sediments is expected during the removal of the existing bulkhead and excavation for the replacement bulkhead, as well as by the movement of construction equipment on the beach. This would briefly reduce water quality, which is a PBF of PS Chinook salmon and PS/GB bocaccio critical habitat. Beach disturbance, another source of sediment, would be minimized by the proposed BMPs (e.g., working in the dry). By working only in the dry, during low tides, we expect only a small amount of turbidity load/slightly elevated levels of turbidity during tidal inundations of work areas during the project construction, and during the first high tide following project completion.

Project-related turbidity is expected to abate within a matter of hours during tidal inundations of the site due to rapid settling of sand and dispersal of finer sediments through the movement of water. Turbid conditions would be localized to the project area (within a 150-foot radius to account for the point of compliance for aquatic life turbidity criteria set forth in the Washington

State Water Quality Standards for marine waters; 173-201A-200 Washington Administrative Code).

The timing of in-water work would minimize exposure to juvenile PS/GB bocaccio rearing in the nearshore, and to juvenile PS Chinook salmon migrating through the nearshore, meaning the values for which the habitat is identified as critical will reestablish their baseline level of function before it is fully occupied. There is no adult PS/GB bocaccio critical habitat within the shallow intertidal area of expected project-related turbidity. For these reasons, we expect that this effect to the condition of water quality as a feature of PS Chinook salmon and PS/GB bocaccio critical habitat would not diminish the action area's conservation value for the species.

Benthic Disturbance and Forage Reduction

There is no documented Pacific herring or sand lance spawning adjacent to the project site, nor within the 150-foot turbidity mixing zone (WDFW 2019b), and therefore, no anticipated direct construction-related effects to spawning of these species would occur. Surf smelt spawning has been documented approximately 0.25 miles northwest of the site. Because substrate in portions of beach in the construction area appears to be suitable for spawning by surf smelt (sand and gravel), there is potential for this species to spawn here. However, by working within the in-water work window that minimizes co-occurrence with surf smelt spawning, or by conducting forage fish spawning survey and implementing avoidance measures outside of the window, would ensure that the proposed action does not impact active surf smelt spawning.

Benthic disturbance by the proposed bulkhead removal, beach excavation and heavy equipment could affect primary productivity in the action area. However, these impacts would be minimized by the relatively short-term construction period (2 months), and the confinement of activity to a narrow beach work corridor (25 feet). Additionally, the proposed beach nourishment with surf smelt and sand lance spawning-appropriate substrate (sand and gravel) would mitigate construction-related disturbance of spawning substrate waterward of the bulkhead. Therefore, any impact of proposed construction activities on forage fish or primary productivity are expected to have at most only a temporary, minor, and diminishing effect on forage potential as a PBF of PS Chinook salmon and PS/GB bocaccio critical habitat.

Permanent Effects

The proposed in-water (below HAT) structure (bulkhead) would have long-term adverse effects on the features and function of nearshore and intertidal habitat, including PS Chinook salmon and PS/GB bocaccio critical habitat. Effects of the replacement bulkhead on habitat function may include diminished sediment supply, diminished over-water (riparian) vegetation, diminished submerged aquatic vegetation, diminished prey availability, diminished aquatic habitat availability, diminished primary productivity (e.g., phytoplankton and zooplankton), diminished invertebrate colonization, and diminished forage fish populations (see Shipman et al. 2010, Dethier et al. 2016).

These impacts are reasonably certain to include adverse effects on the forage and cover PBFs of PS Chinook salmon critical habitat and the forage PBF of PS/GB bocaccio critical habitat. These effects would be long-term and are considered permanent, for the life of the structure. For this assessment we consider the life of the proposed bulkhead to be 50 years. The area of permanent effects to habitat includes the aquatic area (below HAT) adjacent to the proposed bulkhead, both perpendicular and parallel to the structure, to account for more localized effects like diminished riparian cover, and broader effects such as impacts to sediment supply and forage fish populations. As described below, we expect these effects to be localized to the intertidal and nearshore areas where adult PS/GB bocaccio critical habitat is not designated. Therefore we anticipate measureable effects of the proposed action only on juvenile PS/GB bocaccio critical habitat.

Benthic Conditions/Forage

Permanent reductions in forage may result from the effects of the proposed bulkhead on primary productivity and invertebrate abundance in the intertidal and nearshore environments. These provide an important food source for juvenile PS Chinook salmon and juvenile PS/GB bocaccio, as well as for forage fish prey species of PS Chinook salmon (Pacific herring, sand lance and surf smelt). The proposed replacement bulkhead is expected to result in a higher rate of beach erosion waterward of the armoring from increased wave energy from the reflection of waves (Holsman and Willig 2007; Dethier et al. 2016). This leads to beach lowering, coarsening of substrates, increases in sediment temperature, and decreased SAV, leading to reductions in primary productivity and invertebrate density within the intertidal and nearshore environment (Bilkovic and Roggero 2008; Fresh et al. 2011; Morley et al. 2012; Dethier et al. 2016). Because the proposed bulkhead would be located within the intertidal zone (below HAT), it would prevent natural upper intertidal shoreline processes, such as deposition and accumulation of beach wrack (Sobocinski et al. 2010; Dethier et al 2016), particularly when combined with increased wave energy. As a result, this would further reduce primary productivity within the intertidal zone and diminish invertebrate populations associated with beach wrack (Sobocinski et al. 2010; Morley et al. 2012; Dethier et al. 2016).

In addition to higher rates of beach erosion and substrate coarsening by increased wave energy, the bulkhead would also prevent input of sediment from landward of the bulkhead to the beach, further diminishing the supply of fine sediment. Finer material like gravel and sand provide important spawning substrate for sand lance and surf smelt, important prey species of PS Chinook salmon. Therefore, a reduction to this substrate type within the intertidal and nearshore zone as a result of the bulkhead would reduce the availability of potential spawning habitat and thus reduce the fecundity of both species (Rice 2006).

The project site is located within a left to right drift cell, meaning that sediment (sand and gravel) in the intertidal and nearshore adjacent to the project moves in a left (northwest) to right (southeast) direction. Because the proposed bulkhead would prevent deposition of sediment from landward of the bulkhead to the beach, it impacts the entire length of the drift cell from the project site to the southeast end of the cell (approximately 3000 feet of shoreline). We anticipate coarsening of substrate for this entire distance.

We anticipate slight reductions in forage fish abundance as a result of the degraded intertidal and nearshore habitat adjacent to the proposed bulkhead. The extent of the action area is broadly defined to account for the range of movement of fish that encounter the modified intertidal and nearshore habitat resulting from the proposed permanent structure (bulkhead) and restored shoreline. Although populations that encounter the bulkhead may be wide ranging in the PS, we anticipate no measureable impact to PS Chinook salmon, PS steelhead and PS/GB bocaccio forage potential (i.e. abundance) outside of the intertidal and nearshore areas adjacent to the impacted drift cell. Because effects of the bulkhead on individual forage fish would be localized to this area, there would be a very small effect to forage fish populations through decreased fitness of individual fish (e.g., from decreased primary productivity) and decrease spawning habitat availability, relative to the forage fish populations of the wider area (i.e. Blakely Harbor and southern and central PS). Beyond this area close to the impacted drift cell, within the broader action area, we anticipate no measureable effect on forage fish populations, nor a detectable effect on the forage potential of PS Chinook salmon, PS steelhead and PS/GB bocaccio.

Riparian Vegetation/Cover/Forage

The proposed replacement bulkhead would continue to result in the absence of riparian vegetation in some portions of the site (e.g., no vegetation on the proposed structures). Additionally, the bulkhead would increase the vertical distance between the riparian vegetation along the top of the bank and the beach or water surface during high tide cycles. Although the proposed riparian planting would help to minimize reductions in vegetation, the bulkhead would result in reduced riparian cover compared to natural shorelines in the action area. This would reduce shading and increase temperatures of shallow water in the upper intertidal, thereby elevating the risk of desiccation of invertebrates and reduction of intra-sediment moisture, which is important for intertidal invertebrate survival (Rice 2006; Holsman and Willig 2007). The reduced shading provided by riparian vegetation may also increase exposure of forage fish eggs to solar radiation and lead to increased rates of desiccation (see Rice 2006). This, combined with reduced input of detritus and terrestrial insects from riparian vegetation further reduces forage potential for juvenile PS Chinook salmon and juvenile PS/GB bocaccio (see Holsman and Willig 2007; Toft et al. 2007).

The PBF of suitable cover for critical habitat of PS Chinook salmon may also be impacted by the proposed bulkhead replacement. The suppression of riparian vegetation would reduce the recruitment source for large woody debris as in-water cover for fish, including Chinook salmon. Additionally, the quantity of driftwood on the beach, another potential source of cover for juvenile PS Chinook salmon, is also expected to be reduced in the long-term as a result of deepening of the upper intertidal and increased wave energy. As a result of deepening of the intertidal zone adjacent to the bulkhead, as well as increased wave energy, the replacement bulkhead would also be expected to reduce the establishment and growth of SAV waterward of the proposed bulkhead (see Patrick et al. 2014). This may cause a reduction to in-water cover for PS Chinook salmon.

The proposed bulkhead would cause a suite of permanent effects (50 years) on nearshore habitat function. Because of the expected reductions to the PBFs of cover and forage of PS Chinook salmon critical habitat and reductions to the forage PBF of juvenile PS/GB bocaccio in the action area, the proposed action is likely to adversely affect critical habitat for the life of the proposed structure. We expect these effects to be measurable for critical habitat adjacent to the proposed structure and within the drift-cell down-drift (southeast) of the site, but very small relative to total critical habitat for PS Chinook salmon and PS/GB bocaccio in the action area and the wider PS.

The proposed permanent removal of concrete groins and stairs from the intertidal and removal of approximately 169 feet of bulkhead would result in permanent improvements to intertidal and nearshore habitat quality, including cover and forage components of PBFs of PS Chinook salmon and PS/GB bocaccio critical habitat. It would also increase available aquatic habitat in the footprint of the existing structures. The proposed riparian planting for the entire shoreline, and restoration of the shoreline area of the proposed bulkhead removal would further enhance habitat quality.

In contrast to the effects of the proposed replacement bulkhead, along the shoreline adjacent to the proposed bulkhead removal and shoreline restoration areas, we expect increased cover resulting from increased riparian vegetation and drift wood accumulation. We also anticipate increased forage as a result of increased primary productivity and improved forage fish habitat quality associated with proposed sand and gravel placement, increased sediment transport to the beach and accumulation in the intertidal zone, increased riparian cover, and increased SAV.

2.4.2 Effects on Species

This effects analysis reviews anticipated habitat effects that would lead to changes in fish behavior, and habitat-modifications that would cause injury or death of individual PS Chinook salmon, PS steelhead and PS/GB bocaccio. Although conservation measures and BMPs are proposed that minimize exposure of ESA-listed species to impacts of the proposed action, they do not completely avoid fish exposure to construction effects. Further, exposure to the permanent effects, caused by the proposed structures and removal of other structures, would remain, and affect individuals of each fish species for the life of the project.

Likelihood of Exposure by Species and Lifestage

As noted above in the effects to critical habitat, the project has both temporary and permanent effects. The temporary effects, including turbidity, largely occur during the removal of the existing structures and the construction of the new structure. The presence of the proposed structure (bulkhead) is considered a permanent effect. Our exposure and response analysis identifies the multiple life-stages of listed species that use the action area, and whether they would encounter these effects, as different life-stages of a species may not be exposed to all effects, and when exposed, can respond in different ways to the same habitat perturbations.

Juvenile Salmonid Exposure

As described in Section 1.3 (Proposed Action), all in-water work would occur only between July 16 and February 15 in any year the permit is valid. PS Chinook salmon juveniles generally emigrate from freshwater natal areas to estuarine and nearshore habitats from January to April as fry, and from April through early July as larger sub-yearlings. However, juveniles have been found in PS neritic waters between April and November (Rice et al. 2011). Thus, juvenile Chinook may be present in the action area in low numbers during project construction.

Juvenile PS steelhead primarily emigrate from natal streams in April and May, and appear to move directly out into the ocean to rear, spending little time in the nearshore zone (Goetz et al. 2015). However, steelhead smolts have been found in low abundances in the marine nearshore, outside of their natal estuary, between May and August (Brennan 2004), which overlaps with the in-water work window. Juvenile steelhead may be exposed to construction effects in low numbers.

Because exposure cannot be fully excluded by in-water work timing for PS Chinook salmon and PS steelhead, we evaluate other factors influencing potential presence of these fish, and if present, the potential duration of their exposure. The likelihood of presence of juvenile PS Chinook salmon and PS steelhead in the action area is reduced by there being no natal streams in close proximity. The nearest known natal streams are over 6 miles away for both species (NOAA 2006; NOAA 2015a). Juvenile Chinook salmon are however, nearshore oriented (Fresh 2006) and thus, although numbers are expected to be low at any given time, individuals of this species are likely to encounter the intertidal and nearshore area where construction and permanent structure effects are anticipated. Because juvenile PS steelhead spend little time in the nearshore, and there is no natal spawning in Blakely Harbor, we expect few juvenile PS steelhead to be exposed to the construction-related effects (150-foot mixing zone for turbidity) and the duration of exposure to be brief.

Once constructed, the bulkhead is considered permanent (50 years), with any impacts occurring year-round. Any juvenile PS Chinook salmon or PS steelhead in the action area in the foreseeable future would experience the long-term habitat modifications and impacts associated with the proposed bulkhead. Because steelhead smolts are not nearshore-dependent, leave PS quickly, and are larger and more mobile than PS Chinook salmon, we expect limited exposure to the nearshore habitat effects of the proposed permanent structure. Because juvenile PS Chinook salmon rely more heavily on nearshore habitat, we expect greater exposure to the permanent habitat effects of the proposed structures.

Adult Salmonid Exposure

Adult PS Chinook salmon can reside in PS year-round, but usually inhabit water much deeper than the areas adjacent to where the proposed bulkhead would be located. The presence of adult PS Chinook salmon and PS steelhead overlaps with the proposed in-water construction window. Like adult PS Chinook salmon, adult PS steelhead occupy deep water, deeper than the location where the replacement bulkhead is proposed. Thus, we expect the direct habitat effects from the structures to be of little importance to adult PS Chinook salmon and PS steelhead as they do not rely on the nearshore.

PS/GB Bocaccio Exposure

Only larval and juvenile PS/GB bocaccio are expected to occur in the nearshore area of the action area where effects are anticipated. Rockfish fertilize their eggs internally and extrude the young as larvae (Love et al. 2002). Inflation of the swim bladder has been shown to generally occur within 48 hours after release, at which time larval rockfish may be carried by currents (McConnell Chaille 2006). Larval rockfish appear in the greatest numbers during the spring months (Moser and Boehlert 1991; Palsson et al. 2009). However, PS rockfish have been reported to extrude larvae as late as September (Beckmann et al. 1998). Rockfish larvae are typically found in the pelagic zone, often occupying the upper layers of open waters, under floating algae, detached seagrass, and kelp. Rockfish larvae are thought to be mostly distributed passively by currents (Love et al. 2002). Bocaccio larvae presence may overlap with the work window (July through March) so their exposure to construction effects is likely.

Juvenile bocaccio are known to settle onto rocky or cobble substrates in the shallow nearshore at 3 to 6 months of age in areas that support kelp and other aquatic vegetation, and then move to progressively deeper waters as they grow (Love et al. 1991; Love et al. 2002; Palsson et al. 2009). Juvenile bocaccio rockfish also recruit to sandy zones with eelgrass or drift algae (Love et al. 2002). Areas with suitable substrate, as well as eelgrass are documented in the action area, in the intertidal and nearshore area adjacent to the project site. Therefore, we consider juvenile bocaccio to likely to be present and exposed to both short-term construction-related effects and long-term effects of permanent structures. The number of larval and juvenile bocaccio is expected to be low in the action area because adults do not occur or spawn in the shallow-water habitat present in most of the action area, and immediately adjacent to the shoreline of the project area (depths less than 100 feet within 0.25 miles). Adult bocaccio prefer deeper water (critical habitat designated in areas over 98 feet deep) which is only present near the eastern-most edge of the action area, making it extremely unlikely that they would be exposed to any of the effects of the proposed action. With adult bocaccio unlikely to occur in most of the action area, and not in the nearshore area where project-related effects are expected, the number of larval and juvenile bocaccio is expected to also be low at any given time. Therefore, we expect only small numbers of larval and juvenile bocaccio to be exposed to effects of the proposed action.

Response to Temporary Effects

Water Quality

Bulkhead and other structure removal, excavation and construction would cause short-term and localized increases in turbidity and total suspended solids (TSS). The effects of suspended sediment on fish increase in severity with sediment concentration and exposure time and can progressively include behavioral avoidance and/or disorientation, physiological stress (e.g., coughing), gill abrasion, and death—at extremely high concentrations. Newcombe and Jensen (1996) analyzed numerous reports on documented fish responses to suspended sediment in streams and estuaries, and identified a scale of ill effects based on sediment concentration and duration of exposure, or dose. Exposure to concentrations of suspended sediments expected during the proposed in-water construction activities could elicit sublethal effects such as a short-term reduction in feeding rate or success, or minor physiological stress such as coughing or increased respiration. Studies show that salmonids have an ability to detect and distinguish turbidity and other water quality gradients (Quinn 2005; Simenstad 1988), and that larger juvenile salmonids are more tolerant to suspended sediment than smaller juveniles (Servizi and Martens 1991; Newcombe and Jensen 1996).

Juvenile PS steelhead are not expected to be in the shallow water in large numbers, and those present are expected to be only briefly in the area where elevated suspended sediment would occur (within a 150-foot radius to account for the point of compliance for aquatic life turbidity criteria). We accordingly consider their exposure to the temporary effects will not be sufficient to cause any injury or harmful response.

Juvenile PS Chinook salmon and juvenile PS/GB bocaccio are likely to be present during in-water construction activities and likely to be exposed to the temporary construction effects, most notably elevated levels of suspended sediment. The proposed minimization measures (i.e. only working in the dry) indicate that TSS levels will be only slightly elevated near the construction area and only during tidal inundations of the site during the project and during the first tidal inundation after completion of the project. Turbidity and TSS levels would return to background levels quickly and be localized to the in-water construction areas (150-foot radius turbidity mixing zone). Thus, duration and intensity of exposure among this species and this lifestage are also unlikely to cause injury or harmful response.

Benthic conditions/forage

The area in which benthic forage base is temporarily diminished by disturbed substrate is very small, and because benthic prey recruits from adjacent area via tides and currents, the prey base can re-establish in a matter of weeks. We expect only the cohorts of PS Chinook salmon, PS steelhead and PS/GB bocaccio that are present in the action area to be exposed to this reduction of prey, and we expect that because prey is abundant in close proximity, feeding, growth, development and fitness of the individuals that are present during this brief habitat disruption would not be affected. Therefore, we consider the temporary effects on any juvenile PS Chinook salmon, PS steelhead and PS/GB bocaccio in the action area to be unlikely to cause injury at the individual scale.

Response to Permanent Effects

The proposed bulkhead would cause negative impacts to intertidal and nearshore habitat availability and function. Once constructed, the bulkhead would be expected to remain for the life of the structure (50 years). Thus, PS Chinook salmon, PS steelhead and PS/GB bocaccio would experience the long-term habitat modifications associated with the presence of the bulkhead. As described in Section 2.4.1 (Effects on Critical Habitat), it is anticipated that within the area immediately adjacent to the proposed bulkhead and within the drift-cell down-drift of the site, the proposed action would result in decreased cover and forage for juvenile PS Chinook salmon, PS steelhead and PS/GB bocaccio. This would be expected to result in a decrease in individual fish survival from reduced forage, and increased predation associated with a decrease in available cover. Low quality habitat conditions (reduced cover and forage) in the shallow intertidal and nearshore areas may also cause fish to move to deeper water where they are at a greater risk of predation by larger predatory species (e.g., Willette 2001). Furthermore, any avoidance behavior translates to reduced habitat availability for salmonids and rockfish, particularly rearing juveniles, and may result in increased competition in other areas and reduced fitness and survival of individuals. Additionally, a decrease in shallow water habitat in the upper intertidal resulting from the bulkhead would expose juvenile fish in this area to increased predation by larger predatory species that occur in deeper water.

The reduction in prey base, cover and shallow water habitat associated with the proposed bulkhead would be localized to the adjacent intertidal and nearshore areas. Juvenile PS Chinook salmon are nearshore oriented, while juvenile PS steelhead tend to move directly out into deeper water to rear, spending little time in the nearshore zone. Therefore, we anticipate there to be little utilization of the affected area for rearing by PS steelhead, particularly with the closest natal stream to the proposed action being approximately 6.5 miles away. However, some limited rearing and passing through the area adjacent to the proposed bulkhead by PS steelhead is expected over the life of the structure. Although there are also no natal streams for PS Chinook salmon near the proposed action, nearshore-oriented juveniles may pass through or spend time rearing in the intertidal and nearshore area adjacent to the proposed bulkhead. Reductions in cover and shallow water habitat may reduce the ability of salmonids to avoid predation, and reduced forage may lead to decreased growth rates, fitness and survival. Therefore, we expect that effects to forage, cover and water depth for juvenile PS Chinook salmon and PS steelhead to culminate in a very small decrease in survival.

Adult PS Chinook salmon and PS steelhead can reside in PS year-round, but typically occur in waters deeper than those present in the shallow nearshore and intertidal areas adjacent to the proposed project areas where measurable long-term effects would occur. Thus, we expect the direct habitat effects from the proposed structures to have a negligible effect on adult PS Chinook salmon and steelhead. Expected local reductions in forage fish populations associated with the proposed bulkhead could result in decreased forage for adult PS Chinook salmon and PS steelhead. However, because effects to forage fish habitat would be localized to the areas adjacent to the project and drift cell, and adult Chinook salmon and steelhead are highly mobile, any decrease in forage is not expected to affect the survival of individual adult fish.

Larval and juvenile PS/GB bocaccio may be affected by permanent impacts of the proposed action. Larval PS/GB bocaccio may occur adjacent to the project site, but their numbers are expected to be low. The vast majority of the action area does not include deep water habitat where adult PS/GB bocaccio typically occur, particularly the nearshore areas where impacts to forage and cover are anticipated. Therefore, only low numbers of larval PS/GB bocaccio would be expected to be passively distributed by currents to the nearshore action area. However, juvenile PS/GB bocaccio may also occur in the action area, settling in rocky areas or in areas that support kelp or other aquatic vegetation. Therefore, reductions to cover, including SAV, resulting from impacts of the proposed shoreline armoring would be expected to impair predator avoidance abilities, and reductions to primary productivity and invertebrates (forage) would be expected to reduce fitness and survival of individual PS/GB bocaccio. Adult PS/GB bocaccio are not expected to be affected by impacts of the proposed action, as depths in the action area where impacts to cover and forage are anticipated are shallower (less than 100 feet) than where adults typically occur (deeper than 120 feet).

Bulkhead Removal

The proposed removal of approximately 169 feet of shoreline armoring (bulkhead) and shoreline restoration actions would be expected to result in long-term improvements to intertidal and nearshore habitat functions adjacent to the shoreline. This would be particularly beneficial for juvenile PS Chinook salmon and juvenile PS/GB bocaccio that rear in or migrate through this area, and to a lesser degree juvenile PS steelhead that may pass through the area. We expect this to result in improved cover and forage for juvenile PS Chinook salmon, PS steelhead and PS/GB bocaccio. This may also result in a very small increase in forage for adult PS Chinook salmon and PS steelhead. However, because effects to forage fish habitat would be localized to the shallow areas adjacent to the project, and adult PS Chinook salmon and PS steelhead are highly mobile, any increase in forage is not expected to affect the survival of individual adult fish. The removal of the bulkhead would also increase suitable shallow-water habitat and reduce the predation risk associated with juvenile fish moving to deeper water. Therefore, we expect the proposed removal of shoreline armoring to result in a slight increase in the fitness and survival of juveniles of these three species.

Effects on Population Viability

We assess the importance of effects in the action area to the Evolutionarily Significant Units (ESUs)/Distinct Population Segments (DPS) by examining the relevance of those effects to the characteristics of Viable Salmon Populations (VSPs). The characteristics of VSPs are sufficient abundance, population growth rate (productivity), spatial structure, and diversity. While these characteristics are described as unique components of population dynamics, each characteristic exerts significant influence on the others. For example, declining abundance can reduce spatial structure of a population when habitats are less varied diversity among the population declines. We expect a small, but measurable negative effect of the proposed bulkhead on the survival of juvenile PS Chinook salmon, PS steelhead and PS/GB bocaccio. Adult PS Chinook salmon and PS steelhead are only expected to occur in small numbers in the area adjacent to the proposed bulkhead and within the drift cell down-drift of the site (where measureable habitat effects are anticipated) and would be expected to avoid the resulting small, localized area of poor quality habitat associated with the proposed bulkhead. Adult PS/GB bocaccio do not occur in the shallow nearshore where effects of the proposed action are anticipated. Therefore, we expect no measurable effects of the proposed action on adult PS Chinook salmon, adult PS steelhead or adult PS/GB bocaccio survival.

Abundance

Long-term habitat changes caused by the proposed permanent structures are expected to result in an incremental increase in stress, a reduction in foraging success, impairment of predator avoidance (less cover) and avoidance of areas of reduced habitat quality for juvenile PS Chinook salmon, PS steelhead and PS/GB bocaccio. The impacts of the proposed bulkhead would predominantly apply to juvenile PS Chinook and juvenile PS/GB bocaccio since they migrate through and rear in the nearshore area, while juvenile PS steelhead are not nearshore-oriented. Effects to individual juvenile PS Chinook salmon, PS steelhead and PS/GB bocaccio would occur among an undetermined percentage of all future cohorts of all populations that use the action area. Any effects to juvenile PS steelhead would be limited to a very small number of individuals.

While we cannot accurately quantify these long-term structure-related effects, we believe them to be proportional to the relatively small size of affected habitat. The proposed bulkhead would armor 82 feet of shoreline, with associated effects to adjacent, waterward intertidal and nearshore critical habitat. We believe the impact to juvenile PS Chinook salmon, PS steelhead and PS/GB bocaccio, given the length of impacted shoreline relative to the total shoreline area in the general area (i.e. Blakely Harbor and central PS). Because no natal streams for ESA-listed PS Chinook or steelhead are in close proximity to the project site, and the action area is presumed to be occupied by individuals from any number of natal streams in the PS, we would expect any changes in the abundance to be spread across several populations.

In summary, we expect a continued suppression of habitat quality as a result of the new bulkhead. We anticipate that a small number of juvenile PS Chinook salmon and juvenile PS/GBO bocaccio, and a very small number of juvenile PS steelhead would have reduced survival as a result of the reduced habitat quality. We expect these decreases to be proportional to the relatively small amount of habitat affected. Because only a localized reduction in food supply and cover is expected, we anticipate no population-scale effects to these species.

Productivity

The proposed new bulkhead would incrementally degrade nearshore habitat conditions. In response to these habitat changes, we expect changes in behavior of juvenile PS Chinook salmon, PS steelhead and PS/GB bocaccio, including reduced foraging success and avoidance of areas with reduced cover. Avoidance of areas lacking suitable cover would reduce the overall habitat available to fish, in particular juvenile PS Chinook salmon that rely more heavily on nearshore habitat. All of these effects, independently or in combination, would likely lead to proportional decreases in individual fitness and survival. The long-term changes to the nearshore environment would be expected to exert a sustained downward pressure on nearshore habitat function in the PS and, proportionally to the relatively small amount of nearshore habitat affected, reduce the rearing and foraging capacity of a portion of the action area (primarily adjacent to the proposed 131-foot bulkhead). The habitat impacts from the proposed bulkhead would likely contribute to decreases in productivity of juvenile PS/GB bocaccio, and early marine life-history stages in PS Chinook salmon and PS steelhead.

Spatial structure

We do not expect the proposed project to affect the spatial structure of PS Chinook salmon ESU, the PS steelhead DPS or the PS/GB bocaccio DPS. There are no PS Chinook salmon or PS steelhead natal streams in the action area or in close proximity. Salmonid populations spread across the nearshore and mix when they enter PS (Fresh et al. 2006). Juvenile and larval PS/GB bocaccio in the action area would also be expected to come from the wider central Puget Sound. This one proposed action would be unlikely to disproportionately affect any one population of PS Chinook salmon, PS steelhead or PS/GB bocaccio.

Diversity

Salmonids have complex life histories and changes in the nearshore environment have a greater effect on specific life-history traits that make prolonged use of the nearshore. The proposed in-water construction would occur when most juvenile PS Chinook salmon and PS steelhead have moved away from the nearshore, utilizing deeper water. However, juvenile PS Chinook salmon and PS steelhead would be exposed to long-term impacts of the permanent structure (bulkhead) on habitat conditions. The impacts are expected to be greatest on juvenile PS Chinook salmon because they spend a longer period of time in nearshore environments (i.e. rearing). Juvenile PS/GB bocaccio also utilize nearshore areas in the PS, including the action area and would thus also be exposed to effects of the proposed bulkhead.

Over time, selective pressure on one component of a life-history strategy tends to eliminate that divergent element from the population, reducing diversity in successive generations and the ability of the population to adapt to new environmental changes (McElhany et al. 2000). Any specific populations that experience increased mortality or survival from the proposed action would have their life-history strategy selected against or for, respectively. The long-term effects of the proposed permanent structure (bulkhead) would likely result in a slight, proportional to the limited habitat alteration, decline in PS Chinook salmon and PS/GB bocaccio diversity by differentially affecting specific populations that encounter the armored shoreline and impacted drift cell within the action area with greater frequency during juvenile life stanges. We are unable to determine which specific populations of PS Chinook salmon or PS/GB bocaccio most frequently use resources within the action area. Because of limited use of the nearshore by PS steelhead, we do not anticipate any effects that would result in a reduction in diversity of the DPS.

2.5 Cumulative Effects

"Cumulative effects" are those effects of future state or private activities, not involving Federal activities, that are reasonably certain to occur within the action area of the Federal action subject to consultation (50 CFR 402.02). Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the ESA.

The action area is influenced by actions in the nearshore, along the shoreline, and also in tributary watersheds of which effects extend into the action area. Actions in the nearshore and along the shoreline of the action area are mainly residential development, shoreline modifications and road construction. Some future development and maintenance activities will occur without a Federal nexus, including residential construction and even shoreline stabilization if it occurs above the ordinary high water mark (OHWM; interpreted by the Seattle District COE as their line of federal jurisdiction under the Clean Water Act). However, activities that occur waterward of the OHWM require a Corps permit and future ESA consultation, and these are excluded from cumulative effects as they will be evaluated in future ESA Section 7 consultations.

The non-federal actions in the nearshore as well as in tributary watersheds will cause long-lasting environmental changes and will continue to harm ESA-listed species and their critical habitats. Especially relevant effects include the loss or degradation of nearshore habitats and pocket estuaries. We consider human population growth to be the main driver for most of the future negative effects on salmon and steelhead and their habitat.

Similarly, additional future private and public development actions are very likely to continue in the action area, which will affect aquatic habitat conditions. The populations of the 12 counties around Puget Sound increased from 1.29 million people in 1950 to roughly 4.22 million people in 2005 (Quinn 2010). Future private and public development actions are very likely to continue in and around the Puget Sound. Between 2010 and 2014, Washington's population is expected to grow by about 2,375,500 people, reaching 9,100,100 in 2040 (OFM 2017). As the human population continues to grow, demand for agricultural, commercial, and residential development and supporting public infrastructure is also likely to grow. We believe the majority of environmental effects related to future growth will be linked to these activities, in particular land clearing, associated land-use changes (i.e., from forest to impervious, lawn or pasture), increased impervious surface, and related contributions of contaminants to area waters. Land use changes and development of the built environment that are detrimental to salmonid habitats are likely to continue under existing regulations. Though the existing regulations could decrease potential adverse effects on salmon habitat, as currently constructed and implemented, they still will allow substantial degradation to occur. Over time, the incremental degradation, when added to the already degraded environmental baseline, will likely result in reduced habitat quality for at-risk PS Chinook salmon and steelhead.

As the human population continues to grow, demand for agricultural, commercial and residential development, and supporting public infrastructure is also likely to grow. We believe the majority of environmental effects related to future growth will be linked to these activities. In particular, we anticipate major impacts from land clearing and associated land-use changes (i.e., from forest to impervious, lawn or pasture), and increased impervious surfaces and inputs of contaminants to PS and tributary waters. Land use changes and development of the built environment that are detrimental to salmonid habitats are likely to continue under existing regulations. Though the existing regulations could decrease potential adverse effects on salmon habitat, as currently constructed and implemented, they allow substantial degradation to occur. Over time, the incremental degradation, when added to the already degraded environmental baseline, will likely result in reduced habitat quality for at-risk salmon, steelhead and rockfish.

Of particular relevance to this proposed action and effects of other development in the action area are the impacts of shoreline armoring not regulated by Federal agencies. For example, WDFW permitting data found bank armoring projects resulted in 2.04 miles of new armoring, 7.99 miles of replacement armoring and 1.71 miles of removed armoring between 2012 and 2015 (Dionne et al. 2015). Many of the projects were not reviewed by the Army Corp of Engineers because they were above the MHHW mark and the Corp did not assert jurisdiction up to HAT. The adverse effects of shoreline armoring on intertidal and nearshore habitat are well documented (see Shipman et al. 2010; Dethier et al. 2016), and the cumulative effects of continued armoring of shorelines throughout the action area and wider PS are expected to have significant impacts on ESA-listed species (see COE 2014; Dethier et al. 2016).

In addition to these growth-related habitat changes, climate change has become an increasing driver for infrastructure development and changes to protect against sea level rise in coastal areas, such as large sea walls to protect coastal cities (e.g., Marshall 2014). Regardless of the environmental effects, the cost of flooding has been predicted to be higher than the cost of building such sea walls (Lehmann 2014), which increases the likelihood of more flood protection projects coming to PS in the future. These flood protection projects will likely include filling of shorelines and floodplains, dikes, revetments, flood gates, pump stations and sea walls. As discussed in Section 2.4.1, as sea level rises, the elevation of the intertidal zone will also rise, and where shoreline armoring prevents beach formation at these higher elevations, the area of intertidal habitat will be reduced. Thus, all of these habitat modifications will be detrimental to aquatic habitat availability and function.

In June 2005, the Shared Strategy Development Committee presented its recovery plan for PS salmon to NOAA Fisheries, which adopted and expanded the salmon recovery plans to meet its obligations under the ESA. Together, the joint plans comprise the 2007 Puget Sound Salmon Recovery Plan (SSDC 2007). Several not-for-profit organizations and State and Federal agencies are implementing recovery actions identified in these recovery plans. Notwithstanding the beneficial effects of ongoing habitat restoration actions, the cumulative effects associated with continued development are likely to have ongoing adverse effects on PS Chinook salmon, PS steelhead and PS/GB bocaccio population abundance and productivity. Only improved low-impact development actions in combination with restoration actions, watershed planning and recovery plan implementation would address growth-related impacts into the future. To the extent that non-Federal recovery actions are implemented and offset impacts of on-going development actions, adverse cumulative effects may be minimized, but will probably not be completely avoided.

2.6 Integration and Synthesis

The Integration and Synthesis section is the final step in our assessment of the risk posed to species and critical habitat as a result of implementing the proposed action. In this section, we add the effects of the action (Section 2.4) to the environmental baseline (Section 2.3) and the cumulative effects (Section 2.5), 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) reduce the value of designated or proposed critical habitat for the conservation of the species.

PS Chinook salmon and PS steelhead are listed as threatened, based on their overall reductions in abundance, diversity and spatial structure, and current limits to their productivity. For salmonids, shoreline conditions are a factor among many habitat conditions that are limiting productivity. All 19 nearshore marine zones (zones occupied by PS Chinook salmon; from extreme high water to a depth of 30 meter) are considered to have high conservation value (i.e. limiting factors throughout) (NMFS 2005, Appendix A). Nevertheless, conditions in the environmental baseline in the action area and systemically throughout PS presently restrict carrying capacity, meaning that productivity cannot appreciably increase because the habitat will not support significantly higher numbers of fish. Conditions in the action area are similar.

PS/GB bocaccio are listed as endangered based on abundance, productivity and spatial structure. Though bocaccio were never a predominant segment of the multi-species rockfish population within the PS/GB, their present-day abundance is likely a fraction of their pre-contemporary fishery abundance. Limiting factors identified for PS/GB bocaccio include over-harvest, water pollution, climate-induced changes to rockfish habitat and small population dynamics. Existing habitat threats include degradation of rocky habitat, loss of eelgrass and kelp, introduction of non-native species that modify habitat, and degradation of water quality as specific threats to rockfish habitat in the PS/GB

To this degraded baseline, we add the effects of the proposed action. As a general matter, although an individual action in isolation may only impose small or localized impacts on the affected populations, when considered with the baseline and cumulative effects of watershed modifications, it may be identified as contributing to, or likely to perpetuate, broader suppressed population dynamics (Williams and Thom 2001). Any land or water management action that changes habitat conditions beyond the tolerance of the species results in reduced survival and abundance of the species. In some cases, the range of tolerance for some species is quite narrow and relatively small changes in habitat can have large effects on species survival (e.g., UCSRB 2007).

The temporary effects are additive among only individuals and cohorts of the species that are exposed during construction. The permanent effects, because the propose action is a replacement of an existing structure, is also additive, but not in terms of exposure of fish to more degraded habitat. Rather it is additive in the number of individuals and cohorts that would be exposed to the same degraded habitat for an additional period of an estimated 50 years, as the replacement ensures the habitat impacts would persist for the bulkhead's design life. Thus, continued presence of the structure in the rearing area of already high-risk species would extend the level of risk among PS Chinook salmon, PS steelhead and PS/GB bocaccio.

Because only a small number of fish relative to the affected populations would be killed or injured by the construction effects, and the project's permanent effects perpetuate, but do not aggravate the constraint in carrying capacity, the effects on productivity, diversity and spatial structure are not expected to be discernible, and therefore unlikely to alter the current trends for PS Chinook salmon, PS steelhead or PS/GB bocaccio population viability. In other words, we expect that the total effects of the proposed action on individual fish identified in this opinion would be indiscernible at the population level. Additionally, PS Chinook salmon, PS steelhead and PS/GB bocaccio, although currently well below historic levels, are distributed widely enough and are presently at high enough abundance levels that any adverse effects resulting from the proposed action would not have an observable effect on their spatial structure, productivity, abundance and diversity. Therefore, when considered in light of existing risk, baseline effects and cumulative effects, the proposed action itself does not increase risk to the affected populations to a level that would reduce appreciably the likelihood for survival of PS Chinook salmon, PS steelhead and PS/GB bocaccio.

When considering critical habitat, the action's adverse effects are predominantly long-term effects, and these must be added to the baseline as well. The status of critical habitat at the designation scale varies, with much of the habitat degraded by human activities. In the action area, habitat quality is degraded as well, with some characteristics of habitat functioning properly and some not. Even when potential impacts of climate change (e.g., changes in water temperature, acidity, sea level and biotic elements of the ecosystem) are added to the effects of the action (permanent degradation of shallow water habitat conditions), the scale of impact is very small relative to the designated intertidal and nearshore areas.

Long-term effects also include intertidal habitat improvements where the bulkhead and groins are proposed for removal and natural shoreline conditions restored. This would provide an unquantifiable increment of benefit that improves conservation potential of habitat and slightly reduces constraints on carrying capacity. Given the small scale of adverse effects and the small size of the affected critical habitat relative to total critical habitat of PS Chinook salmon and PS/GB bocaccio, combined with the beneficial effects of the proposed action, we consider that the effects of the action would not impair the conservation value of PS critical habitat when added to the environmental baseline and anticipated cumulative effects.

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, any effects of interrelated and interdependent activities, and cumulative effects, it is NMFS' biological opinion that the proposed action is not likely to jeopardize the continued existence of PS Chinook salmon, PS steelhead or PS/GB bocaccio, nor destroy or adversely modify the designated critical habitat for PS Chinook salmon or PS/GB bocaccio.

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). "Incidental take" is defined by regulation as takings that result from, but are not the purpose of, carrying out an otherwise lawful activity conducted by the Federal agency or applicant (50 CFR 402.02). Section 7(b)(4) and section 7(o)(2) provide that taking that is incidental to an otherwise lawful agency action is not considered to be prohibited taking under the ESA if that action is performed in compliance with the terms and conditions of this incidental take statement.

2.8.1 Amount or Extent of Take

In the biological opinion, NMFS determined that incidental take would occur because individual PS Chinook salmon, PS steelhead and PS/GB bocaccio would be present in, and co-occur with, the effects of the action. Take would occur among a small number of all future cohorts from the specified populations of PS Chinook salmon, PS steelhead and PS/GB bocaccio in the form of: (1) Harm where permanent (50 year) habitat modification (bulkhead) reduces individual fitness and survival through reduced food supply among a small number of all future cohorts from specified populations of PS Chinook salmon, PS steelhead and PS/GB bocaccio; and (2) death resulting from increased predation risk from reduced shallow water habitat and cover associated with the permanent habitat modification.

This form of incidental take - harm (injury or death resulting from habitat effects) - cannot be accurately quantified as a number of fish. The distribution and abundance of fish within the action area cannot be predicted over time because of temporal and dynamic variability in population dynamics in the action area. Neither can NMFS precisely predict the range of responses among the fish that would experience adverse habitat modifications caused by from the proposed action. When NMFS cannot quantify take in numbers of affected animals, we instead consider likely extent of changes in habitat quantity and quality to indicate the extent of take.

For this consultation, the best available indicator for the extent of take from decreased habitat function caused by the proposed bulkhead is the spatial extent of impacts to water depth, cover and forage for PS Chinook salmon, PS steelhead and PS/GB bocaccio. The spatial extent of impacts that could result in take is calculated as the shoreline area (intertidal and nearshore) along the length of the proposed bulkhead (131 feet). This surrogate for take is causally related to and representative of take resulting from the proposed bulkhead, as impacts to intertidal and nearshore habitat function are directly proportional to the length of shoreline armoring. This is because the amount of habitat impact increases in a linear manner as the length of the bulkhead increases along the area just landward of the shoreline.

The extent of take can be easily monitored and verified. The extent of take will be exceeded if the total length of the bulkhead is more than 131 feet long. The COE has authority to conduct compliance inspections and to take actions to address non-compliance, including post-construction (33 CFR 326.4).

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 PS Chinook salmon, PS steelhead and PS/GB bocaccio, or destruction or adverse modification of PS Chinook salmon and PS/GB bocaccio critical habitat.

2.8.3 Reasonable and Prudent Measures

"Reasonable and prudent measures" (RPMs) are nondiscretionary measures that are necessary or appropriate to minimize the impact of the amount or extent of incidental take (50 CFR 402.02). NMFS believes that the full application of the reasonable and prudent measures described below is necessary and appropriate to minimize the likelihood of incidental take of ESA-listed species, the COE or its applicant shall:

1. Minimize construction-related and permanent structure effects on intertidal and nearshore habitat function; and
2. Provide NMFS with a monitoring report to confirm that the minimization measures are implemented and incidental take surrogates are not exceeded.

2.8.4 Terms and Conditions

The terms and conditions (T&Cs) described below are non-discretionary, and the COE or any applicant must comply with them in order to implement the RPMs (50 CFR 402.14). The COE or any applicant has a continuing duty to monitor the impacts of incidental take and must report the progress of the action and its impact on the species as specified in this incidental take statement (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 RPM number 1:

   a. To minimize effects of the proposed action on reduced intertidal vegetation over the life of the proposed structure, following completion of the proposed action, the applicant shall take no actions that prevent the establishment of or disturbs native intertidal vegetation waterward of the completed replacement bulkhead for the life of the structure. The intertidal area shall be kept clear of materials that could limit the establishment and growth of vegetation (e.g., overwater structures or storage of boats and other materials that cause shading). There shall be no excavation of beach substrate.

2. The following terms and conditions implement RPM number 2:

   a. To ensure the project was built as proposed, the COE shall require the applicant to submit before and after photos of the project (i.e. the bulkhead and shoreline restoration/bulkhead removal area) to NMFS (projectreports.wcr@noaa.gov and jeff.vanderpham@noaa.gov), including all construction areas, within 4 weeks of the close of construction.

   b. The COE shall require the applicant to report to NMFS within 4 weeks of the close of construction:
      i. The length of the bulkhead; and
      ii. The elevation of the replacement bulkhead footing.

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 (CR) 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).

NMFS recommends that the following actions be implemented by the COE to reduce the potential for adverse effects of new bulkhead construction, or repair or replacement of an existing bulkhead, on ESA listed species and critical habitat, and EFH.

1. Where possible, bulkheads should be located above HAT. For all new bulkheads, and bulkhead repair or replacement projects, the feasibility of locating the bulkhead and related

footings above HAT should be fully assessed. The necessity of the bulkhead should also be determined. This feasibility assessment should be included in any necessary ESA Section 7 consultation initiation package submitted to NMFS.

2. Where a bulkhead is determined to be necessary and locating the bulkhead above HAT is determined to not be feasible, we recommend that the most appropriate, site specific method be used to minimize impacts to the nearshore zone. We believe an important source of available scientific information for options of soft-shore armoring is the Washington Department of Fish and Wildlife's Marine Shoreline Design Guidelines (Johannessen et al. 2014; available at: http://wdfw.wa.gov/publications/01583/). The feasibility of soft-shore armoring options should be fully assessed for each site and this assessment should also be provided to NMFS in the ESA consultation initiation package. The decision process for the selected shoreline armoring/stabilization method, per the above guidelines, should be fully documented.

3. For all proposals to construct, repair or replace shoreline armoring/stabilization structures, we recommend that appropriate mitigation be implemented to avoid, minimize or offset all potential adverse effects of the project. These effects include both short-term construction related effects and long-term effects related to permanent structures. On-site mitigation options are preferred, but off-site/compensatory mitigation options may be appropriate if suitable opportunities for on-site mitigation are not feasible. Off-site mitigation programs should be designed to provide similar ecosystem functions to the same species and populations affected by the project. All mitigation/off-setting plans should be included in the project proposal, as part of the ESA consultation initiation package. Examples of mitigation options (on-site or off-site) that may be incorporated into the project include (this is not an exhaustive list):

   - Riparian planting with native trees and shrubs adjacent to the entire impacted shore zone to mimic natural conditions. This should include an appropriate long-term monitoring and maintenance/replanting plan;

   - Beach nourishment with substrate appropriate to forage fish that may potentially spawn on the beach. Beach nourishment should be provided in perpetuity, with a monitoring and replenishment plan; and

   - Removal of artificial structures or man-made debris (e.g., pilings, concrete debris, adjacent bulkheads, etc.) from the nearshore.

We recommend that the COE provide these recommendations to applicants of COE permits (Rivers and Harbors Act, Section 10; Clean Water Act, Section 404) for shoreline armoring projects. We further recommend that the COE use its existing authority under 33 CFR Part 332 to request mitigation and compensatory mitigation for unavoidable impacts to aquatic habitats, including critical habitat, associated with placement and replacement of shoreline armoring.

2.10 Reinitiation of Consultation

This concludes formal consultation for the WCR-2018-1104 Marks and Maione Shoreline Restoration and Bulkhead Replacement Project. As 50 CFR 402.16 states, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been retained or is authorized by law and if: (1) The amount or extent of incidental taking specified in the incidental take statement is exceeded, (2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion, (3) the agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat that was not considered in this opinion, or (4) a new species is listed or critical habitat designated that may be affected by the action.

2.11 Species and Critical Habitat Not Likely to be Adversely Affected

The COE determined the action may affect and is 'not likely to adversely' (NLAA) affect Puget Sound (PS) Chinook and their critical habitat, PS steelhead, Puget Sound/Georgia Basin (PS/GB) bocaccio and their critical habitat, PS/Georgia Basin (PS/GB) yelloweye rockfish and their critical habitat, southern resident (SR) killer whale and their critical habitat, and humpback whale. Our concurrence with these NLAA determinations is detailed below.

2.11.1 PS/GB Yelloweye Rockfish

Yelloweye rockfish are most frequently observed in waters deeper than 30 meters (98 feet), the approximate upper depth range of adults (Yamanaka et al. 2006), and prefer rocky habitats. Deepwater habitats favored by adult rockfish also include extreme slopes of unconsolidated substrates, or sand, shell, and cobble fields often located in the periphery of rocky outcroppings (Palsson et al. 2009). This preferred habitat is absent from the shallow nearshore area where short-term and long-term effects of the proposed action are expected. Because of their depth preference, it is extremely unlikely that PS/GB yelloweye rockfish would be exposed to any of the intertidal and nearshore habitat effects of the proposed action. Effects among this listed fish are discountable.

Deeper areas on the outer, eastern edge of the action area include critical habitat for PS/GB yelloweye rockfish. Critical habitat for adult and juvenile PS/GB yelloweye rockfish includes benthic habitat or sites deeper than 30 meters (98 feet) that possess or are adjacent to areas of complex bathymetry consisting of rock and/or highly rugose habitat with PBFs including: (1) quantity, quality, and availability of prey species to support individual growth, survival, reproduction, and feeding opportunities; (2) water quality and sufficient levels of dissolved oxygen to support growth, survival, reproduction, and feeding opportunities; and (3) the type and amount of structure and rugosity that supports feeding opportunities and predator avoidance. Effects of the proposed action in these deeper areas with designated critical habitat are anticipated to only include effects on forage fish populations, with no effects to the water quality or habitat structures PBFs. We expect any effect to the forage PBF of critical habitat to be extremely small due to the broad input of forage items at the outer edge of the Harbor (where designated critical habitat is present), and because of the diverse diet of the species (Palsson et al. 2009). All other project impacts would be localized, with any measureable effects limited to habitat where juvenile and adult yelloweye-rockfish do not occur. Therefore, we anticipate insignificant effects on designated critical habitat both life stages.

Rockfish larvae are distributed passively by currents (Love et al. 2002), and could be carried to the degraded habitat associated with the proposed action. Rockfish larvae are typically found in the pelagic zone, often occupying the upper layers of open waters, under floating algae, detached seagrass, and kelp. With deep water areas (over 98 feet) limited to the outer edge of the Blakely Harbor and beyond, the number of larval yelloweye rockfish carried to the intertidal and nearshore area adjacent to the proposed permanent structures and down-drift portion of the drift cell is expected to be low. We expect insignificant impacts to individual fish that may be carried through the area due to only a short duration of exposure to construction-related effects and effects of permanent structures. Furthermore, turbidity levels during in-water construction would not rise to a level to have a significant effect on larval PS/GB yelloweye rockfish. Additionally, although small fish, such as forage fish species (sand lance, surf smelt and Pacific herring) that may be effected by the proposed action, are potential prey of adult yelloweye rockfish, they are not preyed upon by larvae or juveniles (prey items include plankton, copepods, etc.) (Palsson et al. 2009). Therefore, NMFS finds that the proposed action may affect, but is not likely to adversely affect PS/GB yelloweye rockfish and their designated critical habitat.

2.11.2 Southern Resident Killer Whales

SR killer whales may pass through the action area. According to killer whale sighting information from The Whale Museum (2018) between 1990 and 2013, this species was observed 0 to 43 times a month within or near to the action area (documented within sighting quadrant that includes Blakely Harbor) during the proposed work window (July through February). Therefore, their occurrence is common and is likely to coincide with in-water construction activities. SR killer whale would also encounter the long-term (50 years) nearshore habitat effects of the proposed bulkhead.

Nearshore areas of the action area are designated critical habitat for SR killer whales (where depth is 20 feet or more relative to extreme high water). The PBFs for SR killer whale critical habitat are: (1) Water quality to support growth and development; (2) prey species of sufficient quantity, quality, and availability to support individual growth, reproduction and development, as well as overall population growth; and (3) passage conditions to allow for migration, resting, and foraging.

The proposed action would have short-term construction-related effects on water quality through elevated levels of suspended sediment. The project-related turbidity is expected to abate within a matter of hours, and the area in which sediment creates turbid conditions would be highly localized. Most of the turbidity would be contained to the intertidal area adjacent to the bulkhead (within 150 feet of construction area) with water depths of less than 5 feet (relative to MLLW) where killer whales do not occur. For these reasons, we expect that this effect would be insignificant to the condition of water quality as a feature of SR killer whale critical habitat. With turbidity impacts contained within the shallow intertidal and nearshore, an area that SR killer whale do not migrate through, we anticipate insignificant effects on passage conditions.

The short-term turbidity effect would also not be meaningful in terms of prey for SR killer whale. The project would have a small long-term negative effect on the PBF for prey species, with minor reductions in quantity resulting from long-term habitat effect associated with the proposed bulkhead. Harm to mainly juvenile PS Chinook salmon would likely result from long-term effects of the proposed structure on the marine nearshore environment. While we cannot quantify the maximum number of juveniles that likely would be harmed, we believe their number to be extremely small. Thus, any take of salmonids (i.e. PS Chinook salmon and PS steelhead) would result in an insignificant reduction in prey resources for SR killer whales. Therefore, NMFS finds that the proposed action may affect, but is not likely to adversely affect SR killer whales and their designated critical habitat.

2.11.3 Humpback Whales

There are at least two separate ESA-listed DPSs of humpback whales that may occur in the action area, the Central American DPS and Mexico DPS. Since 2000, humpback whales have been sighted with increasing frequency in the inside waters of Washington (Falcone et al. 2005). Humpback whales are most commonly sighted in the PS between May and August (Orca Network 2019), which coincides with the proposed in-water work window. Although humpback may pass through the action are during construction, the likelihood for exposure to construction-related impacts (turbidity) is discountable because humpback whale are extremely unlikely to occur within the shallow waters present in the area with elevated levels of turbidity (i.e. 150-foot mixing zone). Furthermore, anticipated long-term impacts to primary productivity, invertebrates and forage fish, all of which are potential prey of humpbacks, are localized to the intertidal and nearshore areas adjacent to the bulkhead where humpbacks are unlikely to occur. Therefore, we consider both short-term and long-term projects impacts to have a discountable effect on humpback whales.

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

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

This analysis is based, in part, on the EFH assessment provided by the COE and descriptions of EFH for Pacific Coast groundfish (PFMC 2005), coastal pelagic species (PFMC 1998) and

Pacific Coast salmon (PFMC 2014) contained in the fishery management plans developed by the Pacific Fishery Management Council and approved by the Secretary of Commerce.

3.1 Essential Fish Habitat Affected by the Project

The environmental effects of the proposed project may adversely affect EFH for Pacific Coast salmon and Pacific Coast groundfish EFH, both of which are present in the action area. The central PS, including the action area, also contains Habitat Area of Particular Concern (HAPC) for Pacific Coast salmon and Pacific Coast groundfish. Impacts to EFH include reductions in SAV density, prey abundance, productivity, and in-water and over-water cover in the areas adjacent to the proposed bulkhead and the down-drift portions of the drift cell.

3.2 Adverse Effects on Essential Fish Habitat (EFH)

The effects of the proposed project on salmonids (PS Chinook salmon and PS steelhead) and rockfish (PS/GB bocaccio) are described in Section 2.4, above. The same mechanisms of effect are likely to affect EFH of Pacific Coast salmon and Pacific Coast groundfish to varying degrees. These adverse effects are associated with impacts of the permanent (50-year) bulkhead on intertidal and nearshore habitat. They include:

1. Reductions to riparian vegetation and SAV and resulting decreases in primary productivity, forage, and overhead and in-water cover; and
2. Reductions to sediment input to the beach and increased wave energy, resulting in a reduction in shallow-water habitat, substrate coarsening and decreased forage

3.3 Essential Fish Habitat Conservation Recommendations

Fully implementing these EFH Conservation Recommendations (CRs) would protect, by avoiding or minimizing the adverse effects described in Section 3.2, above, on designated EHF for Pacific coast salmon in the area waterward of the entire length of the replacement bulkhead (131 feet):

1. To minimize overall negative effects of shoreline armoring on intertidal and nearshore habitat, including Pacific Coast salmon and Pacific Coast groundfish EFH, the replacement bulkhead should be designed and located in the least impacting way possible. We recommend that the necessity of the bulkhead to protect residential structures be assessed and, if necessary, the feasibility of locating the bulkhead and related footings landward (e.g., above HAT) also be assessed. If the bulkhead is determined to be necessary and locating the bulkhead landward is determined to not be feasible, we recommend that the most appropriate, site specific method be used to minimize impacts to the intertidal and nearshore zone. We believe an important source of available scientific information for options of soft-shore armoring is the Washington Department of Fish and Wildlife's Marine Shoreline Design Guidelines (Johannessen et al. 2014; available at: http://wdfw.wa.gov/publications/01583/). The feasibility of soft-shore armoring options should be fully assessed for the site. The decision process for the

selected shoreline armoring/stabilization method, per the above guidelines, should be fully documented.

2. To minimize effects of the proposed action on reduced intertidal vegetation over the life of the proposed structure, no action should be taken that disturbs or removes native intertidal vegetation waterward of the proposed bulkhead or along the restored portion of shoreline. The intertidal area should be kept clear of materials that could limit the establishment and growth of vegetation (e.g., storage of boats or other materials that cause shading). There should be no excavation of beach substrate.

3. To minimize effects of the bulkhead on sediment transport and substrate coarseness, we recommend that beach nourishment with substrate appropriate to forage fish that may potentially spawn on the beach be provided in perpetuity, maintained with a monitoring and replenishment plan.

3.4 Statutory Response Requirement

As required by section 305(b)(4)(B) of the MSA, the COE must provide a detailed response in writing to NMFS within 30 days after receiving an EFH CRs. 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 CRs unless NMFS and the Federal agency have agreed to use alternative time frames for the Federal agency response. The response must include a description of measures proposed by the agency for avoiding, mitigating, or offsetting the impact of the activity on EFH. In the case of a response that is inconsistent with the CRs, the Federal agency must explain its reasons for not following the recommendations, including the scientific justification for any disagreements with NMFS over the anticipated effects of the action and the measures needed to avoid, minimize, mitigate, or offset such effects (50 CFR 600.920(k)(1)).

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

3.5 Supplemental Consultation

The COE must reinitiate EFH consultation with NMFS if the proposed action is substantially revised in a way that may adversely affect EFH, or if new information becomes available that affects the basis for NMFS' EFH CRs (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 users of this opinion are the U.S. Army Corps of Engineers and its applicant(s). Other interested users could include: shoreline stabilization/armoring applicants and their agents, affected tribes, industry, municipalities and county jurisdictions, recreational boaters and fishers. Individual copies of this opinion were provided to the COE. The format and naming adheres to conventional standards for style.

4.2 Integrity

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

4.3 Objectivity

Information Product Category:

Natural Resource Plan

Standards:

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

Best Available Information:

This consultation and supporting documents use the best available information, as referenced in the References section. The analyses in this opinion and EFH consultation contain more background on information sources and quality.

Referencing:

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

Review Process:

This consultation was drafted by NMFS staff with training in ESA and MSA implementation, and reviewed in accordance with West Coast Region ESA quality control and assurance processes.

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