UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
West Coast Region
1201 NE Lloyd Boulevard, Suite 1100
PORTLAND, OR 97232-1274

Refer to NMFS No:
WCRO-2022-00335

May 15, 2023

Kristine Gilson
United States Maritime Administration (MARAD)
Senior Environmental Specialist
505 S. 336th St.
Federal Way, WA 98422

Re: Endangered Species Act Section 7(a)(2) Biological Opinion and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Response for the Port of Bellingham Marine Infrastructure Maintenance and Rehabilitation, Bellingham, Washington

Dear Ms. Gilson,

Thank you for your letter on February 17, 2022, requesting initiation of consultation with NOAA's National Marine Fisheries Service (NMFS) pursuant to section 7 of the Endangered Species Act of 1973 (ESA) (16 U.S.C. 1531 et seq.) for the Port of Bellingham Marine Infrastructure Maintenance and Rehabilitation project. Thank you, also, for your request for consultation pursuant to the essential fish habitat (EFH) provisions in Section 305(b) of the Magnuson–Stevens Fishery Conservation and Management Act [16 U.S.C. 1855(b)] for this action.

In this opinion, NMFS concludes that the proposed action is adverse to, but not likely to jeopardize the continued existence or result in adverse modification of designated critical habitat for the following species:

- *Oncorhynchus mykiss:* Puget Sound (PS) steelhead
- *O. tshawytscha:* PS Chinook salmon and their critical habitat
- *Sebastes paucispinus:* Puget Sound/Georgia Basin (PS/GB) bocaccio and their critical habitat
- *S. ruberrimus:* PS/GB yelloweye rockfish and their critical habitat
- The designated critical habitat for *Orcinus orca:* Southern Resident Killer Whale (SRKW)

We also conclude that the proposed action is not likely to adversely affect the following species and critical habitat:

- The designated critical habitat for PS steelhead
- SRKW

- *Megaptera novaeangliae:* Central America distinct population and Mexico distinct population of humpback whale

As required by Section 7 of the Endangered Species Act, the NMFS provided an incidental take statement with the biological opinion. The incidental take statement describes reasonable and prudent measures the NMFS considers necessary or appropriate to minimize incidental take associated with this action. The take statement sets forth nondiscretionary terms and conditions. Incidental take from actions that meet the term and condition will be exempt from the Endangered Species Act take prohibition.

NMFS also reviewed the likely effects of the proposed action on essential fish habitat (EFH), pursuant to section 305(b) of the Magnuson-Stevens Fishery Conservation and Management Act (16 U.S.C. 1855(b)), and concluded that the action would adversely affect the EFH of Pacific Coast salmon, Pacific Coast groundfish, and coastal pelagic species. Therefore, we have included the results of that review in Section 3 of this document.

Please contact Sara Tilley, of the Oregon Washington Coastal Office in Lacey, Washington, at sara.m.tilley@noaa.gov, if you have any questions concerning this consultation, or if you require additional information.

Sincerely,

Cc: Larry Scholten

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

Port of Bellingham Marine Infrastructure Maintenance and Repair

NMFS Consultation Number: WCRO-2022-00335

Action Agency: USDOT - MARAD

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	N/A
Puget Sound Chinook Salmon (*O. tshawytscha*)	Threatened	Yes	No	Yes	No
Bocaccio Rockfish (*Sebastes paucispinus*) (Puget Sound/Georgia Basin DPS)	Endangered	Yes	No	Yes	No
Yelloweye Rockfish (*S. rubberimus*) (Puget Sound/Georgia Basin DPS)	Threatened	Yes	No	Yes	No
Southern Resident Killer Whale (*Orcinus orca*)	Endangered	No	No	Yes	No
Humpback Whale (*Megaptera novaeangliae*) (Central America DPS/Mexico DPS)	CAM (Endangered) MEX (Threatened)	No	No	No	N/A

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
Coastal Pelagic Species	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: May 15, 2023

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1. INTRODUCTION

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

1.1. Background

The National Marine Fisheries Service (NMFS) prepared the biological opinion (opinion) and incidental take statement (ITS) portions of this document in accordance with section 7(b) of the Endangered Species Act (ESA) of 1973 (16 U.S.C. 1531 et seq.), as amended, and implementing regulations at 50 CFR part 402.

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

We completed pre-dissemination review of this document using standards for utility, integrity, and objectivity in compliance with applicable guidelines issued under the Data Quality Act (DQA) (section 515 of the Treasury and General Government Appropriations Act for Fiscal Year 2001, Public Law 106-554). The document will be available at the NOAA Library Institutional Repository [https://repository.library.noaa.gov/welcome]. A complete record of this consultation is on file at the Central Puget Sound Branch in Lacey, Washington.

1.2. Consultation History

On February 15, 2022, the U.S. Department of Transportation (USDOT) Maritime Administration (MARAD), provided NMFS with a combined BE submitted for both maintenance projects (the maintenance dredging of Berths 1 and 2 and the Central Terminal heavy lift area (HLA) replacement) and a Puget Sound Nearshore Conservation Calculator as NMFS advised that this project would potentially be eligible for consultation under the Salish Sea Nearshore Programmatic (SSNP). The applicant also requested that informal consultation be completed for the subject project, based on its determination that the proposed action was not likely to adversely affect (NLAA) ESA-listed species or designated critical habitat, as well as EFH.

On December 2, 2022, NMFS confirmed to the USACE and MARAD that this project was suitable for consultation under the SSNP as long as the USACE acts as a co-Action Agency along with MARAD. On February 10, 2023, the USACE responded that based on guidance from the Seattle District, the USACE would not be able to assume federal lead or co-lead status on the project and that the project would not be eligible for SSNP consultation. As the USACE did not make a formal request for initiation under SSNP, no request was withdrawn.

On February 15, 2023, the applicant, on behalf of MARAD, confirmed that they would like to proceed with individual consultation on the subject project under MARAD's original request from February 15, 2022.

On March 14, 2023, the applicant, on behalf of MARAD, indicated by email that they would revise their consultation request to a request for formal consultation on Puget Sound steelhead as well as Puget Sound Chinook salmon, rockfish, SRKW and their critical habitats. On the same day, NMFS initiated the formal consultation. On the same day, the applicant provided revised information on pile driving activities (Appendix C) and the NMFS biologist indicated that a review of the project's habitat impacts via the Puget Sound Nearshore Conservation Calculator resulted in -305 debits. On April 18, 2023, the project proponent entered into a purchase agreement with the Puget Sound Partnership (PSP) for the purchase of 305 offsetting credits.

On July 5, 2022, the U.S. District Court for the Northern District of California issued an order vacating the 2019 regulations that were revised or added to 50 CFR part 402 in 2019 ("2019 Regulations," see 84 FR 44976, August 27, 2019) without making a finding on the merits. On September 21, 2022, the U.S. Court of Appeals for the Ninth Circuit granted a temporary stay of the district court's July 5 order. On November 14, 2022, the Northern District of California issued an order granting the government's request for voluntary remand without vacating the 2019 regulations. The District Court issued a slightly amended order two days later on November 16, 2022. As a result, the 2019 regulations remain in effect, and we are applying the 2019 regulations here. For purposes of this consultation and in an abundance of caution, we considered whether the substantive analysis and conclusions articulated in the biological opinion and incidental take statement would be any different under the pre-2019 regulations. We have determined that our analysis and conclusions would not be any different.

1.3. Proposed Federal Action

Under the ESA, "action" means all activities or programs of any kind authorized, funded, or carried out, in whole or in part, by Federal agencies (see 50 CFR 402.02). Under MSA, federal action means any action authorized, funded, or undertaken, or proposed to be authorized, funded or undertaken by a federal agency (50 CFR 600.910).

MARAD has awarded federal funding to the Port of Bellingham (Port) to conduct repairs and maintenance to rehabilitate the Bellingham Shipping Terminal (BST). The BST has 1,300 feet (ft.) of wharf length adjacent to an 1,800 ft. berthing area, with over 85,000 square feet (SF) of warehousing on 11 acres of adjacent upland. The BST in located within the City of Bellingham's industrial waterfront to the south of the city center in marine waters of the Whatcom Waterway, which provides vessel access into Port facilities from Bellingham Bay (Figure 1). The Port of Bellingham Marine Infrastructure, Maintenance and Rehabilitation Project (Project) proposes to repair specific structural components of the terminal and perform maintenance dredging to a depth of -35.5 ft. mean lower low water (MLLW) with a 1 ft. over dredge allowance (to -36.5 ft. MLLW) to accommodate safe vessel access to the berths.

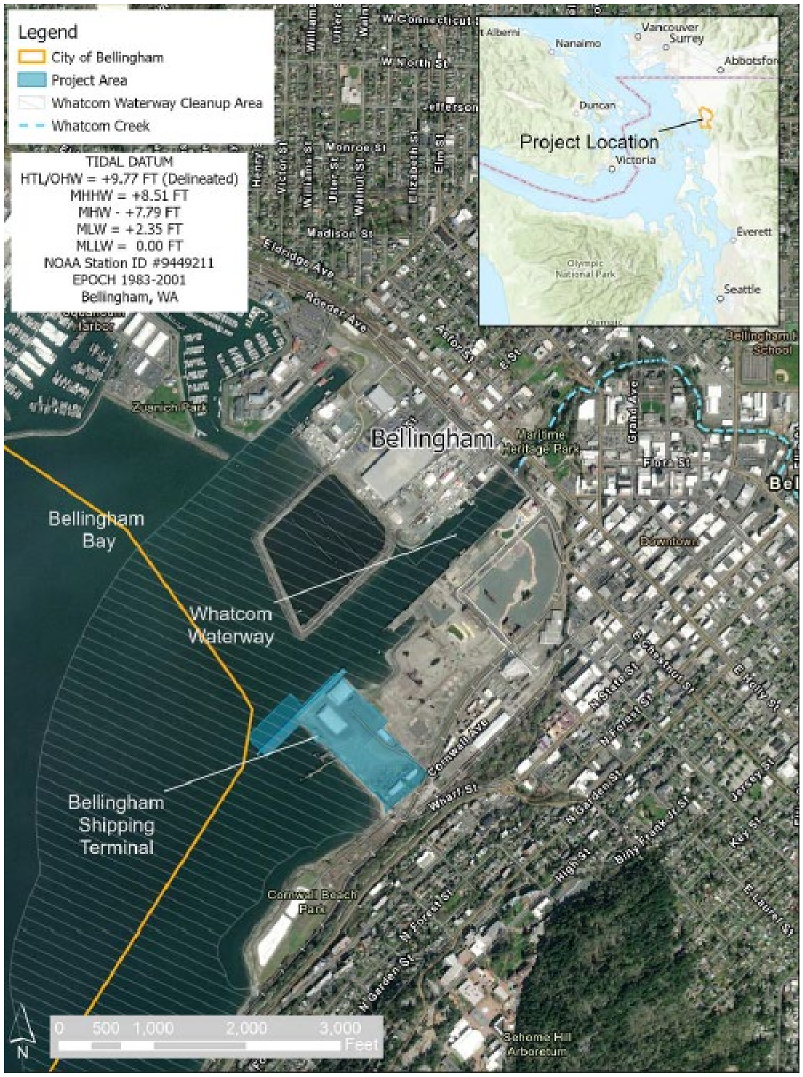

Figure 1. Image of map from BE showing project location and project area

The purpose of the Project is to rehabilitate and return the BST to current maritime safety standards by performing wharf and dock repairs and dredging the area in front of Berths 1 and 2 to previously authorized depths. The Project includes the following actions to accomplish these goals:

- Perform structural repairs to a 9,800 square foot (SF) (140 liner foot [LF]) section of the Central Terminal, including the replacement of the current decking with a more resilient material, minor bulkhead disturbance to access and replace the decking on top of it, and the replacement of piles below the deck. Up to 36 existing structural steel piles would be removed below the 140 LF deck area and up to 16 existing ammoniacal copper zinc arsenate (ACZA)-treated timber fender piles would be removed. These piles would be replaced with up to 56 steel pipe piles waterward of the existing bulkhead, up to 13 steel pipe fender piles, and up to 14 steel pipe piles behind the existing bulkhead wall above highest astronomical tide (HAT).

- Reconfigure the riprap located immediately around the piles being removed at the Central Terminal to facilitate pile replacement. No new fill material would be placed as a part of work.
- Remove and replace up to the top 5 feet of the existing concrete bulkhead in the 9,800 SF area of work at the Central Terminal to accommodate decking repairs and pile replacement. The proposed bulkhead work would be completed landward of the HAT in order to facilitate decking and pile replacement and would not extend the life of the structure.
- Replacement of up to 2 creosote piles at the South Terminal with up to 2 ACZA-treated timber piles (sealed/sheathed with wrapping or a polyurea barrier) and replacement of up to 30 ACZA-treated timber cross members with ACZA-treated timber material. Additional split pile repair, decking and pile cap replacement may also be performed in small areas.
- Upgrade the existing electrical system and stormwater system adjacent to the wharf to meet current electrical standards and enhanced stormwater treatment. These actions would involve an anticipated 14,000 SF of upland repaving.
- Conduct maintenance dredging in front of Berths 1 and 2 to restore the dredge prism to a finished elevation of -35.5 ft. MLLW with a 1 ft. overdredge allowance. Up to 19,000 cubic yards (CY) of sediment would be dredged and disposed of at a permitted upland disposal site. As soil sampling revealed concentrations of mercury and dioxins/furans within the dredge prism, a minimum 6-inch layer (approximately 2,000 CY) of clean sand would be placed after dredging is complete to address the potential presence of contaminated sediment left after dredging is complete. The dredge prism would include 134,000 SF (3.1 acres) of the Whatcom Waterway.

<u>Construction Methods</u>

Work would be completed from land and in the dry wherever feasible. In-water equipment could include up to two barges, work boats, a saw cutter and small hand tools. No new concrete or riprap is proposed for placement below the HAT. Up to two construction-related vessels (likely a barge and a derrick) could remain moored at the BST berths outside of the in-water work window in support of upland deck replacement. These vessels would be berthed within the existing and operational deep-water BST berths, inhabiting an area that is normally used year-round for Port cargo operations and ensuring that vessels would not ground out during low tide events.

Pile replacement would be completed from a barge utilizing vibratory and impact hammers. Timber treated pile remove and installation with be completed with a vibratory hammer. Steel pile removal and installation would be completed with a vibratory hammer wherever possible, however an impact hammer would also be required to “proof” the steel piles. Removed piles would be transported offsite by barge.

Cross-member and top-split pile repairs would be completed with small hand tools by boat. Decking and bulkhead repairs would be completed primarily from land and would not require disturbance of the surrounding riprap adjacent to the bulkhead wall.

The dredging specifications for the Project would be performance-based and shall be performed in accordance with the existing Whatcom Waterway Cleanup Consent Decree. It is anticipated that sediment would be mechanically dredged to the required elevations by an excavator-operated clamshell bucket mounted on a barge. Gravity dewatering of the dredged sediment would occur on a flatdeck, sealed barge equipped with sideboards and scuppers within the vicinity of the project limits. The scuppers would be covered by filter media, such as straw bales and/or geotextile fabric. Excess water from the dredge material would be conveyed to the scuppers and filtered to retain suspended sediment while allowing the filtered water to drain back into Bellingham Bay.

The dewatered material would then be transferred to a permitted upland transfer station where it would be subsequently transported by truck or rail to an appropriate upland disposal facility. Contractor staging would occur on barges and in existing developed upland areas.

Project Timing

The Project is expected to be completed in 1 year. In-water work would be performed consistent with allowable in-water work windows established by regulatory agencies to minimize potential disturbance of sensitive fish and wildlife species. Within Bellingham Bay, these work windows are expected to occur between August 1 and February 15. The in-water work window is designed to be protective of outmigrating juvenile salmonids. Maintenance dredging would be completed over approximately 3 months within a singular in-water work window; however, wharf and dock repair activities may require a second in-water work window the following year for completion.

Best Management Practices

Best management practices (BMPs) have been incorporated into the project design to avoid or minimize environmental effects and the exposure of sensitive species to potential effects from the proposed project activities. The following BMPs would be implemented to avoid or minimize environmental impacts during the project:

1. In-water work window:
   To minimize the presence of ESA-listed species, all in-water work would be conducted between August 1 and February 15 (when outmigrating juvenile salmonids are less likely to be present).

2. Equipment and fueling
   - Work barges or work boats would not be allowed to ground out in the mudline.
   - Vessels in support of upland work would be berthed in existing deep water BST berthing areas to avoid shading out submerged aquatic vegetation in the area.
   - Equipment shall be inspected for leaks and other problems that could result in the discharge of materials at the site or into the waters of Bellingham Bay.
   - Fuel storage, fueling and servicing of equipment would be confined to an established staging area at least 150 ft. from surface waters.

3. Stockpiling
   No stockpiling or staging of materials would occur waterward of the HAT unless on a barge, workboat, or solid wharf deck. Stockpiles would be covered with plastic to prevent contact with the elements and erosion.

4. Spill prevention:
   - The contractor(s) would be required to develop a Spill Prevention and Control Countermeasures (SPCC) plan describing how the contractor would store all fuels and hazardous substances that may be onsite during construction. Containment and cleanup efforts would begin immediately upon discovery of the spill and would be completed in an expeditious manner in accordance with all local, state, and federal regulations. Cleanup would include proper disposal of all spilled material and used cleanup material.
   - The cause of the spill would be ascertained and appropriate actions would be taken to prevent further incidents or environmental damage. Spills into surface waters would be reported to the Ecology Northwest Regional Spill Response Office (360-255-4400) pursuant to the Washington Administrative Code (WAC) 173-303-145 and WAC 173-182-260.
   - Oil-absorbent materials would be present on site for use in the event of a spill or if any oil product is observed in the water.

5. Surface water runoff:
   - Proper BMPs such as straw wattles and/or silt fence would be installed to provide a physical barrier to sediment and prevent runoff into surface waters.
   - Leftover concrete product, slurry, cuttings, and process water would not be allowed to drain onto the deck, into storm drains, or allowed to drain into waters of the state.
   - Work that could result in debris and substances entering surface waters shall include a containment structure capable of collecting all debris and substances. Collected debris would be removed from the water and disposed of at an appropriate upland facility pursuant to applicable regulations.

6. Waste disposal:
   - Excess or waste material would not be allowed to enter surface waters. Construction debris and waste materials would be transported and disposed of in an appropriate manner consistent with applicable regulations.

7. Stormwater:
   - Stormwater BMPs would be in place to assure that any dust is not carried through existing wharf deck drains and to assure that stormwater does not contact wet or fresh concrete.

8. Pile Removal and Driving:
   - Removal of creosote-treated piles would be conducted consistent with the BMPs and established by the Washington State Department of Ecology (Ecology), which build upon and include pile removal guidance from the Environmental

Protection Agency (EPA) Region 10, the Washington Department of Natural Resources (DNR), and Washington Department of Fish and Wildlife (WDFW).
- A containment boom would surround the work area to contain and collect any floating debris and sheen while creosote-treated piles are being removed. Debris would be retrieved of at an appropriate upland landfill.
- Piles for removal would be dislodged with a vibratory hammer when possible and would not be intentionally broken by twisting or bending.
- Piles for removal would be removed in a single, slow, and continuous motion when possible to minimize sediment disturbance and turbidity in the water column. If a treated timber pile breaks above or below the mudline, it would be cut or pushed into the sediment (the existing rock slope may limit the ability to cut timber piles below the mudline).
- Removed creosote-treated piles and timber and associated sediments would be contained on a barge. If piles are placed directly on the barge and not in a container, the storage area would consist of a row of hay or straw bales, filter fabric, or similar material placed around the perimeter of the barge.

9. <u>In-water Noise:</u>
   When possible, construction would be performed in the dry (i.e. the first two bents of pile to be installed waterward of the existing bulkhead wall would likely be able to accommodate pile driving in the dry), thus minimizing the potential for in-water noise impacts and increased turbidity. Methods to reduce in-water noise would be implemented, such as the use of a soft start technique and the use of a wood cushion block and/or bubble curtain. Noise reduction techniques would be chosen and implemented based on pile material-specific effectiveness. Wherever feasible, a vibratory hammer would be used instead of an impact hammer.

10. <u>Marine Mammal Monitoring:</u>
    A Marine Mammal Monitoring Plan has been developed for the Project and is included as Appendix B of this Opinion. To avoid impacts to Southern Resident killer whales and humpback whales an exclusion zone would be monitored during and immediately before pile driving activity. The following in-water shutdown zones are anticipated to avoid Level A and Level B harassment for Southern Resident killer whales and humpback whales during in-water pile driving activities (Appendix B):
    - A 2,512-meter (1.56 miles) shutdown zone would be implemented during vibratory installation of 24-inch diameter steel piles.
    - A 1,000-meter shutdown zone (0.62 miles) shutdown zone would be implemented during impact installation of 24-inch diameter steel piles.

11. <u>Turbidity:</u>
    Appropriate BMPs would be employed to minimize sediment loss and turbidity during dredging. BMPs may include but are not limited to the following:
    - No stockpiling of dredged material below the HAT.
    - Smooth closure of the clamshell bucket when at the bottom.
    - Slowing of the velocity of the ascending loaded clamshell bucket through the water column.

- Pausing the dredge bucket near the bottom while descending and near the waterline while ascending.
- Placing filter material over the barge scuppers to clear return water.

We considered, under the ESA, whether or not the proposed action would cause any other activities and determined that repairs to the BST and dredging activities would cause the enduring presence of cargo vessel use at this berth that would not occur but for the permit issued by USACE.

The project would not result in any new pollution generating impervious surface (PGIS), but it would replace a portion of the existing impervious surface at the BST in order to provide enhanced stormwater treatment at the terminal. Up to 30,000 SF of the BST could be repaved, though the Port estimates that the area will likely be closer to 14,000 SF. The BST is a 35-acre (1,524,600 SF) terminal, 10.5 acres (457,380 SF) of which are paved. This proposal would replace up to 6% of the BST's existing PGIS and would impact just under 2% of the terminal as a whole. Due to space limitations at the BST, Low Impact Development (LID) stormwater techniques cannot be utilized. Therefore, the Port would implement a proprietary stormwater treatment system to provide enhanced treatment. The specific proprietary treatment system has not yet been selected but would adhere to the requirements laid out by the Washington State Department of Ecology (Ecology, 2023a). Accordingly, we determined that the proposed action would result in the discharge of treated stormwater into Bellingham Bay and the Puget Sound.

1.4. Action Area

Under the ESA, "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). Under the MSA, "Federal action" means any action authorized, funded, or undertaken, or proposed to be authorized, funded, or undertaken by a Federal agency (see 50 CFR 600.910).

The furthest-reaching effect from the proposed project activities is likely to be the noise generated from pile driving. The Project proposes to install 24-inch diameter steel or concrete piles, 15-in diameter steel piles, and 14- to 16-inch diameter ACZA-treated piles. The installation of 24-inch steel piles has the potential to produce the greatest in-air and in-water noise and was therefore used to establish the geographic limits of the action area. Steel piles would be installed using a vibratory hammer with proofing strikes by an impact hammer. The impact pile driving could result in in-water noise levels of 206 decibel (dB) peak, 195 dBrms, and 179 dB sound exposure level (SEL) and a bubble curtain would be used to reduce the noise levels by 5 dB. While site specific underwater noise levels are not available for this location, the background noise level is assumed to be 130 dB based on noise data collected at Admiralty Inlet due to its similar atmospheric conditions and commercial use (Bassett et al. 2010). Using 190 dBrms to calculate the extent of in-water noise, the activity is anticipated to attenuate to background noise levels within 100,000 meters (62.2 miles). However, the actual area of increased underwater sound will be constrained by land masses well before it fully attenuates to background levels. The furthest point that underwater sound will travel is 23 miles before it is blocked by Lummi Island. Underwater noise levels would be elevated throughout the marine waters of Bellingham Bay and within the tidal estuary at the mouth of the Nooksack River. The surrounding tributaries would not be subject to elevated noise levels, as land masses would block the noise. It is conservatively assumed that the in-air unweighted noise level for steel pile driving could be up to 101 dBrms and that this noise would attenuate to background levels within 3,041 meters (1.89 miles).

The action area is utilized by PS Chinook salmon, PS steelhead, PS/GB bocaccio, and PS/GB yelloweye rockfish and is designated critical habitat for PS Chinook salmon, rockfish, and SRKW. The action area is also EFH for Pacific Coast Salmon, Pacific Coast groundfish, and coastal pelagic species.

2. ENDANGERED SPECIES ACT BIOLOGICAL OPINION AND INCIDENTAL TAKE STATEMENT

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

MARAD determined the proposed action is not likely to adversely affect either DPS of humpback whales or the critical habitat for humpback whales and Puget Sound steelhead. Our concurrence is documented in the "Not Likely to Adversely Affect" Determinations section (Section 2.13).

2.1. Analytical Approach

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

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

The designation of critical habitat for SRKW uses the term primary constituent element (PCE) or essential features. The 2016 final rule (81 FR 7414; February 11, 2016) that revised the critical habitat regulations (50 CFR 424.12) replaced this term with physical or biological features

(PBFs). The shift in terminology does not change the approach used in conducting a "destruction or adverse modification" analysis, which is the same regardless of whether the original designation identified PCEs, PBFs, or essential features. In this biological opinion, we use the term PBF to mean PCE or essential feature, as appropriate for the specific critical habitat.

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

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

- Evaluate the rangewide status of the species and critical habitat expected to be adversely affected by the proposed action.
- Evaluate the environmental baseline of the species and critical habitat.
- Evaluate the effects of the proposed action on species and their critical habitat using an exposure–response approach.
- Evaluate cumulative effects.
- In the integration and synthesis, add the effects of the action and cumulative effects to the environmental baseline, and, in light of the status of the species and critical habitat, analyze whether the proposed action is likely to: (1) directly or indirectly reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species; or (2) directly or indirectly result in an alteration that appreciably diminishes the value of critical habitat as a whole for the conservation of a listed species.
- If necessary, suggest a reasonable and prudent alternative to the proposed action.

For this consultation, NMFS evaluated the proposed action using a Habitat Equivalency Analysis (HEA)[1] and the Puget Sound Nearshore Habitat Values Model (NHVM) that we adapted from Ehinger et al. 2015. We developed an input calculator ("conservation calculator") that serves as an interface to simplify model use. Ecological equivalency that forms the basis of HEA is a concept that uses a common currency to express and assign a value to functional habitat loss and gain. Ecological equivalency is traditionally a service-to-service approach where the ecological functions and services for a species or group of species lost from an impacting activity are fully offset by the services gained from a conservation activity. In this case, we use this approach to calculate the "cost" and "benefit" of the proposed action, as well as the impacts of the existing environmental baseline, using the NHVM.

[1] A common "habitat currency" to quantify habitat impacts or gains can be calculated using Habitat Equivalency Analysis (HEA) methodology when used with a tool to consistently determine the habitat value of the affected area before and after impact. NMFS selected HEA as a means to identify section 7 project related habitat losses, gains, and quantify appropriate mitigation because of its long use by NOAA in natural resource damage assessment to scale compensatory restoration (Dunford et al. 2004; Thur 2006) and extensive independent literature on the model (Milon and Dodge 2001; Cacela et al. 2005; Strange et al. 2002). In Washington State, NMFS has also expanded the use of HEA to calculate conservation credits available from fish conservation banks (NMFS 2008, NMFS 2015), from which "withdrawals" can be made to address mitigation for adverse impacts to ESA species and their designated CH.

NMFS developed the NHVM based specifically on the designated critical habitat of listed salmonids in Puget Sound, scientific literature, and our best professional judgement. The model, run by inputting project specific information into the conservation calculator, produces numerical outputs in the form of conservation credits and debits. Credits (+) indicate positive environmental results to nearshore habitat quality, quantity, or function. Debits (-) on the other hand indicate a loss of nearshore habitat quality, quantity, or function. The model can be used to assess credits and debits for nearshore development projects and restoration projects; in the past, we have used this approach in the Structures in Marine Waters Programmatic consultation (NMFS 2016a). More recently, on June 29, 2022, NMFS issued the Salish Sea Nearshore Programmatic biological opinion (NMFS 2022) for over-, in- and near-shore projects in the marine shoreline of Puget Sound. That programmatic uses the NHVM to establish a credit/debit target of no-net-loss of critical habitat functions.

Conservation credits calculated using the NHVM will be used to offset the enduring effects of replaced or repaired structures. The enduring effects of these structures and continued vessel use on the environment through their new design life span is analyzed in Section 2.5, Effects of the Action. The NHVM is also used to assess critical habitat impacts resulting from dredging. The NHVM quantifies the number of and extent to which PCE's are impacted by the proposed dredging. The entirety of the dredged material being removed as a result of this project is contaminated sediment; therefore, NMFS has verified that this project activity is considered soil remediation. The NHVM does not require conservation offsets for these remediation activities. Short-term effects, like elevated suspended sediments and re-suspended contaminants, are addressed qualitatively in Section 2.5 (Effects of the Action) below.

There is no current mechanism to analyze the benefits of stormwater treatment upgrades within the NHVM. NMFS determined that the voluntary upgrade of the stormwater treatment system at the BST from basic treatment to enhanced treatment would provide long-term water quality benefits and therefore amended the final debit total within the NHVM by a factor of 10%. Long-term effects from stormwater discharge into the Puget Sound will still occur and are addressed qualitatively in Section 2.5 (Effects of the Action) below.

Appendix A has a summary sheet of debits for the proposed project. A Purchase Agreement between the Port and the PSP is available with the file in the NMFS Lacey office.

2.2. Rangewide Status of the Species and Critical Habitat

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

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

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

Forests

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

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

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

Freshwater Environments

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

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

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

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

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

Marine and Estuarine Environments

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

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

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

Climate change effects on salmon and steelhead

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

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

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

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

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

2.2.1 Status of the Species

Table 1, below provides a summary of listing and recovery plan information, status summaries and limiting factors for the species addressed in this opinion. More information can be found in recovery plans and status reviews for these species. Acronyms appearing in the table include DPS (Distinct Population Segment), ESU (Evolutionarily Significant Unit), ICTRT (Interior Columbia Technical Recovery Team), MPG (Multiple Population Grouping), NWFSC (Northwest Fisheries Science Center), TRT (Technical Recovery Team), and VSP (Viable Salmonid Population).

Table 1 Listing classification and date, recovery plan reference, most recent status review, status summary, and limiting factors for each species considered in this opinion.

Species	Listing Classification and Date	Recovery Plan Reference	Most Recent Status Review	Status Summary	Limiting Factors
Puget Sound Chinook salmon	Threatened 6/28/05 (70 FR 37159)	Shared Strategy for Puget Sound 2007 NMFS 2006	NMFS 2016; Ford 2022	This ESU comprises 22 populations distributed over five geographic areas. All Puget Sound Chinook salmon populations continue to remain well below the TRT planning ranges for recovery escapement levels. Most populations also remain consistently below the spawner–recruit levels identified by the TRT as necessary for recovery. Across the ESU, most populations have increased somewhat in abundance since the last status review in 2016, but have small negative trends over the past 15 years. Productivity remains low in most populations. Overall, the Puget Sound Chinook salmon ESU remains at "moderate" risk of extinction.	• Degraded floodplain and in-river channel structure • Degraded estuarine conditions and loss of estuarine habitat • Degraded riparian areas and loss of in-river large woody debris • Excessive fine-grained sediment in spawning gravel • Degraded water quality and temperature • Degraded nearshore conditions • Impaired passage for migrating fish • Severely altered flow regime
Puget Sound steelhead	Threatened 5/11/07	NMFS 2019	NMFS 2016; Ford 2022	This DPS comprises 32 populations. Viability of has improved somewhat since the PSTRT concluded that the DPS was at very low viability, as were all three of its constituent MPGs, and many of its 32 DIPs (Hard et al. 2015). Increases in spawner abundance were observed in a number of populations over the last five years within the Central & South Puget Sound and the Hood Canal & Strait of Juan de Fuca MPGs, primarily among smaller populations. There were also declines for summer- and winter-run populations in the Snohomish River basin. In fact, all summer-run steelhead populations in the Northern Cascades MPG are likely at a very high demographic risk.	• Continued destruction and modification of habitat • Widespread declines in adult abundance despite significant reductions in harvest • Threats to diversity posed by use of two hatchery steelhead stocks • Declining diversity in the DPS, including the uncertain but weak status of summer-run fish • A reduction in spatial structure • Reduced habitat quality • Urbanization • Dikes, hardening of banks with riprap, and channelization

Species	Listing Classification and Date	Recovery Plan Reference	Most Recent Status Review	Status Summary	Limiting Factors
Puget Sound/ Georgia Basin DPS of yelloweye Rockfish	Threatened 04/28/10	NMFS 2017d	NMFS 2016c	Yelloweye rockfish within the Puget Sound/Georgia Basin (in U.S. waters) are very likely the most abundant within the San Juan Basin of the DPS. Yelloweye rockfish spatial structure and connectivity is threatened by the apparent reduction of fish within each of the basins of the DPS. This reduction is probably most acute within the basins of Puget Sound proper. The severe reduction of fish in these basins may eventually result in a contraction of the DPS' range.	• Over harvest • Water pollution • Climate-induced changes to rockfish habitat • Small population dynamics
Puget Sound/ Georgia Basin DPS of Bocaccio	Endangered 04/28/10	NMFS 2017d	NMFS 2016c	Though bocaccio were never a predominant segment of the multi-species rockfish population within the Puget Sound/Georgia Basin, their present-day abundance is likely a fraction of their pre-contemporary fishery abundance. Most bocaccio within the DPS may have been historically spatially limited to several basins within the DPS. They were apparently historically most abundant in the Central and South Sound with no documented occurrences in the San Juan Basin until 2008. 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.	• Over harvest • Water pollution • Climate-induced changes to rockfish habitat • Small population dynamics

2.2.2 Status of the Critical Habitat

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

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

A summary of the status of critical habitats, considered in this opinion, is provided in Table 2, below.

Table 2. Critical habitat, designation date, federal register citation, and status summary for critical habitat considered in this opinion

Species	Designation Date and Federal Register Citation	Critical Habitat Status Summary
Puget Sound Chinook salmon	9/02/05 70 FR 52630	Critical habitat for Puget Sound Chinook salmon 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.
Puget Sound/Georgia Basin DPS of yelloweye rockfish	11/13/2014 79 FR68042	Critical habitat for yelloweye rockfish includes 414.1 square miles of deepwater marine habitat in Puget Sound, all of which overlaps with areas designated for canary rockfish and bocaccio. No nearshore component was included in the CH listing for juvenile yelloweye rockfish as they, different from bocaccio and canary rockfish, typically are not found in intertidal waters (Love et al., 1991). Yelloweye rockfish are most frequently observed in waters deeper than 30 meters (98 ft) near the upper depth range of adults (Yamanaka et al., 2006). 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.
Puget Sound/Georgia Basin DPS of bocaccio	11/13/2014 79 FR68042	Critical habitat for bocaccio 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.

Species	Designation Date and Federal Register Citation	Critical Habitat Status Summary
Southern resident killer whale	08/02/21 86 FR 41668	Critical habitat includes approximately 2,560 square miles of marine inland waters of Washington: 1) the Summer Core Area in Haro Strait and waters around the San Juan Islands; 2) Puget Sound; and 3) the Strait of Juan de Fuca. Six additional areas include 15,910 square miles of marine waters between the 20-feet (ft) (6.1-meter (m)) depth contour and the 656.2-ft (200-m) depth contour from the U.S. international border with Canada south to Point Sur, California. We have excluded the Quinault Range Site. Based on the natural history of the Southern Residents and their habitat needs, NMFS identified three PCEs, or physical or biological features, essential for the conservation of Southern Residents: 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 Water quality in Puget Sound, in general, is degraded. Some pollutants in Puget Sound persist and build up in marine organisms including Southern Residents and their prey resources, despite bans in the 1970s of some harmful substances and cleanup efforts. The primary concern for direct effects on whales from water quality is oil spills, although oil spills can also have long-lasting impacts on other habitat features In regards to passage, human activities can interfere with movements of the whales and impact their passage. In particular, vessels may present obstacles to whales' passage, causing the whales to swim further and change direction more often, which can increase energy expenditure for whales and impacts foraging behavior. Reduced prey abundance, particularly Chinook salmon, is also a concern for critical habitat.

2.3. Environmental Baseline

The “environmental baseline” refers to the condition of the listed species or its designated critical habitat in the action area, without the consequences to the listed species or designated critical habitat caused by the proposed action. The environmental baseline includes the past and present impacts of all Federal, State, or private actions and other human activities in the action area, the anticipated impacts of all proposed Federal projects in the action area that have already undergone formal or early section 7 consultations, and the impact of State or private actions which are contemporaneous with the consultation in process. The consequences to listed species or designated critical habitat from ongoing agency activities or existing agency facilities that are not within the agency’s discretion to modify are part of the environmental baseline (50 CFR 402.02).

The BST is located along a major shipping route for bulk and containerized cargo and is bordered by other Port and heavy industrial properties, berths and industry, and a BNSF railway mainline. This portion of the Bellingham Bay is estuarine, where freshwater from several waterways (the Nooksack River, Silver Creek, Squalicum Creek, and Whatcom Creek) mixes with the salt water of the Puget Sound Estuary. Habitat conditions for listed species in the action area are degraded. The existing stormwater treatment at the site involves the collection of sheet flow runoff into a series of modified Media Filter Drains mounted on the edge of the wharf prior to discharge. Runoff from the area upland of the wharf is collected and treated by a series of Contech StormFilter cartridge vaults. Both the modified Media Filter Drains and the StormFilters provide basic treatment.

The project area is located within the boundaries of the Whatcom Waterway Cleanup Site and existing benthic habitat is degraded by contaminated sediment resulting from decades of heavily industrialized uses. The Whatcom Waterway is listed as a Category 5 impaired water under Ecology’s 303(d) list for the methyl mercury parameter. The waterway also contains 36 listings of Category 4B impaired sediments for a variety of contaminants (Ecology 2023a). The site lacks natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, or side channels.

The project area is dominated by bare substrate with small patches of floating vegetation and no aquatic vegetation. However, several species of aquatic vegetation including sugar kelp (*Laminaria saccharina*), rockweed (*Fucus distichus*), sea lettuce (*Ulva lactuca*), iridescent seaweed (*Mazzaella spendens*), epiphytic red algae (*Smithora maiadum*) and red algae (*Porphyra spp.* and *Rhodophyta spp.*) have been documented within the action area. While absent from the project footprint, eelgrass has been documented in three nearby areas, the closest of which is approximately 37 ft. from the BST.

Forage fish (surf smelt (*Hypomesus pretiosus*) and Pacific sand lance (*Ammodytes hexapterus*)) spawning has been documented along portions of the shoreline of Bellingham Bay, the closest of which is approximately 0.2 miles southeast of the project area. Although the project will not impact spawning habitat or further alter the shoreline, the area where the BST is located likely did support forage fish spawning historically (WDFW 2023b).

The Project is located approximately 4 miles east of the Nooksack River tidal delta, which has several documented natal Chinook salmon estuaries in the immediate vicinity. A recent logjam has altered the channel connections within the Nooksack tidal delta, resulting in a predicted increase in juvenile Chinook salmon utilizing the western portion of the tidal delta and associated decrease with use of the eastern portion of the tidal delta (located more closely to the Project) (Beamer et al, 2016).

<u>Use of the action area by listed species</u>

Chinook Salmon:

Chinook salmon presence is documented within Bellingham Bay, and juveniles and adults migrate within the action area. There are several nearby tributaries (the Nooksack River, Whatcom Creek, Padden Creek, and Squalicum Creek) that support Chinook salmon spawning and rearing, but the action area does not extend up into these freshwater areas (WDFW 2023a, Beamer et al 2016). Juvenile Chinook salmon utilize nearshore and estuarine habitat in the action area, particularly within the Nooksack tidal delta natal estuary approximately 4 miles west of the BST. It is expected that adult and juvenile Chinook salmon may be present in the vicinity of the action area during the summer and fall during their upstream spawning migration. The in-water work window of August 1 and February 15 avoids the time of year when juvenile salmonids are nearshore dependent and most abundant. Smolts usually migrate to estuarine areas within the first year, approximately three months after emergence from spawning gravel, with peak outmigration from natal rivers to the Puget Sound from March through June. By mid-July, juveniles would be highly mobile and not strictly nearshore dependent, meaning that they can move offshore into deeper water within Bellingham Bay. Yearling PS Chinook may occur anywhere in Puget Sound at any time of year, though not in concentrated numbers. The two early-run (spring) native stocks of adult PS Chinook salmon are expected to migrate upstream between February and August and the third late-run (fall) hatchery-enhanced stock of adult PS Chinook salmon is expected to migrate upstream between September and December (WRIA 1 Salmon Recovery Program).

Steelhead:

Steelhead presence is documented within Bellingham Bay, and juveniles and adults migrate in the action area. There are several nearby tributaries (the Nooksack River, Whatcom Creek, Padden Creek, and Squalicum Creek) that provide steelhead habitat, but the action area does not extend up into these freshwater areas (WDFW 2023a). The Nooksack River provides spawning habitat for steelhead whereas habitat conditions in Whatcom Creek, Padden Creek, and Squalicum Creek are highly degraded and likely provide migratory habitat for steelhead but do not support spawning (Smith 2002). Based on typical run timing for winter steelhead (December through mid-March) and summer steelhead (August through December) and spawning patterns, juvenile steelhead are expected to outmigrate between mid-March and early June. Based on the work window of August 1 through February 15, adult steelhead are more likely than juvenile steelhead to be present in the action area during construction activities.

Bocaccio:

Bocaccio rockfish adults stay in deep waters (98 feet or deeper) but juveniles use shallow areas within their designated critical habitat, and larval lifestages float in the water column. Larvae are born with limited abilities to swim, maintain buoyancy in the water column, and feed. These larvae are pelagic for approximately 2 months and occur in the water column from near the surface to depths of 328 feet or more. Larval presence in the Puget Sound peaks in spring and again in summer, and larvae are commonly associated with kelp beds. There are documented patches of kelp and eelgrass within the action area but outside of the project footprint. While there is limited data related to bocaccio use of Bellingham Bay, it is assumed that bocaccio could be present within the action area during construction activities.

Yelloweye:
Similar to bocaccio, yelloweye rockfish larvae are produced 2 times per year in Puget Sound, and float within the water column for approximately 2 months. Unlike bocaccio, yelloweye juveniles ‘settle’ in deeper water, and thus critical habitat and juvenile and adult lifestages are expected only in the deep-water portion of the action area.

SRKW:
Southern Resident killer whale may occur within the deeper areas of Bellingham Bay within the action area. Areas with water less than 20 feet deep are not designated as critical habitat for SRKW, but the offshore habitat of Bellingham Bay, with water deeper than 20 feet, could support SRKW. The action area is confined to Bellingham Bay by adjacent land including Lummi Island and Portage Island. Sighting data from the Orca Network indicates that there have been two SRKW sightings within the action area in the last five years (Orca Network 2023).

Humpback Whale:
The humpback whale may occur within the deeper areas of Bellingham Bay within the action area. The shallower areas around the BST do not provide habitat for the humpback whale, but the offshore habitat of Bellingham Bay could support humpback use. Sighting data from the Orca Network indicates that there have been four humpback whale sightings within the action area in the last five years (Orca Network 2023). NMFS has identified three DPSs of humpback whales that are found off the coasts of Washington, Oregon and California. These are: the Hawaii DPS (found predominantly off the coast of Washington and southern British Columbia), which is not listed under the ESA; the Mexico DPS (found all along the coast), which is listed as threatened under the ESA; and the Central America DPS (found all along the coast), which is listed as endangered under the ESA. Within the action area, a very small proportion (5.2%) of foraging humpback whales are expected to originate from the endangered Central America DPS, while the majority of humpback whales are expected to originate from the threatened Mexico DPS (41.9%) or the non-listed Hawaii DPS (52.9%) (NMFS 2016b). Therefore, we would assume that two of the four humpback whales seen within the action area in the last five years are likely to be from either the endangered Central America DPS or the threatened Mexico DPS.

2.4. Effects of the Action

Under the ESA, “effects of the action” are all consequences to listed species or critical habitat that are caused by the proposed action, including the consequences of other activities that are caused by the proposed action (see 50 CFR 402.02). A consequence is caused by the proposed action if it would not occur but for the proposed action and it is reasonably certain to occur. Effects of the action may occur later in time and may include consequences occurring outside the immediate area involved in the action (see 50 CFR 402.17). In our analysis, which describes the effects of the proposed action, we considered the factors set forth in 50 CFR 402.17(a) and (b).

The assessment below considers the intensity of expected effects in terms of the change they would cause on habitat features from their baseline conditions, and the severity of each effect, considered in terms of the time required to recover from the effect. Ephemeral effects are those that are likely to last for hours or days, short-term effects would likely last for weeks, and long-term effects are likely to last for months, years or decades.

Effects of the proposed action include:

- Noise - Underwater sound, from both vibratory and impact pile driving, attenuated by employing a bubble curtain (temporary);
- Shade - the replacement of the overwater structure and attendant piles (– long lasting)
- Water quality diminishment - from discharge of effluent into the Puget Sound (– long lasting) and suspended sediment (temporary)
- Disturbance of bottom sediments of benthic communities (forage - temporary).
- Vessel traffic and use during construction and post construction (noise, shade, sediment disturbance, and water pollution – long lasting);

2.4.1 Effects on Critical Habitat

As mentioned in Section 2.3, designated critical habitat for PS Chinook salmon, PS/GB bocaccio, PS/GB yelloweye, and SRKW occurs within the action area. Critical habitat includes Physical and Biological Features (PBFs) necessary to support various life stages of salmonid and non-salmonid listed species (i.e. rearing, migration). The NMFS reviews effects on critical habitat affected by a proposed action by examining how the PBFs of critical habitat would be altered, and the duration of such changes.

Three of the six PBFs established for Chinook salmon critical habitat are likely to be present in the action area. Those PBFs are:

1. Estuarine areas free of obstruction 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, and side channels; and juvenile and adult forage, including aquatic invertebrates and fishes, supporting growth and maturation,

2. Nearshore marine areas free of obstruction 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, and

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

Both of the PBFs established for PS/GB bocaccio and yelloweye rockfish are likely to be present in the action area. Those PBFs are:

1. Benthic habitats or sites deeper than 30 m (98ft) that possess or are adjacent to areas of complex bathymetry consisting of rock and or highly rugose habitat are essential to conservation because these features support growth, survival, reproduction, and feeding opportunities by providing the structure for rockfishes to avoid predation, seek food and persist for decades (essential for the conservation of adult bocaccio and adult and juvenile yelloweye rockfish), and

2. Juvenile settlement habitats located in the nearshore with substrates such as sand, rock and/or cobble compositions that also support kelp (families *Chordaceae, Alariaceae, Lessoniacea, Costariaceae, and Laminaricea*) are essential for conservation because these features enable forage opportunities and refuge from predators and enable behavioral and physiological changes needed for juveniles to occupy deeper adult habitats (essential for the conservation of juvenile bocaccio).

All three of the PBFs established for SRKW are likely to be present in the action area. Those PBFs are:

1. Water quality to support growth and development. Water quality supports Southern Resident killer whales' ability to forage, grow, and reproduce free from disease and impairment,

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.

Effects to habitat features include temporary and permanent impediments to migration, potential permanent increases in predators and predator success upon juvenile salmonids, temporary and permanent diminishment of forage opportunities (i.e., prey abundance and diversity), and temporary and permanent impacts to water quality. Timing, duration, and intensity of the effects on critical habitat are taken into account in the analysis, and we also consider them as the pathways of exposure creating effects to the species, as discussed below.

PBFs in common across these designations are water quality, prey, and migration. Conservation roles in common that are served by the CH are survival, growth, maturation.

<u>Noise</u>
Migration – Fish and marine mammals can detect and respond to sound from pile driving and from vessel motors in a manner that delays their migratory behavior and makes them more susceptible to predation. Dredging activities are unlikely to create in-water noise at a decibel level above the baseline conditions, and given the BST's continuous use as a marine terminal for heavy cargo, it is unlikely that vessel noise associated with construction would cause a meaningful change in migratory habits. However, for the period of time (72 days) that vibratory driving and impact driving occurs, the migration value of the action area is diminished. These are temporary conditions and the action area will re-establish the baseline value for migration role

for PS Chinook salmon when pile driving ceases. There is research indicating that sound exposure can result in long-term behavioral effects to SRKW wherein they avoid a once popular area for foraging, breeding, or socializing (Holt 2008). However, these studies all examined the effects of vessel traffic, which is already a condition of the baseline within the action area. As the action area is likely not popular for foraging due to the continuous noise impacts from vessel traffic, it is unlikely that the temporary pile driving activities would result in significant, long-term effects to SRKW's use of the area.

Feeding opportunities and predator avoidance – The elevated noise from pile driving is likely to cause any bocaccio or yelloweye, or PS Chinook salmon that are utilizing kelp beds within the action area to temporarily abandon the site, or engage in a startle response that includes cessation of feeding, thereby reducing that habitat's ability to support feeding opportunities, or to rely on these seagrasses for predator avoidance (Pearson et al 2011).

Reproduction, growth, development - Noise may also inhibit the mask rockfish 'calling,' which is assumed to be a behavior for reproductive purpose (Kok et al 2021). Hastings and Popper (2005) suggest that sound can inhibit growth or development of eggs and larvae. For 72 days, in which pile driving occurs, the value of the action area is diminished for several key purposes of critical habitat (growth, maturation, migration, reproduction), but these are temporary occurrences that do not impact the long-term status of the critical habitat.

The noise from this project would cause temporary reductions to the physical and biological features of critical habitat for PS Chinook salmon, SRKW, PS/GB bocaccio, and PS/GB yelloweye rockfish, and cause a temporary diminishment in the ability of the habitat to support conservation roles for which the critical habitat was designated. These values will return when pile driving ceases. The in-water noise impacts could reach the outlet in the Puget Sound of several streams designated as PS steelhead critical habitat (Nooksack River, Silver Creek, Squalicum Creek, Whatcom Creek, and Padden Creek), but would not extend up into those systems due to land masses blocking the underwater noise. These noise impacts have the potential to mask calling for rockfish and impair the social purposes of this behavior (i.e. reproduction). However, calling has been most commonly documented at night when pile driving activities will not occur. Therefore, we expect that noise impacts associated with pile driving could infringe on rockfish calling behaviors but would not fully erode the value of this habitat during construction. Based on these factors, the impairment of these PBFs would not reduce the conservation value of the habitat for these species in the long-term.

<u>Shade</u> – Shade has two main effects on features of aquatic habitat: 1) it can promote conditions for piscivorous fishes, and 2) it can reduce subaquatic plant and prey communities. These effects can diminish the quality of nearshore habitat, increasing predation risk and reducing forage potential.

The proposed wharf repairs would not extend the existing footprint of overwater structures within the Whatcom Waterway but would perpetuate the existing shade impacts caused by the BST. The 9800 SF section of dock being replaced would be at the existing structure's height and therefore would not affect the size or location of the areas underneath the dock that currently experience shade. The vessels utilizing the BST would also create shade when they are moored.

Predation – Shading from moored vessels in support of construction activities could create predator habitat where juvenile salmonids migrate, when present; however, because vessels are not permanently stationed and the presence of vessels would occur over water at depths where light penetration is already low, this is not expected to significantly diminish habitat beyond its existing condition. After the construction period, juvenile Chinook salmon could occur near the proposed piles while migrating and be vulnerable to fish predators utilizing the piles. Adult migration would not be affected by the proposed structures. The presence of proposed piles and shade from the BST would likely adversely affect the migration value of critical habitat for juvenile Chinook salmon in the action area.

Prey reduction – The BST is in a fixed location and does not cast shade on any submerged aquatic vegetation; however, surrounding aquatic vegetation including an eelgrass bed as close as 50 ft. from the BST indicates that the area could support submerged aquatic vegetation were it not for the shade created by the wharf. Submerged aquatic vegetation provide essential forage and refuge opportunities for juvenile bocaccio and support some of the main food sources for juvenile salmonids. These enduring shade impacts will continue to diminish the quality of this nearshore habitat for juvenile bocaccio and salmonids. The repairs to the BST will also result in enduring vessel use within the area, resulting in additional shading. The vessels utilizing the BST are not expected to remain docked for durations long enough to significantly shade out aquatic plant and prey communities, should they occur. For these reasons, the wharf's shade impact on prey communities is expected to be significant, while the vessels' shade impact is expected to be minor in nature.

Migration - The shade impacts from this project would cause minor impacts to the migratory physical and biological features of critical habitat for PS Chinook salmon. There is significant research indicating that juvenile salmon are reluctant to pass under overwater structures, particularly wider structures like a terminal (Celedonia et al. 2008). These juvenile salmonids, which are highly nearshore dependent, have responded to overwater structures either by swimming around its edges or waiting until lower tides to pass under the structures when more light penetrated their edges (Heiser and Finn 1970, Southard et al. 2006, Nightingale and Simenstad 2001). An implication of both of these behavioral responses is the delay in migration for a species that tends to quickly migrate out to the ocean. The shade impacts created by the BST alone likely do not create a significant impediment to migrating salmonids. However, given that the shoreline of the Puget Sound, especially within Bellingham Bay, is significantly developed, this structure must be considered as part of a much larger impairment to migratory patterns. However, this proposed Project would not extend shade beyond the existing BST footprint and the temporary shade cast by berthing vessels. Therefore, although this replacement represents a perpetuation of impacts to migratory PBFs for Chinook salmon, it is not expected to degrade this designated critical habitat beyond its existing condition.

<u>Water Quality</u> –
Water quality is an essential element of the PBFs of salmonid critical habitat, PCEs of PS/GB bocaccio and yelloweye rockfish critical habitat, and PCEs of SRKW critical habitat. The water quality effects from dredging are not expected to extend to the designated critical habitat for steelhead, bocaccio, or yelloweye; however, dredging operations are expected to affect the

critical habitat of PS Chinook salmon and SRKW. Dredging operations would be completed using mechanical (clamshell) methods and would remove approximately 19,000 CY of benthic material. Effects to water quality due to dredging can include increased suspended sediments leading to increased turbidity, decreased dissolved oxygen (DO), or resupplied toxins. Stormwater runoff is also a major contributing factor in water quality impairments due to the discharge of effluent from PGIS at the BST.

Turbidity – Temporary and localized increases in turbidity are expected in the immediate vicinity of the clamshell during dredging operations. However, the contractor will be responsible for monitoring turbidity levels at the point of compliance (150 ft. from activity) as a condition of the Section 401 Water Quality Certification. As a result, the area of effect from dredging operations will be much more localized than the action area and will minimize potential impacts. Turbidity resulting from dredging activities will temporarily impact the nearshore water quality PBF for Chinook salmon. For the period of time that dredging occurs, the value of the critical habitat would be diminished such that fish within the area are likely to avoid the dredge plume. The effects of turbidity are significant in proportion to the ratio of the size of the dredged area to the size of the bottom area and water volume (Morton 1977). Given the relatively small size of the dredge prism in relation to the designated Chinook salmon critical habitat within Bellingham Bay, it is not likely that this action will greatly reduce the value of this habitat. Once dredging operations have ceased, the proposed Project will not prevent the action area from serving its role for the species mentioned above.

Dissolved oxygen – Suspension of anoxic sediment compounds during dredging can result in reduced DO in the water column as the sediments oxidize. Sub-lethal effects of DO levels below saturation can include metabolic, feeding, growth, behavioral, and productivity effects. Behavior responses can include avoidance and migration disruption (NMFS 2005).

Based on a review of six studies on the effects of dredging on DO levels, LaSalle (1988) concluded that, considering the relatively low levels of suspended material generated by dredging operations and counterbalancing factors such as flushing, DO depletion around dredging activities is minimal. In addition, when DO depletion is observed near dredging activities, it usually occurs in the lower water column, whereas juvenile salmon are more closely associated with the upper water column. A number of other studies reviewed by LaSalle (1988) showed little or no measurable reduction in DO around dredging operations. Simenstad (1988) concluded that because high sediment biological oxygen demand is not common, significant depletion of DO is usually not a factor in dredging operations. A model created by LaSalle (1988) demonstrated that, even in a situation where the upper limit of expected suspended sediment is reached during dredging operations, DO depletion of no more than 0.1 mg/L would occur at depth. Any reduction in DO beyond background should be limited in extent and temporary in nature. For these reasons, this proposed action is not likely to result in the sub-lethal effects outlined above. Additionally, the short duration of the project further reduces the potential for effects of low DO due to turbidity and suspended sediment.

Resuspended toxins – The Whatcom Waterway is under a Consent Decree from Ecology to remediate the contaminated sediments in the area. As such, the entirety of the dredged material would be contaminated. Maintenance dredging has the potential to expose aquatic species to contaminants within the Whatcom Waterway's sediments through resuspension.

Resuspension rates of contaminated sediments have been reported ranging from less than 0.1 percent to over 5 percent and are dependent on a number of factors including the method of dredging, sediment properties, and site conditions (Bridges et al 2008). There are no specific data available at the project site detailing how the site conditions within Bellingham Bay may affect sediment resuspension. However, comprehensive studies indicate that when using bucket dredges without barge overflow, resuspension rates are typically less than one percent (Hayes and Wu 2001). Assuming a one percent sediment resuspension rate, approximately 190 CY of material would be resuspended during the course of dredging. During dredging, dioxin/furans and other contaminants would be re-suspended in the water column throughout and immediately following the activity. However, the probability of exposure of individuals to water quality effects is generally low, given that the work windows would avoid peak presence of juvenile salmonids, and BMPs would be implemented to minimize the mobilization of sediments (See Section 1.3). This is not the case, however, for larval rockfish, which float within the water column during their pelagic life stage, and juvenile bocaccio that rely on nearshore and intertidal habitat. Water quality sufficient to support growth, survival, reproduction, and feeding opportunities has been defined as an attribute of juvenile settlement habitats (PBF 2 for listed rockfish). There is no PBF for larval rockfish, as their essential habitat features are not well understood. However, NMFS notes in its final designation of critical habitat that larval bocaccio and yelloweye rockfish very likely use areas of critical habitat designated as essential for other rockfish life-stages (NMFS 2014). Short-term and intermittent exposure to reduced water quality could result in minor reductions in foraging success, gill damage and/or sublethal toxicity within 150 ft. of dredging activities. During dredging operations (3 months), the designated critical habitat for juvenile rockfish is expected to be significantly degraded.

Over the long term, removal of this sediment is expected to provide a net beneficial effect by improving water quality for ESA-listed species and their prey by decreasing dioxin/furan and mercury concentrations in the water column. Removal of the contaminants from the environment is especially important for SRKW, which, as long-lived apex predators, accumulate persistent toxins, which are passed across trophic levels and concentrated at the top of the food chain.

Discharge of Effluent – The impervious surfaces of the BST alter the natural infiltration of vegetation and natural soil and accumulate several pollutants associated with the heavy machinery utilizing the wharf. During heavy rainfall, accumulated pollutants are mobilized and transported via runoff and conveyed into adjacent surface waters. The Project would not result in any new pollution generating impervious surface (PGIS), but it would replace a portion of the existing impervious surface at the BST in order to provide enhanced stormwater treatment at the terminal. Up to 30,000 SF of the BST could be repaved, though the Port estimates that the area will likely be closer to 14,000 SF. The current stormwater treatments systems at the BST meet the basic treatment standard outlined by the Department of Ecology, including: 80 percent removal of total suspended solids (TSS) for an influent concentration range of 100-200 mg/L and 20 mg/L TSS for influent concentration less than 100 mg/L. The proposed action intends to upgrade the stormwater treatment system to meet enhanced treatment standards, which meet the basic treatment goal and include the following conditions: 30 percent removal of dissolved copper for influent concentrations between 0.005 – 0.02 mg/L and 60 percent removal of dissolved zinc for influent concentrations between 0.02 – 0.3 mg/L (Ecology 2023a).

Despite water quality standards and treatment, environmental monitoring has documented pollution-driven degradation in nearly all aquatic habitats, including those presently listed for protection under the ESA. In the Project area, this includes designated critical habitat supporting PS Chinook salmon, PS steelhead, PS/GB bocaccio, PS/GB yelloweye rockfish, and SRKW. The agency must consider potential direct and indirect impacts of toxins on species and their designated critical habitat, as well as EFH (under the MSA, addressed in Section 3). The physical, biological, and chemical dimensions of habitat quality, including aquatic food webs, encompass the abundance and productivity of freshwater macroinvertebrates (as prey for juvenile salmon), the health of shoreline macroalgal communities (e.g. sheltering eelgrass habitats), and the survival and abundance of shore-spawning herring and other marine forage fish (keystone species for marine food webs).

Recent research by a NMFS' science team (Northwest Fisheries Science Center, Ecotoxicology and Environmental Chemistry Programs) has shown that untreated stormwater is highly toxic to aquatic species, including Pacific salmon and marine forage fish (French et al 2022). Conversely, parallel studies have shown that clean water/green infrastructure treatment methods can remove pollutants from stormwater (McIntyre 2015). We expect that despite the enhanced treatment provided by the proprietary system, effluent would still contain some contaminants, such as PAHs and 6PPD/6PPD-quinone (6-PPD-q). The stormwater treatment upgrades would diminish the quantity and concentration of effluent discharging into Bellingham Bay, resulting in a long-term improvement in water quality; however, discharges would still adversely affect water quality due to uncaptured contaminants. Stormwater may also include an array of contaminants depending on the surrounding land use and proximity to industrial facilities (Table 3). At this project location, the most likely contaminants are microplastics from tires, petroleum products from vehicles and vessels on the dock, and metals from the resurfaced roads.

Stormwater can discharge at any time of year. However, first-flush rain events after long dry periods typically occur in September in western Washington. As with stormwater runoff globally, the leading edge of hydrographs (the first flush) in Puget Sound have proportionally higher concentrations of contaminants, including those long known to resource managers (as evidenced by existing aquatic life criteria under the Clean Water Act), as well as many chemicals of emerging concern, so-called because they were largely unknown a decade ago (Peter et al, 2020). Higher concentrations of pollutants occur less frequently between March and October as longer dry periods exist between storm events. In western Washington, most stormwater discharge occurs between October and March, when the region receives the most rain.

Table 3. Pollutants commonly found in stormwater runoff in Washington State.

Pollutant Class	Examples	Urban Sources
Petroleum hydrocarbons	PAHs (poly aromatic hydrocarbons)	Roads (vehicles, tires), industrial, consumer products
Metals	Mercury, copper, chromium, nickel, titanium, zinc, arsenic, lead	Roads, electronics, pesticides, paint, waste treatment
Microplastics	6PPD/6PPD-q	Vehicle tires
Common use pesticides, surfactants	Herbicides (glyphosate, diquat), insecticides, fungicides, adjuvants, surfactants (detergents, soaps)	Fertilizer, soil erosion
Persistent bio-accumulative toxicants (PBT)	POPs (persistent organic pollutants), PCBs (polychlorinated diphenyl ethers), PFCs (poly- and per-fluorinated compounds), pharmaceuticals (estrogen, antidepressant)	Eroding soils, solids, development, redevelopment, vehicles, emissions, industrial, consumer products
Temperature and dissolved oxygen	Warm water, unvegetated exposed surfaces (soil, water, sediments)	Impervious surfaces, rock, soils (roads, parking lots, railways, roofs)
Bacteria	*Escherichia coli*	Livestock waste, organic solids, pet waste, septic tanks

Based on water and sediments (Zhang et al 2016) to be affected by certain likely contaminants, we estimate that the area of effect from stormwater discharge is 1 kilometer (km) radially from the outfall (Law et al 1997). Stormwater negatively impacts critical habitat of the ESA listed fishes and SRKW by degrading water quality (water quality is also a feature of EFH, see the analysis in Section 3). Contaminants in stormwater can be transported far downstream to estuaries and the ocean dissolved in surface waters, attached to suspended sediments, or via aquatic food webs (e.g., bioaccumulation). Aquatic organisms including ESA-listed fish and marine mammals may take up contaminants from their surrounding environments by direct contact with water and sediments, or ingestion of contaminated plankton, invertebrates, detritus, or sediment, indicating that prey and substrate are also adversely affected features of critical habitat.

The water quality impacts from this project would cause temporary impacts to the physical and biological features of critical habitat for PS Chinook salmon, PS/GB bocaccio, juvenile PS/GB yelloweye rockfish, and SRKW via dredging activities and long-term impacts to these same PBFs via stormwater discharge into Bellingham Bay. Dredging activities would degrade water quality in the Whatcom Waterway and a 150 ft. area surrounding the dredge prism by elevating suspended sediments for approximately 3 months within the in-water work window, and which would return to baseline levels within hours after work ceases. Conditions for juvenile maturation and adult fitness during migration would be disrupted by the water quality degradation. Maintenance dredging would cause no measurable changes in water temperature and salinity, but mobilized contaminants and suspended sediments in the water column could temporarily impair the value of critical habitat for growth and maturation of juvenile salmon by exposing them to pollutants with both immediate and latent health effects. Increased levels of contaminants could also incrementally impair forage/prey communities that are exposed to the contaminants, delaying the speed that these communities re-establish after being physically disrupted by dredging. Additionally, while it is unlikely that SRKW would utilize the area being impacted by dredging activities, SRKW critical habitat has been designated within the dredge prism to water depths as shallow as 20 feet. The dredging impacts would impair the SRKW PBFs for water quality supporting growth and development as well as prey species availability for the duration of construction but are expected to return to baseline conditions within hours after work ceases.

We anticipate water quality to be degraded by the discharge of stormwater effluent despite the addition of upgraded treatment. The proprietary enhanced treatment system would provide a reduction of pollutants in stormwater effluent, but the discharge itself would still result in some degradation of the water quality PBF of critical habitat for PS Chinook salmon, PS/GB bocaccio, PS/GB yelloweye rockfish, and SRKW. However, given that discharges from this enhanced treatment system would contain *less* contaminant than currently occurs with the basic treatment system, we believe that water quality, sediment quality, and prey communities would continue to support the conservation role (e.g., growth, maturation, survival) for individuals of each of the designated species. Based on these factors, the impairment of these PBFs would not reduce the conservation value of the habitat for these species.

<u>Disturbed Bottom Sediment and Benthic Communities –</u>
Sessile, benthic, and epibenthic organisms within the sediments of the dredge prism that cannot move fast enough to avoid the capture of sediment by the clamshell bucket are entrained and experience high mortalities. Several studies have demonstrated that benthic organisms rapidly recolonize habitats disturbed by dredging (McCabe et al, 1996; Quinn et al, 2003; Richardson et al, 1977; Van Dolah et al, 1984). However, the speed of recovery by benthic communities is affected by several factors, including the intensity of the disturbance, with greater disturbance increasing the time to recovery (Dernie et al, 2003). The infaunal community within Bellingham Bay would experience disruption during dredging and for a short time after, and would be expected to recover toward baseline levels within several months with full recruitment of prey complexity and abundance taking up to 3 years. While prey complexity and benthic diversity may take three years to fully re-establish, we would expect the forage availability and the conservation value of the habitat to return to functioning levels within weeks to months.

<u>Vessels</u>
The presence of vessels for construction, or during regular operation of the location, produce a variety of habitat effects consistent with those described above: Noise, shade, and water quality diminishments. Each of these pathways is well described, and we refer to those sections for a more detailed presentation of these effects, to which vessels will contribute.

Project Impact Offsets

The NMFS NHVM outputs reflects a total of -339 debits (Appendix A) as a result of the structural elements of the proposed action. The purpose of the nearshore calculator is to quantify the long-term impact of habitat changes, and identify the need for offsetting activities in order to avoid aggregating and systemic loss of conservation value. As the calculator does not currently provide a mechanism to quantify stormwater treatment upgrades, NMFS determined that this project activity would result in a conservation benefit equivalent to 10% of the total debits generated by the Project (34 credits). Therefore, the applicant has signed a purchase agreement with PSP to offset the adjusted total of 305 debits, thus achieving no long-term adverse habitat loss from this project. No debits are associated with the dredging, which affords a habitat improvement by removing contaminated sediments.

The purchase of credits provides a high level of certainty that the benefits of a credit purchase would be realized because the NMFS-approved program considered in this opinion has mechanisms in place to ensure credit values are met over time. Such mechanisms include legally binding conservation easements, long-term management plans, detailed performance standards, credit release schedules that are based on meeting performance standards, monitoring plans and annual monitoring reporting to NMFS, non-wasting endowment funds that are used to manage and maintain the bank and habitat values in perpetuity, performance security requirements, a remedial action plan, and site inspections by NMFS.

2.4.2 Effects on Listed Species

Effects of the proposed action on species are based, in part, on habitat effects, as described above. The in-water work window has been designed to minimize exposure of juvenile salmonids to short-term habitat effects, but these effects are still possible. Because habitat conditions are generally poor in the action area, we do not expect significant presence (high numbers) of any of these species during construction. Individuals of these species would be exposed to the habitat effects described above – noise, water quality reductions, shade, reduced prey, and increased predation, as well as risk of entrainment. However, adult and juvenile responses to these effects are very different. SRKW are not likely to be adversely affected and our analysis on this species appears on section 2.11 of this document.

Noise –

Impact pile driving
The project proposes to install up to 56 24-inch steel piles and 13 steel fender piles within the water. These steel piles would be installed using both vibratory hammer and impact pile drivers. The NMFS established the injury thresholds for impulsive sound at 206 dB peak, 187 dB cumulative sound exposure (SEL_{cum}) for fish more than 2 grams, and 183 dB SEL_{cum} for fish less than 2 grams (Fisheries Hydroacoustic Working Group, 2008). The behavioral disturbance threshold is 150 dB root mean square (RMS). Any received level below 150 dB sound exposure level (SEL) is considered "Effective Quiet" (Stadler and Woodbury, 2009).

Noise generated from in-water impact driving is estimated based on single strike noise levels of 206 dB peak, 179 dB SEL_{cum}, and 195 dB RMS for 24-inch piles at a distance of 10 meters (WSDOT, 2020). A bubble curtain would be used during impact pile driving and would be anticipated to reduce noise levels by 5 dB. Therefore, we expect the maximum possible sound from impact driving the 69 steel piles to be 201 dB peak, 174 dB SEL_{cum}, and 190 RMS. Up to one and a half steel piles would be driven per day and up to 1,150 strikes would be needed to drive each pile (a total of 1,725 strikes per day). Any PS Chinook salmon, PS steelhead, bocaccio, or yelloweye that is within 5 meters of impact proofing could be injured or killed from exposure to a single pile impact strike (Table 3).

Table 4. Distance to reach NMFS accepted threshold for behavioral disturbance and the onset of physical injury to fish from unattenuated impact pile proofing under the proposed project.

	Onset of Physical Injury			**Behavior**
	Peak dB	Cumulative SEL dB		RMS dB
		Fish ≥ 2 g	Fish < 2 g	
NMFS accepted threshold	206	187	183	150
Distance (m) to threshold	**5**	**196**	**361**	**4642**

Juvenile fish that remain within the nearshore environment surrounding the BST for the full duration of impact pile driving would likely experience physiological impacts on auditory and non-auditory soft tissues from accumulated sound energy (Table 5). The severity and permanence of those impacts would depend on the distance from the source and the duration of the exposure, with intensity decreasing with increased distance and/or reduced length of exposure. Additionally, juvenile or yearling PS Chinook salmon within the action area, but not close enough for immediate harm, may experience sublethal effects from impact pile driving. This may include acoustic masking (Codarin et al. 2009), startle responses and altered swimming (Neo et al. 2014), abandonment or avoidance of the area of acoustic effect (Mueller 1980; Picciulin et al. 2010; Sebastianutto et al. 2011; Xie et al. 2008) and increased vulnerability to predators (Simpson et al. 2016). Juvenile salmonids may occupy the 4,642 meter (2.88 mile) area surrounding pile driving; however, the majority of these fish are expected to be in the Nooksack River tidal delta natal estuary, approximately 4 miles west of the project activities and beyond the behavioral disturbance threshold. The project timing would also ensure that the majority of juvenile fish are mobile and capable of occupying deeper waters to avoid the 361 meter (0.22 mile) area around the project that would cause injurious noise. The "soft start" technique employed by the Contractor(s) would also ensure that any fish within the vicinity would have an opportunity to leave the area before impact driving begins. Therefore, a small number, relative to the local populations from the Nooksack River, Squalicum Creek, Whatcom Creek, and Padden Creek, of individual juvenile and/or yearling PS Chinook salmon and PS steelhead may be harmed or killed during impact pile driving.

Impact pile driving sound waves may also harm rockfish in each of their life stages if any are within the waters surrounding the Whatcom Waterway during this project activity. These effects would be most impactful to larval bocaccio and yelloweye rockfish, which would not be able to leave the area and could be susceptible to injurious noise levels resulting in lethal or sub-lethal effects. The proposed "soft start" technique would likely limit the presence of juvenile or adult rockfish within the immediate vicinity, but we can expect that rockfish could still be within the 4,642 meter area and would thus be susceptible to behavioral effects. There is insufficient data to determine how many rockfish would be injured or killed as a result of underwater noise levels. However, because of the small spatial area of the BST in relation to the larger, more suitable habitat of Bellingham Bay, the number of bocaccio and yelloweye rockfish injured or killed would be too small to cause detectable effects on local fish populations in the action area.

PS Chinook salmon, PS steelhead, and rockfish could also experience effects to their prey base as a result of underwater noise. It is likely that any forage fish in the area could be exposed to injurious levels of noise associated with pile driving and would lack the ability to move into deeper waters due to their life histories (particularly in the case of Pacific sand lance and surf smelt). Surf smelt utilize the action area year-round for spawning and are therefore expected to be within the nearshore area during pile driving activities. Since forage fish spawning typically takes between 10 days and 5 weeks given the species, we would expect up to 8 broods of forage fish to be impacted by the 72 days of pile driving (WDFW 1998). However, the effects of pile driving would be localized to a small spatial area and would not be expected to result in a significant loss in prey base for the fish foraging within Bellingham Bay. Therefore, construction-related forage reductions would be too small to cause detectable effects among individual PS Chinook salmon in the action area, with no discernable effect to the local PS Chinook, PS/GP bocaccio, and PS/GP yelloweye populations.

Vibratory pile driving

The Project activities would require 56 days of vibratory pile driving activities for a duration of 1.5 hours per day. While impact pile driving produces an intense impulsive underwater noise, vibratory pile driving produces a lower level continuous noise (Duncan et al. 2010) that does not injure fish. Fish consistently avoid sounds like those of a vibratory hammer (Dolat 1997; Enger et al. 1993; Knudsen et al. 1997; Sand et al. 2000) and appear not to habituate to these sounds, even after repeated exposure (Dolat 1997; Knudsen et al. 1997). Therefore, for the vibratory pile driving, it is highly unlikely that fish would be directly harmed by the sound waves. Vibratory pile drivers generally produce less sound than impact hammers and do not produce the kind of impulsive sound associated with fish injuries (Caltrans 2015). Vibratory pile drivers are often employed as a minimization/avoidance measure to reduce the potential for adverse effects on fish that could result from impact pile driving (Caltrans 2015). NMFS does not have established injury threshold criteria for vibratory pile driving for fish (meaning that there is no level at which fish injuries are presumed to occur (Caltrans 2015). However, the vibratory sound waves would carry throughout the action area. Response to vibratory pile driving sound does not typically include avoidance behavior. Masking caused by this source of sound could interfere with juvenile salmonids' ability to detect both prey and predators.. For PS/GP bocaccio, and PS/GP yelloweye should they occur in the action area while pile driving occurs could also experience masking of their calling noises, interfering with their social behavior, potentially impairing reproduction (Kok et al 2021).

<u>Shade</u> –

The proposed replacement of the 9,800 SF portion of the BST would have long-term adverse effects on the features and function of intertidal habitat by extending the useful life of the 9800 SF section of the wharf. The existing wharf creates shade over the intertidal zone, creating a barrier to salmonid movement along the shoreline. Juvenile salmon migrate along the shallow nearshore margins of estuaries and swim along the edges of eelgrass beds and along shadows cast by docks and piers. The eyes of salmonids adjust slowly to changes in light intensity so that salmonids often avoid swimming into shaded areas (Simenstad et al. 1999). In the marine nearshore, there is substantial evidence that overwater structures impede nearshore movements of juvenile salmonids with fish stopping at the edge of the structure and avoiding swimming into the shadow or underneath the structure (Heiser and Finn 1970, Able et al. 1998, Simenstad 1999, Southard et al. 2006, Toft et al. 2007, Ono 2010). As a result of juvenile salmon avoiding overwater structures, some are expected to swim around the structure (Nightingale and Simenstad 2001). This behavior modification would cause them to temporarily swim into deeper water, exposing them to increased predation. Hesitating upon first encountering the structure also exposes salmonids to avian predators.

The continued effect of the BST replacement would directly affect PS Chinook salmon and PS steelhead migrating through the project area by diminishing prey availability (benthic invertebrates) and increasing predation (Shipman et al. 2010, Dethier et al. 2016). 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 structure to be 50 years. In terms of effects of the wharf replacement on the population of PS Chinook salmon and PS steelhead within the action area, the presence of the BST would continue to increase the risk of predation for those individuals that pass through the Whatcom Waterway and reduce the availability of food for them. Therefore, it is likely that a small fraction of those fish may die as a direct result of the BST. However, the effect to the population would not be measurable because only a small fraction of the juveniles from any one cohort are likely to enter the area and be exposed to predation in this particular action area. The vast majority of the fish are likely to swim directly out of Bellingham Bay and not enter the portion of the action area subject to shading effects.

<u>Water Quality –</u>

Exposure to diminished water quality is likely to adversely affect adult PS Chinook and PS steelhead, as well as juvenile PS Chinook salmon, and larval PS/GB bocaccio and PS/GB yelloweye rockfish within the Project vicinity during dredging activities. While adult PS/GB bocaccio and PS/GB yelloweye are likely to be utilizing deeper waters outside of the area of impact, this diminished water quality also has the potential to adversely affect those populations. Water quality would be impaired by suspended sediments and contaminants for a period of up to 3 months.

Suspended sediment

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, gill abrasion, and, at extremely high concentrations, death. 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. Exposure to concentrations of suspended sediments expected during dredging could elicit sub-lethal effects such as a short-term reduction in feeding rate or success, or minor physiological stress such as coughing or increased respiration. In general, fish are more likely to undergo sublethal stress from suspended sediments rather than lethality because of their ability to move away from or out of an area of higher concentration to a lower concentration (Kjelland et al. 2015).

Several reports have documented the behavior of dredged material and sediment resuspension resulting from clamshell dredging and associated open water disposal (Palermo et al. 2009; LaSalle et al. 1991; Havis 1988; McLellan et al. 1989; Herbich and Brahme 1991; Truitt 1988). Laboratory studies have consistently found that the 96-hour lethal concentration of fine sediments for juvenile salmonids is above 6,000 mg/L (Stober et al. 1981) and 1,097 mg/L for 1 to 3-hour exposure (Newcombe and Jensen 1996). LaSalle (1991) determined that the expected concentrations of silty suspended sediment levels during clamshell dredge events was 700 mg/L and 1,100 mg/L at the surface and bottom of the water column, respectively (within approximately 300 ft. of the operation). Sediment in the action area consists primarily of sands which would settle out of the water column faster than fine silt or clay. Suspended sediment from the proposed dredge operations is not expected to reach levels leading to injury of exposed fishes because salmonids are expected to avoid or promptly vacate areas where sediment concentrations are high enough to cause injury. Studies show that salmonids have an ability to detect and distinguish turbidity and other water quality gradients (Quinn 2005; Simenstad 1988). Also, by the time juvenile salmonids are in the marine environment we expect them to be large, so that even with exposure, injury would not result since studies have shown that larger juvenile salmonids are more tolerant to suspended sediment than smaller juveniles (Servizi and Martens 1991; Newcombe and Jensen 1996). Thus, behavioral responses and perhaps cough or gill irritation are the most likely responses, and lasting injury is unlikely to result. The in-water work window has been designed to reduce the presence of juvenile salmonids within the action area to the greatest extent, further reducing juvenile salmonid exposure to suspended sediments. Adult PS Chinook salmon and PS steelhead are expected to be migrating through the action area during operations but are not expected to remain long enough to be significantly impacted. Larval PS/GB bocaccio and PS/GB yelloweye are subject to currents and could be within the area of impact for durations that could cause injury. It is also possible that juvenile rockfish could be utilizing the area and would likewise experience injury. While little data is available about rockfish populations within Bellingham Bay, the suspended sediments resulting from dredging do have the potential to adversely affect rockfish populations in various life stages.

Dissolved oxygen

Habitat and prey resources may be affected through temporary decreases in DO contemporaneous with the increased suspended sediment (Mitchell et al, 1999). "Suspended sediments absorb heat energy thereby raising water temperatures … Turbidity can reduce light transmission through the water and decrease photosynthesis by aquatic plants, consequently affecting dissolved oxygen levels …." (Kjelland et al. 2015, internal citations omitted). Reductions in DO would likely be short lived if they occur at all. Because the window for the dredging operation is between August and February, we anticipate both that water temperatures are likely to remain cold, and inflow from the freshwater environment would be strong, both of which should limit reductions in DO. Fish exposure to decreased DO is therefore not expected to have either an intensity or duration that would be expected to injure fish.

Resuspended contaminants (dredging)
Due to the highly industrialized nature of the project area, numerous sites containing hazardous substances exist in and near the project area. Contaminants in sediments and dissolved in-water can have varying levels of toxicity, most often occurring as sub-lethal effects. The Whatcom Waterway is currently under a consent decree from the Department of Ecology due to the legacy contaminants within the sediments. Elevated concentrations of mercury and dioxin/furans (D/Fs) have been measured in sediments associated with portions of this source control area. Because concentrations of these contaminants exceeded screening levels, the potential effects of those contaminants are discussed in more detail below. Some of the effects of these contaminants to salmon species include:

- Dioxins act similarly on salmon and other fish species. Reported effects on juvenile salmon include a wide range of sub-lethal outcomes including impaired growth and reproduction, hormonal alterations, enzyme induction, alterations to behavior patterns, and mutagenicity (Meador 2002). Eisler (1986) stated that in general, toxicity increased with increasing exposure, crustaceans and younger developmental stages were the most sensitive groups tested, and lower chlorinated biphenyls were more toxic than higher chlorinated biphenyls.
- Exposure to dioxin can result in developmental or reproductive toxicity in fish, birds, and mammals. Fish larvae are among the most sensitive vertebrates to the toxic effects of dioxins/furans (Peterson et al. 1993); and exhibit similar signs of toxicity as other vertebrates including decreased food intake, wasting syndrome, and delayed mortality. Adult fish are less susceptible to dioxin-induced toxicity compared to earlier life stages, requiring considerably higher body burdens to elicit adverse effects (Lanham et al. 2011; Peterson et al. 1993; Walker and Peterson 1992; Walker et al. 1994).
- Predatory fishes (including salmon) are particularly susceptible to mercury bioaccumation, as the primary exposure pathway is through food rather than contaminated water (Peterson et al. 2007). Reported effects of mercury and methylmercury on salmon are lethal and sub-lethal in nature, including latent effects on the feeding behavior and predator avoidance of hatchlings, necrotic injury, impacts to growth, and additional neurological and behavioral effects (Berntssen et al. 2003).

Resuspension of contaminated sediments are proportional to the amount of dredging and the local levels of contamination. Assuming a one percent sediment resuspension rate, approximately 190 CY of material would be resuspended during the course of dredging (Hayes and Wu 2001). In addition, disturbance of the substrate would increase contaminant concentrations by resuspending particulates, thereby allowing more contaminants to transport into the water column. However, measures to limit suspended sediment, such as the dredging techniques, would reduce disturbance of substrate particles and contaminants (Bridges et al 2008). Contaminant concentrations would be increased for up to 3 months during the work window (August 1 to February 15), with potentially harmful acute increases contained within the 150-foot compliance boundary. This compliance boundary would be monitored in accordance with the Project's Water Quality Monitoring Plan issued by Ecology, limiting the spatial extent of impacts associated with resuspended contaminants. Ultimately, once the contaminated sediment has been removed, the concentration of contaminated material in the surrounding environment would decrease and the pathway of exposure for fish through contamination of prey would be reduced in perpetuity. Additionally, the 6-inch layer of clean sand that would be placed in the dredge prism after dredging is complete would further reduce impacts of any remaining contaminated soil to fish.

Stormwater discharge (effluent)
The Project would not result in any new pollution generating impervious surface (PGIS), but it would replace a portion of the existing impervious surface at the BST in order to provide enhanced stormwater treatment at the terminal. Up to 30,000 SF of the BST could be repaved, though the Port estimates that the area will likely be closer to 14,000 SF. The BST is a working port berth and is used frequently for the transport of cargo from large vessels. As a result, the stormwater runoff from the BST is highly likely to contain several contaminants that have proven damaging to fish, including PAHs and microplastics such as 6PPD/6PPD-q from the vehicles regularly operating on the deck. As these contaminants are of particular concern for salmonids, their effects are discussed in greater detail below.

PAHs: A large and growing body of environmental monitoring data (analytical chemistry) has established PAHs as a ubiquitous component of stormwater-driven runoff into the Puget Sound. Whether originating from oils spills or stormwater, PAH toxicity to fish can be framed as a bottom-up approach to understanding the impacts of complex mixtures, where one or more PAH compound may share a common mechanism of action, interact with other chemicals in mixtures, and/or interact with non-chemical variables such as the thermal stress anticipated with a changing regional climate. The historical NOAA research on oils spill and urban stormwater are increasingly converging on a risk framework where certain PAHs (Figure 2) cause a well-described syndrome of involving the abnormal development of the heart, eye and jaw structure, and energy reserves of larval fish (Harding et al. 2020). Over the ensuing 30 years, combined research from NOAA's Alaska Fisheries Science Center (AFSC) and the Northwest Fisheries Science Center (NWFSC) clearly established the developing fish heart as the primary biological target organ for the toxic impacts of water-soluble chemical mixtures derived from petroleum (Incardona 2017; Incardona and Scholz 2016, 2017, 2018; Incardona et al. 2011). At the egg (developing embryo, pre-hatch) and larval stages, organ-specific detoxification pathways (e.g., cytochrome P450 enzymes in the liver) are not yet in place, and therefore do no offer the same intrinsic metabolic protections available to older fish with a fully developed hepatic function. Absent this protective metabolism in larval fish, petroleum-derived hydrophobic compounds such as PAHs bioconcentrate to high tissue levels in fertilized eggs, resulting in more severe corresponding toxicity.

Numerous controlled laboratory exposure-response studies have elucidated a toxicity syndrome with a distinctive and characteristic suite of developmental abnormalities. Severe PAH toxicity is characterized by complete heart failure, with ensuing extra-cardiac defects (secondary to loss of circulation) and mortality at or soon after hatching. More moderate forms of PAH toxicity, such as might be expected for untreated/unfiltered roadway runoff, include acute and latent alterations in subtle aspects of cardiac structure, reduced cardiorespiratory performance and latent mortality in surviving larvae and juveniles. These effects have been studied extensively and characterized in over 20 species of fish at the organismal, tissue and cellular levels (Marty et al., 1997; Carls et al., 1999; Heintz et al., 1999; Hatlen et al., 2010; Hicken et al., 2011; Incardona et al., 2013; Jung et al., 2013; Esbaugh et al., 2016; Morris et al., 2018). Unlike 6PPD-quinone, which varies in hazard across closely related salmonids (e.g., high acute toxicity to coho, low toxicity to chum; McIntyre et al., 2018, 2021), all fish species studied to date are vulnerable to PAH toxicity, with thresholds for severe developmental abnormalities often in the low parts-per-billion (µg/L) range (Figure 2).

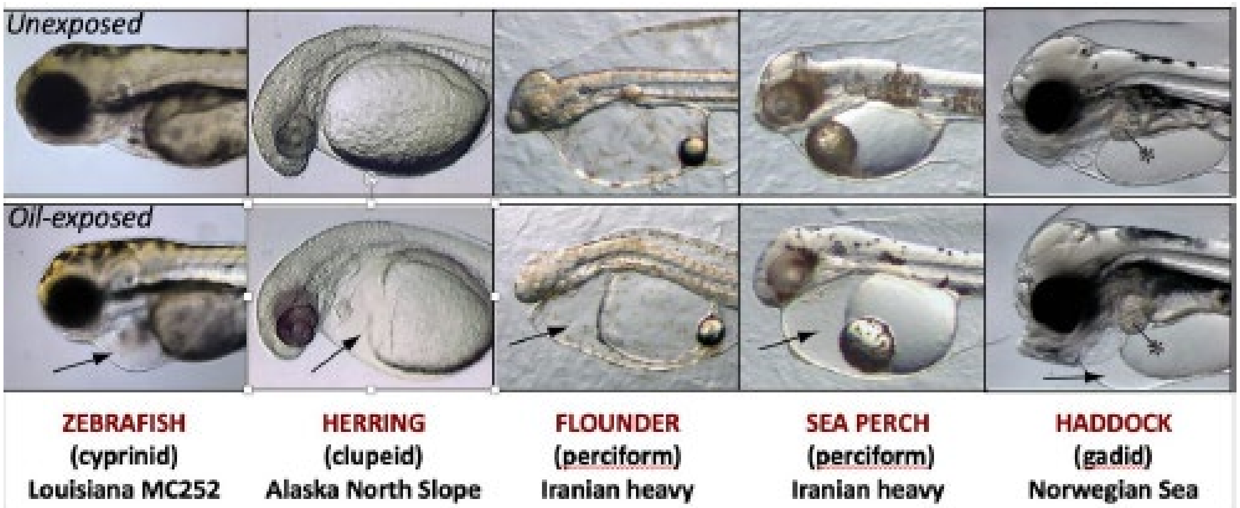

Figure 2. Examples of PAH-induced developmental abnormalities in a wide range of fish species (freshwater to marine, tropical to temperate). Our current understanding of PAH toxicity to fish embryos and larvae is drawn from several NOAA-F studies, representing major lessons learned from the Exxon Valdez and Deepwater Horizon disasters, and has been widely confirmed by independent research groups around the world. The primary form of toxicity is a loss of cardiac function, as exemplified by circulatory failure and accumulation of fluid in the pericardial space around the heart (arrows). The pattern of excess fluid (edema) varies according to the anatomy of each species. Related abnormalities include small eyes, jaw deformities, and a dysregulation of the lipid stores, or yolk, the animal needs to survive to first feeding. This suite of defects, while sublethal, will almost invariably lead to ecological death. Consequently, "delayed-in-time" toxicity is a common risk concern for fish that spawn in PAH-contaminated habitats.

PAH toxicity in fish is often sublethal and delayed in time. The latent impacts of low-level PAH exposures – i.e., representative of the cardiotoxic PAH concentrations and discharge durations comparable with conventional Puget Sound roadway runoff – have been particularly well studied in salmonids (pink salmon, *Oncorhynchus gorbuscha*). Large-scale tagging (mark-and-recapture) studies dating back to Exxon Valdez were among the first to show that embryonic exposure to oil-derived chemical mixtures with total PAH (ΣPAH) levels in the range of 5 - 20 µg/L resulted in cohorts of salmon that survived the exposure (and appeared outwardly normal), but nevertheless displayed reduced growth and reduced survival to reproductive maturity in the marine environment. Follow-up studies at NWFSC have linked this poor survival to reduced individual fitness manifested by reduced swimming performance and subtle changes in cardiac structure. In essence, embryonic exposure to petroleum mixtures leads to juvenile fish that show signs of pathological hypertrophy of the heart (Incardona et al., 2015, 2021; Gardner et al., 2019). The latter is well known to be associated with considerable morbidity and mortality across vertebrate species in general, as evidenced by the downstream consequences of congestive heart failure in humans.

To illustrate how PAHs in runoff from the Puget Sound transportation grid align with historical NOAA research on oil spills, stormwater from the SR520 collection location at the NWFSC in Seattle shows considerable overlap with the pattern of PAHs derived from a pure oil spill (Figure 3). Notably, as an added consequence of the engine internal combustion process, the mixture in stormwater is even more complex due to the appearance of larger numbers of 4-ring and ≥ 5-ring compounds. Much of this higher molecular weight PAH mass is associated with the fine particulate matter from vehicle exhaust. The bioavailability of compounds in waters that receive highway runoff is demonstrated by uptake into passive samplers, which have properties very similar to fish eggs. Passive samples vary in design, but generally consist of a housing for a membrane material that passively accumulates lipophilic compounds such as PAHs, which can subsequently be extracted for chemical analyses. They are particularly useful for profiling patterns of bioavailable PAHs in fish spawning habitats.

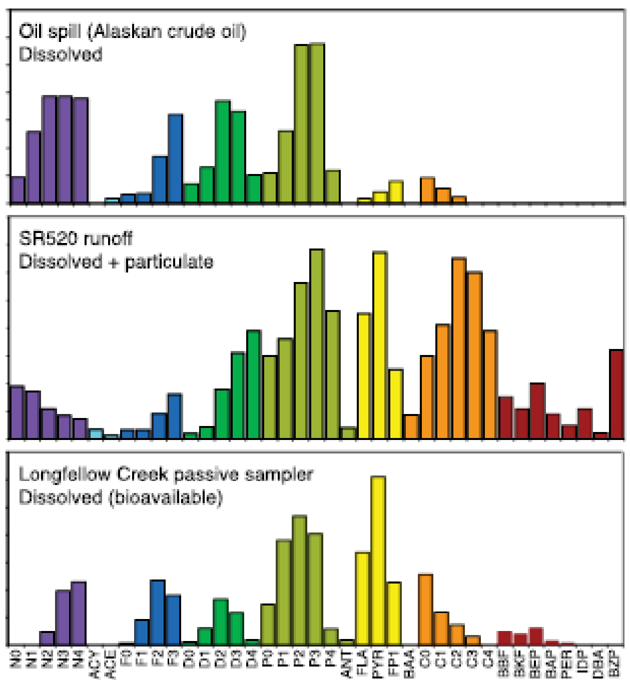

Figure 3. Patterns of PAHs in environmental samples. Top, effluent in seawater flowing over gravel coated with Alaskan crude oil (source for Exxon Valdez). Middle, runoff from the SR520 highway adjacent to NWFSC. Bottom, PAHs extracted from a polyethylene membrane device (PEMD) incubated one week in Longfellow Creek, West Seattle. X-axis shows proportion of total PAH, and values are omitted for simplicity to emphasize overall patterns. Abbreviations: N, naphthalenes; BP, biphenyl; AY, acenaphthylene; AE, acenaphthene; F, fluorene; D, dibenzothiophene; P, phenanthrene; ANT, anthracene; FL, fluoranthene; PY, pyrene; FP, fluoranthenes/pyrenes; BAA, benz[a]anthracene; C, chrysene; BBF, benzo[b]fluoranthene; BKF, benzo[j]fluoranthene/benzo[k]fluoranthene; BEP, benzo[e]pyrene; BAP, benzo[a]pyrene; PER, perylene; IDY, indeno[1,2,3-cd]pyrene; DBA, dibenz[a,h]anthracene/dibenz[a,c]anthracene; BZP, benzo[ghi]perylene. Parent compound is indicated by a 0 (e.g., N0), while numbers of additional carbons (e.g. methyl groups) for alkylated homologs are indicated as N1, N2, etc.

The pattern of bioavailable PAHs in the Seattle-area urban streams depicted above in Figure 3 closely resembles a pure oil spill pattern, with the exception of a larger proportion of combustion-associated 4-ring compounds such as pyrenes and fluoranthenes. Accordingly, urban runoff is a transport pathway for PAHs, and the pattern of bioavailable PAHs closely resembles the relative enrichment of cardiotoxic phenanthrenes. Although more work is needed for Pacific salmonids (e.g., species beyond pink salmon), collected runoff from SR520 containing ΣPAH of 7.5 µg/L produced the stereotypical syndrome of heart failure and associated developmental defects in Pacific herring (Harding et al., 2020). Measured concentrations of PAH runoff from SR520 runoff are often considerably higher than the petroleum toxicity threshold for pink salmon.

6PPD-Quinone**:** After years of forensic investigation, the urban runoff coho mortality syndrome has now been directly linked to motor vehicle tires, which deposit the compound 6PPD and its abiotic transformation product 6PPD-q onto roads. 6PPD or [(N-(1, 3-dimethylbutyl)-N'-phenyl-p-phenylenediamine] is used to preserve the elasticity of tires. 6PPD can transform in the presence of ozone (O3) to 6PPD-q. 6PPD-q is ubiquitous to roadways (Sutton et al., 2019) and was identified by Tian et al., (2020) as the primary cause of urban runoff coho mortality syndrome described by Scholz et al., (2011). Laboratory studies have demonstrated that juvenile coho salmon (Chow et al., 2019), juvenile steelhead, and juvenile Chinook salmon are also susceptible to varying degrees of mortality when exposed to urban stormwater (French et al., 2022). Fortunately, recent literature has also shown that mortality can be prevented by infiltrating road runoff through soil media containing organic matter, which removes 6PPD-q and other contaminants (Fardel et al., 2020; Spromberg et al., 2016; McIntrye et al., 2015). Research and corresponding adaptive management surrounding 6PPD is rapidly evolving. Nevertheless, key findings to date include:

- 6PPD/6PPD-q has been killing coho in Puget Sound urban streams for decades, dating back to at least the 1980s, likely longer (McCarthy 2008; Scholz 2011)
- Wild coho populations in Puget Sound are at a very high risk of localized extinction, based on field observations of adult spawner mortality in > 50 spawning reach stream segments (Spromberg 2011).
- Source-sink metapopulation dynamics (mediated by straying) are likely to place a significant drag on the future abundances of wild coho salmon in upland forested watersheds (the last best places for coho conservation in Puget Sound). In other words, urban mortality syndrome experienced in one part of the watershed could lead to abundance reductions in other populations because fewer fish are available to stray (Spromberg 2011).
- Coho are extremely sensitive to 6PPD-q, more so than most other known contaminants in stormwater (Scholz 2011; Chow 2019; Tian 2020).
- Coho juveniles appear to be similarly susceptible to the acutely lethal toxicity of 6PPD/6PPD-q (McIntyre 2015; Chow 2021).
- The onset of mortality is very rapid in coho (i.e., within the duration of a typical runoff event) (French et al., 2022).
- Once coho become symptomatic, they do not recover, even when returned to clean water (Chow 2019).
- It does not appear that dilution will be the solution to 6PPD pollution, as diluting Puget Sound roadway runoff in 95% clean water is not sufficient to protect coho from the mortality syndrome (French et al., 2022).

- Preliminary evidence indicates an uneven vulnerability across other species of Puget Sound salmon and steelhead, and a need to further investigate sublethal toxicity to steelhead and Chinook salmon. For example, McIntyre et al., (2018) indicate that chum do not experience the lethal response to stormwater observed in coho salmon.
- Following exposure, the onset of mortality is more delayed in steelhead and Chinook salmon (French et al., 2022).
- The mechanisms underlying mortality in salmonids is under investigation, but are likely to involve cardiorespiratory disruption, consistent with symptomology. Therefore, special consideration should be given to parallel habitat stressors that also affect the salmon gill and heart, and nearly always co-occur with 6PPD such as temperature (as a proxy for climate change impacts at the salmon population-scale) and PAHs.
- Simple and inexpensive green infrastructure mitigation methods are promising in terms of the protections they afford salmon and stream invertebrates, but much more work is needed (McIntyre 2014, 2015, 2016; Spromberg 2016).
- The long-term viability of salmon and other Puget Sound aquatic species is the foremost conservation management concern for NOAA, and thus it will be important to incorporate effectiveness monitoring into future mitigation efforts – i.e., evaluating proposed stormwater treatments not only on chemical loading reductions, but also the environmental health of salmon and other species in receiving waters (Scholz 2011).

There is a risk that untreated runoff could cause delayed mortality in ESA-listed salmonids, and also the prey available to salmon and higher-trophic species such as killer whales through losses of nearshore spawning forage fish. The current risk of this mortality has been reduced by the basic stormwater treatment system currently in use at the BST and would be further reduced by the upgrades proposed in this Project. Furthermore, this enhanced treatment will be particularly beneficial at this location, as it would decrease the bioaccumulation of PAHs within juvenile salmonids utilizing the nearby Nooksack tidal delta natal estuary. While this action would provide a long-term benefit to the ESA-listed species discussed above, these risks may not be entirely avoided by treatment.

<u>Disturbed Bottom Sediment and Benthic Communities –</u>
The Project is expected to result in reduced benthic prey abundance and diversity within the dredge prism for several months (and up to three years for complex diversity). Salmonids present in the action area would experience reduced forage opportunity during the in-water work (3 months) and the period of benthic community recovery. Adult PS Chinook salmon and steelhead migrating through the action area on their way to freshwater could experience reduced prey availability as a result of project activities. However, as larger fish they are likely to seek out much larger prey than the benthic communities would provide. Therefore, reduced benthic prey availability is unlikely to adversely affect adult PS Chinook salmon and steelhead. Likewise, this dredge event is unlikely to significantly impact the food sources for adult PS/GP bocaccio and PS/GP yelloweye, which primarily occupy depths greater than 100 ft. and are expected to eat larger fish.

When juvenile salmonids and rockfish occupy the nearshore environment, they must have abundant prey to allow for growth, development, maturation, and general fitness. As dredging dislodges bottom sediments, benthic communities are disrupted where the sediment removal occurs and in adjacent areas where sediment falls out of suspension and layers on top of adjacent benthic areas. The dredging would be completed within one work window (3 months) and therefore we can expect that benthic prey within the dredge footprint would be unavailable to juvenile salmonids and rockfish for the duration of work. Several studies have demonstrated that benthic organisms rapidly recolonize habitats disturbed by dredging (McCabe et al, 1996; Quinn et al, 2003; Richardson et al, 1977; Van Dolah et al, 1984). However, the speed of recovery by benthic communities is affected by several factors, including the intensity of the disturbance, with greater disturbance increasing the time to recovery (Dernie et al, 2003). The infaunal community within Bellingham Bay would be expected to recover toward baseline levels within several months with full recruitment of prey complexity and abundance taking up to 3 years. Given the relatively small dredge prism being affected and the high level of mobility that juvenile salmonid migrants and rockfish have when they reach the marine environment, it is unlikely that many individual fish would experience reduced growth, fitness, or survival resulting from these impacts to benthic prey communities. Even if several fish from each cohort of each population experience diminished foraging success, this would likely be a transitory condition and the fish would be expected to move to nearby areas with more prey availability. Exposure to the small area of impact would likely result in only minimal reduced prey consumption, if any. Therefore, the level of impact would be impossible to detect numerically and the reduced abundance in juvenile salmonids and rockfish is insufficient to be discerned as an influence on productivity of the populations.

<u>Entrainment –</u>
Entrainment is a pathway of effect that is specifically an impact on fish, or a "direct effect," rather than a habitat effect which fish experience and respond to. In the context of this project, entrainment refers to the uptake of aquatic organisms by dredge equipment. Clamshell dredges entrain organisms that are captured within the bucket. The likelihood of entrainment increases with a fish's proximity to the dredge and the frequency of interactions.

Mechanical dredges commonly entrain slow-moving and sessile benthic epifauna along with burrowing infauna that are removed with the sediments. They also entrain algae and aquatic vegetation. There is little evidence of mechanical dredge entrainment of mobile organisms such as fish (though rockfish larvae would be more susceptible to entrainment, should they be present in the area). In order to be entrained, an organism must be directly under the bucket when it drops. The small size of the bucket, compared against the distribution of the organisms across the available habitat make this situation highly unlikely, and that likelihood would decrease after the first few bucket cycles because mobile organisms are most likely to move away from the disturbance. Further, mechanical dredges move very slowly during dredging operations, with the barge typically staying in one location for many minutes to several hours, while the bucket is repeatedly lowered and raised within an area limited to the range of the crane arm. Most fish in the vicinity of the dredge at the start of the operation would likely swim away to avoid the noise and activity. "Carlson et al. (2001) documented the behavioral responses of salmonids to dredging activities in the Columbia River using hydroacoustics. During dredging operations, out-migrating salmon smolt (Oncorhynchus spp., likely fall Chinook salmon and coho salmon (*O. kisutch*)) behavioral responses ranged from (1) salmon orienting to the channel margin move inshore when encountering the dredge, (2) most out-migrating salmon passing inshore moved offshore upon encountering the discharge plume, and (3) out-migrating salmon were observed to assume their prior distribution trends within a short time after encountering both the dredging activity and dredge plume" (Kjelland et al. 2015).

Entrainment can also occur during material placement, when the material falls through the water column, generating a plume that extends from the bottom of the vessel to the seafloor. Fish that are above the point of discharge or are otherwise not directly below a discharge plume are likely to detect the plume and attempt to evade the descending material as a perceived threat. Based on the available research, fish are likely to initially dive and then initiate horizontal evasion. Fish that are below a discharge plume are likely to initially dive and then initiate horizontal evasion, or to simply move laterally if already on or near the bottom. The determining factor in avoiding entrainment would be whether the fish can swim fast enough to move out of the discharge field once the fish detects the threat. The risk of entrainment would increase with proximity to the center of the plume and/or to the seafloor. Individuals that become entrained, or are unable to escape before contact with the substrate are likely to be buried under the sediments. The likelihood of injury or mortality would again increase with proximity to the center of the discharge field where depth and weight of the sediments would be greatest.

As stated above, the probability of fish entrainment is largely dependent upon the likelihood of fish occurring within the dredge prism, dredge depth, fish densities, the entrainment zone (water column of the clamshell impact), location of dredging within Bellingham Bay, type of equipment operations, time of year, and species life stage. Benthic organisms are most likely to be entrained as they reside on or in the bottom substrates. Consequently, the risk of entrainment of ESA-listed species by the dredge is extremely low.

Summary of construction effects on listed species

Some fish from each of the listed species discussed above are expected to be present during project construction either in their larval stage, as juveniles, or as adults. Most juvenile salmonids present will be migrating juveniles with limited exposure to the effects of the proposed action, with PS Chinook salmon likely to have greater exposure than PS steelhead based on their greater degree of nearshore dependence. Adult PS Chinook salmon and PS steelhead are both likely to be present for a limited duration during Project activities but are not expected to be as adversely impacted as juveniles within the action area. Populations of PS/GB bocaccio and PS/GB yelloweye within Bellingham Bay are not well documented, however their presence is assumed. Due to their life histories, larval rockfish are likewise expected to experience a greater impact than adults.

Most of the fish present would incur short-term stress or other sublethal responses due to interaction with construction equipment, noise, increased energetic costs, and reduced water quality and foraging ability. This stress and other sublethal responses are likely to reduce long-term fitness for some of these fish. A few other fish may die due to the combination of multiple factors, such as the stresses caused by the proposed action combined with other stressors within the environmental baseline but unrelated to the proposed action (e.g., the significant shoreline armoring, vessel use, and stormwater discharge within Bellingham Bay). Any fish in the vicinity of injurious noise levels, as discussed above, may be injured or killed. Death and reduced fitness are most likely to cause minimal, reduced abundance in one cohort of PS Chinook salmon and PS steelhead and the remaining effects would be indiscernible against other factors affecting abundance. We would expect effects to rockfish to be greater due to the susceptibility of rockfish larvae to project-related impacts. However, given the small project area and limited duration of work, these effects are not expected to result in widespread effects to any populations of rockfish in Bellingham Bay. Therefore, effects of Project activities on ESA-listed species are unlikely to result in population-level consequences for exposed populations.

Effects of Compensatory Mitigation

To address impacts to aquatic habitats, the Port of Bellingham would use the PSP program for compensatory mitigation requirements for this Project. The purchase of mitigation credits would address the loss of ecosystem functions due to the modification of habitat. The purchased credits are expected to achieve a no-net-loss of habitat function as a result of this proposed action, which are needed to help ensure that populations of PS Chinook salmon do not drop below the existing 1-2 percent juvenile survival rates (Kilduff et al. 2014, Campbell et al. 2017). PS Chinook salmon juvenile survival is directly linked to the quality and quantity of nearshore habitat. Campbell et al. have most recently added to the evidence and correlation of higher juvenile survival in areas where there is a greater abundance and quality of intact and restored estuary and nearshore habitat. There is also emerging evidence that without sufficient estuary and nearshore habitat, significant life history traits within major population groups are being lost. The purchase of 305 credits from PSP would completely mitigate the long-term impacts to salmonids, rockfish, and their critical habitat.

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 and 402.17(a)). Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the ESA.

Some continuing non-Federal activities are reasonably certain to contribute to climate effects within the action area. However, it is difficult if not impossible to distinguish between the action area's future environmental conditions caused by global climate change that are properly part of the environmental baseline *vs.* cumulative effects. Therefore, all relevant future climate-related environmental conditions in the action area are described earlier in the discussion of environmental baseline (Section 2.4). Because Whatcom Waterway and the nearshore environment of Bellingham Bay are expected to remain highly industrialized and utilized for several decades to come, we do expect climate change conditions to become more pronounced over that time period, which we anticipate may disrupt important habitat features and ecosystem functions that are critical to the survival and recovery of the species discussed in Section 2.5.2.

Other than commercial and recreational use of the waters, NMFS does not expect any new non-Federal activities within the action area, as work within the water would fall under federal authorities such as the Clean Water Act. However, at the watershed scale, future upland development activities lacking a federal nexus would continue and are expected to lead to increased impervious surface, surface runoff, and non-point discharges. NMFS expects these activities to continue in perpetuity, degrading water quality and exerting a negative influence on

ESA-listed species. Any future federal actions would be subject to a Section 7(a)(2) consultation under the ESA.

2.6. Integration and Synthesis

The Integration and Synthesis section is the final step in assessing the risk that the proposed action poses to species and critical habitat. In this section, we add the effects of the action (Section 2.5) to the environmental baseline (Section 2.4) and the cumulative effects (Section 2.6), taking into account the status of the species and critical habitat (Section 2.2), to formulate the agency's biological opinion as to whether the proposed action is likely to: (1) reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing its numbers, reproduction, or distribution; or (2) appreciably diminish the value of designated or proposed critical habitat as a whole for the conservation of the species.

The species considered in this opinion are listed as threatened or endangered with extinction due to declines in abundance, poor productivity, reduced spatial structure, diminished diversity. Factors contributing to this status includes reduced quantity and/or quality of habitat, including reduced prey availability. Systemic anthropogenic detriments in freshwater and marine habitats are impairing populations of PS Chinook salmon, PS steelhead, PS/GB bocaccio, and PS/GB yelloweye within Bellingham Bay, and these are often described as limiting factors.

The environmental baseline in the action area is primarily composed of vessel infrastructure as well as commercial development landward of the HAT that degrades nearshore habitat conditions for listed species. Within the action area there are sources or noise and shade (vessels and wharfs), water quality impairments (non-point sources), and artificial light (marinas and piers).

To this context of species status and baseline conditions, we add the effects of the proposed action, together with cumulative effects (future water quality impairment and stressors associated with climate change), in order to determine the effect of the project on the likelihood of species' survival and recovery. We also evaluate if the project's habitat effects would appreciably diminish the value of designated critical habitat for the conservation of the listed species. Such alterations may include, but are not limited to, those that alter the physical or biological features essential to the conservation of a species or that preclude or significantly delay development of such features.

2.6.1 ESA Listed Species

Because the work window is timed when juvenile salmon peak migration is avoided, we expect that the number of juvenile PS Chinook salmon and juvenile PS steelhead exposed to water construction effects will be low, and that the responses of the exposed fish will largely be behavioral, with very little reduction in fitness, injury, or mortality. PS/GB bocaccio and PS/GB yelloweye rockfish are more likely to be injured or killed as a result of project activities, particularly given their high susceptibility to impacts in their larval stages. There is limited data available on rockfish populations within Bellingham Bay, but it is expected that if present, PS/GB bocaccio and PS/GB yelloweye would experience the greatest effects from the proposed

Project. However, the limited size and duration of Project activities are unlikely to cause disruptions to these species on a population level.
The most chronic of the temporary effects – reduced benthic prey for up to approximately 3 years – should not affect fitness, growth, or survival of enough fish to discernably reduce abundance of any cohort of any population within those 3 years. As described earlier in this document, long-term habitat effects are expected to be fully offset, and therefore are expected to have no influence on the viability parameters of these species.

Accordingly, when NMFS adds the very small reduction in numbers of PS Chinook salmon, PS steelhead, PS/GB bocaccio, and PS/GB yelloweye rockfish, as a consequence of their exposure to the temporary effects, to the baseline, even when considered with cumulative effects, the reduced abundance is insufficient to alter the productivity, spatial structure, or genetic diversity of any of the species. Therefore the action does not appreciably reduce the likelihood for survival and recovery of the listed species.

2.6.2 Critical Habitat

The temporary effects on features of designated critical habitat for the ESA-listed species would be water quality (PS Chinook salmon and SRKW), benthic disturbance (PS Chinook salmon, PS/GB bocaccio and PS/GB yelloweye rockfish), and noise (PS Chinook salmon, SRKW, PS/GB bocaccio, and PS/GB yelloweye rockfish). We expect diminishment of water quality based on turbidity, though suspended sediments would remain high several hours after dredging ceases. Turbidity would diminish water quality for up to 3 months in the work window, and would affect approximately 3.1 acres. Because the duration is brief, primarily occurs when juveniles are not relying on the habitat in high numbers for growth or development, the impaired water quality PBF does not diminish conservation values of the action area. Furthermore, the removal of 19,000 CY of contaminated sediment would result in a net benefit for the water quality PBF in the long term. These positive effects would be incremental but permanent within the action area.

The effects on benthic communities is also temporary, but much more persistent. The dredge prism would take up to 3 years to fully recover from Project activities, with noticeable areas of recovery beginning on the outer edges of the dredged area, starting weeks to months after dredging is completed. Despite the duration of this effect, the forage PBF diminishment is not sufficient to reduce conservation values of the action area and the reduced forage base would be most noticeable in the first year.

The replacement of part of the BST would perpetuate a long-term effect on features of designated critical habitat for PS Chinook salmon and PS/GB bocaccio through increased predation and reduction in benthic communities. Additionally, the stormwater treatment upgrades would reduce water quality impairment resulting from stormwater discharge, but would not eliminate that impairment source entirely. Compensatory mitigation, through the purchase of PSP credits, is reasonably certain to offset the long-term loss of habitat function from the replacement of the overwater structure, resulting in a net-zero-loss of habitat function. The temporary impacts that disrupt benthic environments would diminish juvenile fish rearing habitats and food sources in the action area; however, when scaled up to the designation scale, the effects are not expected to impact the designated critical habitat.

2.7. Conclusion

After reviewing and analyzing the current status of the listed species and critical habitat, the environmental baseline within the action area, the effects of the proposed action, the effects of other activities caused by the proposed action, and the cumulative effects, it is NMFS' biological opinion that the proposed action is not likely to jeopardize the continued existence of PS Chinook salmon, PS steelhead, PS/GB bocaccio, PS/GB yelloweye rockfish, or SRKW or their designated critical habitats.

2.8. Incidental Take Statement

Section 9 of the ESA and Federal regulations pursuant to section 4(d) of the ESA prohibit the take of endangered and threatened species, respectively, without a special exemption. "Take" is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. "Harm" is further defined by regulation to include significant habitat modification or degradation that actually kills or injures fish or wildlife by significantly impairing essential behavioral patterns, including breeding, spawning, rearing, migrating, feeding, or sheltering (50 CFR 222.102). "Harass" is further defined by interim guidance as to "create the likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt normal behavioral patterns which include, but are not limited to, breeding, feeding, or sheltering." "Incidental take" is defined by regulation as takings that result from, but are not the purpose of, carrying out an otherwise lawful activity conducted by the Federal agency or applicant (50 CFR 402.02). Section 7(b)(4) and section 7(o)(2) provide that taking that is incidental to an otherwise lawful agency action is not considered to be prohibited taking under the ESA if that action is performed in compliance with the terms and conditions of this ITS.

2.8.1 Amount or Extent of Take

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

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

1. Take in the form of injury, death, or harm of PS Chinook salmon, PS steelhead, and rockfish from noised during pile driving with an impact hammer. The extent of take for hydroacoustic effects is a maximum of 12 consecutive hours with a 12-hour delay before resuming each day's pile driving, for a total of 72 days of pile driving. This surrogate indicator of take is both easily observable, and is causally linked to incidental take by hydroacoustic impacts because the amount of take increases incrementally with each pile

strike and hydroacoustic impacts go back to baseline SELs after a 12-hour delay.

2. Take in the form of harm of juvenile PS salmonids from predacious fish utilizing shade cast by BST, and the construction vessels. The extent of take is the size of the overwater structure (9,800 SF) for expected 40 year life of the structure, together with an additional vessel-cast shade during construction. These metrics are observable, and are causally related to the take because a larger shaded area or a longer period of shade would increase the suitability of the area to predacious fish/increase risk of predation.

3. Take in the form of harm of PS Chinook salmon, PS steelhead, and rockfish from sediment/contaminated sediment, and from reduced prey availability. The extent of take is the size of the dredge prism (134,000 SF, or 3.1 acres). This metric is easily observed, and is causally related because dredging a larger area will increase the amount of suspended sediment, and will increase the area of impaired benthic prey communities.

4. Take in the form of injury or death of juvenile and adult PS Chinook salmon, PS steelhead, PS/GB bocaccio, and PS/GB yelloweye rockfish from exposure to toxic chemicals in stormwater effluent discharged from the outfall. The surrogate indicator for the extent of take for discharge of stormwater effluent is the area of existing PGIS which would be repaved to accommodate the stormwater and electrical upgrades at the BST. This area is estimated to be 14,000 SF but could be up to 30,000 SF (or 2% of the surface area of the BST). This take indicator is causal and proportional to the take identified in this Opinion as it directly affects the amount of stormwater pollution that would be directed to the new treatment. Take would be exceeded if the amount of replaced PGIS is more than 30,000 SF and/or any area that is not currently pollution-generating is converted to PGIS.

5. Take in the form of injury or death of juvenile PS Chinook salmon, PS/GB bocaccio, and PS/GB yelloweye rockfish from entrainment during dredging activities. The extent of take is the size of the dredge prism (134,000 SF, of 3.1 acres). This metric of take is easily observed, and is causally related because dredging a larger area will increase the area in which fish are at risk of entrainment.

2.8.2 Effect of the Take

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

2.8.3 Reasonable and Prudent Measures

"Reasonable and prudent measures" are measures that are necessary or appropriate to minimize the impact of the amount or extent of incidental take (50 CFR 402.02). MARAD should ensure that the Port of Bellingham:

1. Minimize take associated with stormwater pollution discharging from the site.

2. Minimize take associated with shade.

3. Minimize take associated with pile driving.

4. Ensure completion of a monitoring and reporting program to confirm the take exemption for the proposed action is not exceeded, and that the terms and conditions in this incidental take statement are met.

2.8.4 Terms and Conditions

In order to be exempt from the prohibitions of section 9 of the ESA, the Federal action agency must comply (or must ensure that any applicant complies) with the following terms and conditions. The MARAD or any applicant has a continuing duty to monitor the impacts of incidental take and must report the progress of the action and its impact on the species as specified in this ITS (50 CFR 402.14). If the entity to whom a term and condition is directed does not comply with the following terms and conditions, protective coverage for the proposed action would likely lapse.

1. The following term and condition implements reasonable and prudent measure 1:

   a. The Port shall install and regularly maintain and enhanced treatment stormwater treatment facility, in accordance with the guidance outlined by the Washington State Department of Ecology. The enhanced treatment system, once selected, shall meet the qualifications outlined by the Washington State Technology Assessment Protocol – Ecology (TAPE) Program, or be approved as a functionally equivalent technology.

2. The following term and condition implements reasonable and prudent measure 2:

   Berth barges for the purpose of construction shall remain in place continuously for a period no longer than 4 months.

3. The following term and condition implements reasonable and prudent measure 3:

   When possible, drive piles in the dry, and when driving piles in water, use a confined bubble curtain or similar sound attenuation system capable of achieving up to 5 dB of sound attenuation during impact pile driving.

4. The following terms and conditions implement reasonable and prudent measure 4:

   a. Provide a post-project "as built" report that indicates

      i. the size of the dredged area, amount of sediment removed, and dates of initiation and completion of dredging activities.
      ii. the number of strikes per pile, the number of piles installed, the type of piles installed, the time between pile installation sessions, the total days

of pile driving, the type and use of sound attenuation device, and type of driving hammer used.

iii. completed dimensions of the structure to ensure that the replaced portion of the BST does not exceed 9,800 SF and the replaced portion of creosote decking does not exceed 660 SF of overwater coverage.

iv. the total area of replaced PGIS,

v. the selected proprietary stormwater treatment system

vi. Provide a post-project report informed by the Marine Mammal Monitoring. Document the number of times work was ceased to avoid exposure of whales, the type of whale/s sighted, the location and date of the sighting/s.

b. Fish Impacts Monitoring. While in-water work occurs, make regular visual survey for distressed, injured, or dead fish. Collect dead specimens and have them identified by species. Include results in the post-project reporting.

c. The Port or its contractor must submit these monitoring reports within 60 days of the completion of each project activity (e.g., pile driving, dredging, etc.) to:
ProjectReports.wcr@noaa.gov
Reference Project #: WCRO-2022-00335
CC: sara.m.tilley@noaa.gov

2.9. Conservation Recommendations

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

Continue to support the recovery of ESA-listed species and critical habitat in the Puget Sound through restoration efforts such as removal of derelict overwater structures, replacement of creosote, routine maintenance and cleanup of existing overwater facilities, and applicable upgrades to stormwater facilities with future advances in stormwater science and treatment wherever feasible at the port facilities and adjacent areas in the bay.

2.10. Reinitiation of Consultation

This concludes formal consultation for the Port of Bellingham Marine Infrastructure and Maintenance Project.

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

2.11. "Not Likely to Adversely Affect" Determinations

There are several potential pathways of effect for Southern Resident Killer Whale (SRKW) and humpback whale for this Project, underwater noise, water quality impacts, and prey availability (particularly for SRKW). These pathways for effects are not discountable, and therefore we evaluate if exposure and response will be insignificant

<u>Noise</u> –

Impact pile driving

The NMFS has identified Level A (potential injury) and Level B (potential disturbance) thresholds for cetaceans based on their hearing class. Humpback whales are low-frequency cetaceans with a Level A threshold of 183 dB SEL_{cum} and a Level B threshold of 160 dB RMS. SRKW are mid-frequency cetaceans with a Level A threshold of 185 SEL_{cum} and a Level B threshold of 160 dB RMS. Any humpback whale or SRKW within 1,000 meters could experience noise from impact pile driving. Furthermore, any humpback whale within 360.8 meters and any SRKW within 12.8 meters could experience potential injury during impact pile driving activities (Table 4). According to the Orca Network, there have been two sightings of SRKW and four sightings of humpback whale within the action area in the past 5 years. Therefore, although unlikely, it is possible that either species could be within the action area during project activities.

Table 5. Distance to reach NMFS accepted threshold for the onset of physical injury (Level A) and potential behavioral disturbance (Level B) to marine mammals from unattenuated impact pile proofing under the proposed Project.

	Low Frequency Cetaceans (SRKW)	**Mid Frequency Cetaceans (Humpback Whale)**
NMFS accepted threshold (Level A)	183 dB SEL_{cum}	185 SEL_{cum}
Distance (m) to threshold	**360.8**	**12.8**
NMFS accepted threshold (Level B)	160 dB RMS	160 dB RMS
Distance (m) to threshold	**1,000**	**1,000**

The Port or its contractor(s) will establish an exclusion zone of 1,000 meters (0.62 mile) during impact pile driving activities and monitor the boundary of the exclusion zone for the presence of cetaceans 30 minutes prior to, and during all, pile driving (see Appendix B for Marine Mammal Monitoring Plan and Appendix C for revised pile driving specifications and injury threshold distances). This exclusion zone will encompass the full areas in which potential injury (Level A) and behavioral disruption (Level B) could occur. There will be one to two land-based observers stationed in areas that will allow them to view the entire exclusion zone. If a monitor observes a cetacean approaching or within the exclusion zone, the applicant will cease pile driving or drilling activities until the cetacean leaves the action area or has not been detected within the action area for 30 minutes. Consequently, we do not expect that exposure to noise associated with impact pile driving would occur long enough to haram or injure either SRKW or humpbacks.

Vibratory pile driving

Vibratory pile driving and drilling have the potential to yield adverse effects to the ESA-listed cetaceans from the generation of underwater sound pressure levels, if those levels exceed established injury thresholds (Table 5). NMFS revised its Technical Guidance for Assessing the Effects of Anthropogenic Noise on Marine Mammal Hearing in April 2018, which provides threshold for injury and behavioral disturbance for various noise sources and has identified Level A (potential injury) and Level B (potential disturbance) thresholds for cetaceans based on their hearing class. Humpback whales are low-frequency cetaceans with a Level A threshold of 183 dB SEL_{cum} and a Level B threshold of 160 dB RMS. SRKW are mid-frequency cetaceans with a Level A threshold of 185 SEL_{cum} and a Level B threshold of 160 dB RMS. Any humpback whale or SRKW within 2,512 meters (1.56 miles) could experience potential disturbance during vibratory pile removal or driving. Furthermore, any humpback whale within 19.3 meters and any SRKW within 1.7 meters could experience potential injury while the vibratory hammer is in use (Table 5).

Table 6. Distance to reach NMFS accepted threshold for the onset of physical injury (Level A) and potential behavioral disturbance (Level B) to marine mammals from unattenuated vibratory pile installation under the proposed Project.

	Low Frequency Cetaceans (SRKW)	**Mid Frequency Cetaceans (Humpback Whale)**
NMFS accepted threshold (Level A)	199 dB SEL_{cum}	198 SEL_{cum}
Distance (m) to threshold	**19.3**	**1.7**
NMFS accepted threshold (Level B)	130 dB RMS	130 dB RMS
Distance (m) to threshold	**2,512**	**2,512**

The Port or its contractor(s) will establish an exclusion zone of 2,512 meters during vibratory hammer use for pile driving activities and monitor the boundary of the exclusion zone for the presence of cetaceans 30 minutes prior and during all pile driving activities (see Appendix B for Marine Mammal Monitoring Plan and Appendix C for revised pile driving specifications and injury threshold distances). This exclusion zone will encompass the full areas in which potential injury (Level A) and behavioral disruption (Level B) could occur. There will be one to two land-based observers stationed in areas that will allow them to view the entire exclusion zone. If a monitor observes a cetacean approaching or within the exclusion zone, the applicant will cease pile driving or drilling activities until the cetacean leaves the action area or has not been detected within the action area for 30 minutes. Consequently, we do not expect that exposure to noise associated with vibratory pile removal or driving would long enough to cause harm or injury to SRKW or humpbacks.

Water Quality –
Dredging will result in water quality impacts in the form of turbidity, suspended sediments, reduced DO, and resuspended contaminants, all of which could potentially affect humpback whale and SRKW and will, in fact, adversely affect designated critical habitat for SRKW. The Orca Network reports a total of two sightings of SRKW and four sightings of humpback whale within the action area over the past five years. Therefore, SRKW and humpback whale could be migrating through Bellingham Bay during the 3 months when dredging occurs. It is extremely unlikely, however, that either species would be utilizing the nearshore of Bellingham Bay at any time. As the area of impact during the dredge event will not extend beyond 150 feet from the dredge prism, these effects are considered discountable. Additionally, the Project proposes two actions that will benefit water quality in the long-term: the dredging of 19,000 CY of contaminated sediments from Whatcom Waterway, and the upgrades to the stormwater treatment system at the BST. Exposure to residual contaminants in the effluent post treatment is not expected to occur at an intensity or duration sufficient to cause adverse response in any individual SRKW.

Prey Availability –
The proposed project is likely to affect the quantity of SRKW's preferred prey, which is Chinook salmon. However, as described in section 2.4, the small number of affected juvenile PS Chinook salmon likely to be adversely affected is sufficient to alter viability parameters (productivity, spatial structure, diversity) of the species. In other words, the proposed Project is not expected to measurably decrease the number of adult PS Chinook salmon available to SRKW as prey (Greene et al 2005, Duffy et al 2011). Therefore, SRKW are insignificantly affected by this project's effects on prey. Humpback prey species (eg, krill and small schooling fish) are not known to be limiting, and any reduction in their prey associated with effects of this action are not expected to impair prey availability.

All effects of the proposed action are insignificant for SRKW and humpbacks.

Designated critical habitat for humpback whale and PS steelhead do not exist within the action area of this Project and thus there are no anticipated effects of the proposed action to these critical habitats. There is no nearby designated critical habitat for humpback whale, however, there is designated critical habitat for PS steelhead within the action area's immediate vicinity. The closest PS steelhead critical habitat is within the Nooksack River, Padden Creek, Whatcom Creek, and Squalicum Creek, and underwater noise impacts are expected to extend to the mouth of these streams within the Puget Sound but not travel up into the streams themselves. As a result, the project activities would not diminish the value of this habitat. Therefore, the Project is not likely to adversely affect the designated critical habitat for PS steelhead or humpback whale.

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

Section 305(b) of the MSA directs Federal agencies to consult with NMFS on all actions or proposed actions that may adversely affect EFH. Under the MSA, this consultation is intended to promote the conservation of EFH as necessary to support sustainable fisheries and the managed species' contribution to a healthy ecosystem. For the purposes of the MSA, EFH means "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity", and includes the physical, biological, and chemical properties that are used by fish (50 CFR 600.10). Adverse effect means any impact that reduces quality or quantity of EFH, and may include direct or indirect physical, chemical, or biological alteration of the waters or substrate and loss of (or injury to) benthic organisms, prey species and their habitat, and other ecosystem components, if such modifications reduce the quality or quantity of EFH. Adverse effects 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) of the MSA also requires NMFS to recommend measures that can be taken by the action agency to conserve EFH. Such recommendations may include measures to avoid, minimize, mitigate, or otherwise offset the adverse effects of the action on EFH [CFR 600.905(b)].

This analysis is based, in part, on the EFH assessment provided by the MARAD and descriptions of EFH for Pacific Coast groundfish (Pacific Fishery Management Council (PFMC 2005), coastal pelagic species (CPS) (PFMC 1998), and Pacific Coast salmon (PFMC 2014) contained in the fishery management plans developed by the PFMC and approved by the Secretary of Commerce.

3.1. Essential Fish Habitat Affected by the Project

The entire action area fully overlaps with identified EFH for Pacific Coast Groundfish, Pacific Coast Salmon, and Coastal Pelagic Species. The Project is located within the Whatcom Waterway, where aquatic conditions consist of marine waters from Bellingham Bay transitioning with freshwater from Whatcom Creek, the Nooksack River, Squalicum Creek, and Padden Creek to create nearshore estuarine habitat. Several patches of kelp and eelgrass have been documented within the project vicinity. The action area also encompasses deeper waters within Bellingham Bay. Therefore, we have determined that the proposed action would adversely affect the EFH of Pacific Coast Groundfish, Pacific Coast Salmon, and Coastal Pelagic Species.

3.2. Adverse Effects on Essential Fish Habitat

The proposed actions would cause negative impacts on the quality of habitat by increasing suspended sediment, disturbing benthic communities, increasing concentrations of waterborne contaminants, altering intertidal habitat function by replacing an overwater structure, and creating noise impacts from pile driving activities. The project’s adverse effects are described more fully in Section 2 of this document.

All of the Project activities mentioned above have the potential to adversely affect EFH for Pacific Coast groundfish, Pacific Coast salmon, and coastal pelagic species. However, the effects associated with water quality and noise are expected to be temporary in nature and return to baseline conditions upon completion of the project. Benthic community complexity and abundance is expected to return to baseline levels up to 3 years after the dredge event. The replacement of the overwater structure would have the longest enduring impact on EFH, as it would perpetuate the disruption of intertidal habitat for the life of the structure. The removal of contaminated sediments would improve habitat quality and ecological function over the long term.

Offsetting Actions
The proposed project would have temporary and enduring effects on EFH water bottoms and water columns. These effects culminate in short-term (construction-related) and long-term adverse effects on Pacific Coast groundfish, Pacific Coast salmon EFH, and coastal pelagic species. The proposed action incorporates a number of minimization measures to avoid, reduce, and minimize the adverse effects of the action on EFH. To offset the remaining negative habitat effects, the applicant purchased mitigation though the PSP program. NMFS ran the NHVM which can be found in Appendix A.

3.3. Essential Fish Habitat Conservation Recommendations

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

1. Take care when removing piles to minimize bed disturbance and suspended sediments. Utilize a containment boom to collect any floating debris and sheen while creosote-treated piles are being removed.
2. Do not allow work barges or work boats to ground out in the mudline
3. Monitor turbidity and other water quality parameters to ensure that construction activities are compliant with Washington State Surface Water Quality Standards per WAC 173-201A.
4. Develop a Spill Prevention and Control Countermeasures Plan to address how fuels and hazardous materials onsite shall be stored, used, and cleaned up in the event of a spill.
5. Dispose of dredged materials at an approved upland site.
6. Utilize methods to reduce in-water noise, such as the use of a soft-start technique, the implementation of a bubble curtain or similar noise reduction device, and the use of a vibratory hammer when feasible.
7. Use of a clamshell dredge. A clamshell dredge is the best available technique to minimize sediment input into the water column, reducing the likelihood of significant increases in turbidity/suspended sediment.
8. Develop and implement an adaptive management plan for stormwater treatment, which actively pursues and applies upgrades to its treatment methods with future developments in stormwater science and treatment.

Fully implementing these EFH conservation recommendations would protect, by avoiding or minimizing the adverse effects described in section 3.2, above, for Pacific Coast salmon, Pacific Coast groundfish, and coastal pelagic species.

3.4. Statutory Response Requirement

As required by section 305(b)(4)(B) of the MSA, the MARAD must provide a detailed response in writing to NMFS within 30 days after receiving an EFH Conservation Recommendation. Such a response must be provided at least 10 days prior to final approval of the action if the response is inconsistent with any of NMFS' EFH Conservation Recommendations unless NMFS and the Federal agency have agreed to use alternative time frames for the Federal agency response. The response must include a description of the measures proposed by the agency for avoiding, minimizing, mitigating, or otherwise offsetting the impact of the activity on EFH. In the case of a response that is inconsistent with the Conservation Recommendations, the Federal agency must explain its reasons for not following the recommendations, including the scientific justification for any disagreements with NMFS over the anticipated effects of the action and the measures needed to avoid, minimize, mitigate, or offset such effects [50 CFR 600.920(k)(1)].

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

3.5. Supplemental Consultation

The MARAD must reinitiate EFH consultation with NMFS if the proposed action is substantially revised in a way that may adversely affect EFH, or if new information becomes available that affects the basis for NMFS' EFH Conservation Recommendations [50 CFR 600.920(l)].

4. DATA QUALITY ACT DOCUMENTATION AND PRE-DISSEMINATION REVIEW

The Data Quality Act (DQA) specifies three components contributing to the quality of a document. They are utility, integrity, and objectivity. This section of the opinion addresses these DQA components, documents compliance with the DQA, and certifies that this opinion has undergone pre-dissemination review.

4.1 Utility

Utility principally refers to ensuring that the information contained in this consultation is helpful, serviceable, and beneficial to the intended users. The intended users of this opinion are the MARAD and the Port of Bellingham. Individual copies of this opinion were provided to the MARAD. The document wouldbe available at the NOAA Library Institutional Repository [https://repository.library.noaa.gov/welcome]. The format and naming adhere to conventional standards for style.

4.2 Integrity

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

4.3 Objectivity

Information Product Category: Natural Resource Plan

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

Best Available Information: This consultation and supporting documents use the best available information, as referenced in the References section. The analyses in this opinion [*and EFH consultation, if applicable*] 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, if applicable*], and reviewed in accordance with West Coast Region ESA quality control and assurance processes.

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APPENDIX A

APPENDIX B

APPENDIX C