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

Refer to NMFS No.:
WCR-2018-9371

February 20, 2019

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

Re: Endangered Species Act Section 7 Formal Consultation and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Consultation for Petrogas Pacific LLC 5-Year Maintenance Program, Whatcom County, Washington, COE Number: NWS-2018-318, Sixth Field HUC: 171100020500 – Strait of Georgia.

Dear Ms. Walker:

Thank you for your letter of April 12, 2018, requesting 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 authorization of a five-year maintenance program by Petrogas Pacific LLC (applicant) of an existing marine pier located at 4050 Mountain View Road, Ferndale, WA. Thank you, also, for your request for consultation pursuant to the essential fish habitat (EFH) provisions in Section 305(b) of the Magnuson-Stevens Fishery Conservation and Management Act (MSA)(16 U.S.C. 1855(b)) for this action.

The enclosed document contains the biological opinion (Opinion) prepared by NMFS pursuant to section 7(a)(2) of the ESA on the effects of the proposed action. In this Opinion, NMFS concludes that the proposed action is likely to adversely affect but not likely to jeopardize the continued existence of Puget Sound (PS) Chinook salmon and Puget Sound/Georgia Basin (PS/GB) bocaccio. NMFS also concludes that the proposed action is likely to adversely affect designated critical habitat for PS Chinook salmon and PS/GB bocaccio but is not likely to result in the destruction or adverse modification of those designated critical habitats. In this Opinion, we also conclude that the proposed action is not likely to adversely affect PS steelhead, PS/GB yelloweye rockfish and their designated critical habitat, and southern resident (SR) killer whales and their designated critical habitat.

As required by section 7 of the ESA, NMFS has provided an incidental take statement (ITS) with the Opinion. The ITS describes reasonable and prudent measures (RPM) NMFS considers necessary or appropriate to minimize the impact of incidental take associated with this action, and sets forth nondiscretionary terms and conditions that the COE must comply with to meet those measures. Incidental take from actions that meet these terms and conditions will be exempt from the ESA's prohibition against the take of listed species.

This document also includes the results of our analysis of the action's likely effects on essential fish habitat (EFH) pursuant to Section 305(b) of the MSA. NMFS reviewed the likely effects of the proposed action on EFH, and concluded that the action would adversely affect designated EFH for Pacific Coast Salmon, Pacific Coast Groundfish, and Coastal Pelagic Species. Therefore, we have included the results of that review in Section 3 of this document.

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

Sincerely,

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

cc: Randel Perry, COE

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

for

Petrogas Pacific LLC 5-year Maintenance Program
Whatcom County, Washington
(COE Number: NWS-2018-318), (Sixth Field HUC: 171100020500 – Strait of Georgia)

NMFS Consultation Numbers: WCR-2018-9371

Action Agency: U.S. Army Corps of Engineers

Affected Species and Determinations:

ESA-Listed Species	Status	Is Action Likely to Adversely Affect Species?	Is Action Likely To Jeopardize the Species?	Is Action Likely to Adversely Affect Critical Habitat?	Is Action Likely To Destroy or Adversely Modify Critical Habitat?
Chinook salmon (*Oncorhynchus tshawytscha*) Puget Sound (PS)	Threatened	Yes	No	Yes	No
Steelhead (*O. mykiss*) PS	Threatened	No	No	N/A	N/A
Bocaccio (*Sebastes paucispinis*) Puget Sound /Georgia Basin (PS/GB)	Endangered	Yes	No	Yes	No
Yelloweye rockfish (*S. ruberrimus*) PS/GB	Threatened	No	No	No	No
Killer whales (*Orcinus orca*) Southern resident (SR)	Endangered	No	No	No	No

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

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

Fishery Management Plan That Describes EFH in the Project Area	Does Action Have an Adverse Effect on EFH?	Are EFH Conservation Recommendations Provided?
Pacific Coast Salmon	Yes	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: February 20, 2019

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LIST OF ACRONYMS and ABREVIATIONS

BE – Biological Evaluation
BMP – Best Management Practices
CFR – Code of Federal Regulations
COE – Corps of Engineers, U.S. Army
dB – Decibel
DIP – Demographically Independent Population
DPS – Distinct Population Segment
DQA – Data Quality Act
EFH – Essential Fish Habitat
ESA – Endangered Species Act
ESU – Evolutionarily Significant Unit
FR – Federal Register
HAPC – Habitat Area of Particular Concern
HUC – Hydrologic Unit Code
ITS – Incidental Take Statement
mg/L – Milligrams per Liter
MPG – Major Population Group
MSA – Magnuson-Stevens Fishery Conservation and Management Act
NMFS – National Marine Fisheries Service
NTU – Nephlometric Turbidity Units
Opinion – Biological Opinion
OWCO – Oregon Washington Coastal Office
PAH – Polycyclic Aromatic Hydrocarbons
PBF – Physical or Biological Feature
PCB – Polychlorinated Biphenyl
PCE – Primary Constituent Element
PFMC – Pacific Fishery Management Council
PS – Puget Sound
PSSTRT – Puget Sound Steelhead Technical Recovery Team
PSTRT – Puget Sound Technical Recovery Team
RL – Received Level
RMS – Root Mean Square
RPA – Reasonable and Prudent Alternative
RPM – Reasonable and Prudent Measure
SAV – Submerged Aquatic Vegetation
SEL – Sound Exposure Level
SL – Source Level
SR – Southern Resident (Killer Whales)
TSS – Total Suspended Sediment
VSP – Viable Salmonid Population
WCR – Westcoast Region (NMFS)
WDFW – Washington State Department of Fish and Wildlife
WDOE – Washington State Department of Ecology

1. INTRODUCTION

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

1.1 Background

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

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

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

1.2 Consultation History

The NMFS received a letter from the U.S. Army Corps of Engineers (COE) on April 12, 2018 requesting informal consultation for the proposed action (COE 2018a). The letter stated that it would serve as the COE's request for formal consultation should NMFS determine that the project is likely to adversely affect species or critical habitat under our jurisdiction. The letter also included a memorandum for the services (MFS, COE 2018b) and a biological evaluation (BE) for the proposed action (Petrogas 2018).

On June 21, 2018, NMFS informed the COE that formal consultation would be required for the proposed action, and requested additional information. NMFS received the requested information on June 26, 2018. NMFS initiated formal consultation that day. On December 21, 2018, the federal government experienced a partial shutdown that halted work on this consultation. On December 24, 2018, a ship seriously damaged two breasting dolphins that were part of the original permit request. On January 10, 2019, the COE issued emergency authorization to the applicant to replace those dolphins (COE 2019a), which removed that work from the proposed action. Work on this opinion resumed on January 28, 2019, when the federal shutdown ended.

This Opinion is based on the information in the BE and MFS; supplemental materials and responses to NMFS questions; recovery plans, status reviews, and critical habitat designations for ESA-listed PS Chinook salmon and PS/GB bocaccio; published and unpublished scientific information on the biology and ecology of those species; and relevant scientific and gray literature (see Literature Cited).

1.3 Proposed Action

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

The COE proposes to authorize Petrogas Pacific LLC (the applicant) to conduct a 5-year maintenance program for their pier in the Strait of Georgia, northwest of the City of Bellingham, Washington (Figure 1). The applicant's pier extends about 1,490 feet from the shore, and is about 943 feet wide between the widest mooring dolphins at the offshore end. The pier is used to moor large bulk material vessels, and to transfer products such as liquid petroleum gas and aluminum oxide between those vessels and shore facilities. The COE's action would authorize work that would extend, by decades, the useful life of a large mooring structure. Vessel activity at the pier would be interrelated with the proposed action.

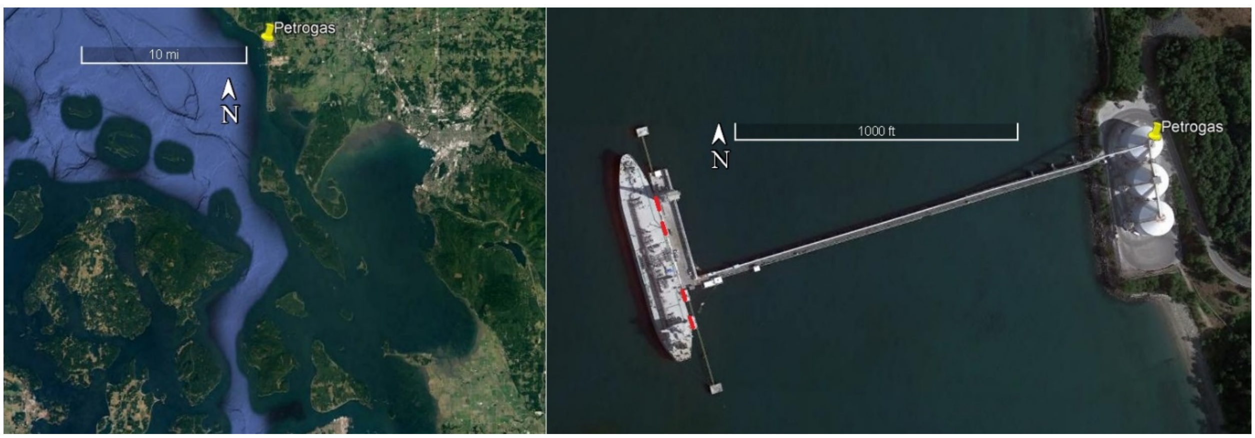

Figure 1. Google satellite photographs of the Petrogas Pacific LLC project site in Whatcom County, Washington. The left image shows the location of the project site relative to Bellingham, Washington, which is visible to the southeast of the site. The right image shows the applicant's pier. The four breasting dolphins to be replaced are identified in red. The piles that would be repaired are scattered under the entire mooring structure.

The project consists of two main components; fender system repairs and pile repairs. Both involve in-water work, and both would extend the useful life of the structure. The applicant's contractors would operate heavy equipment and hand-held power tools. Heavy equipment would be barge-mounted. Barges would either moor against the structure or use mooring spuds (COE 2019c).

<u>Fender System Repairs:</u> Four breasting dolphins, with 12 or 13 creosote-treated timber piles each, are located outboard of the mooring end of the pier. The original permit request included replacement of all four breasting dolphins. However, the COE issued emergency authorization on January 10, 2019 to replace two dolphins that were seriously damaged by a ship. That work is no longer part of the proposed action considered in this Opinion.

To replace the two unrepaired breasting dolphins, the applicant's contractors would moor working barges against the pier, including a 150-ton crane barge with a Vulcan 2300 vibratory pile driver/extractor. They would use hand-held power tools to disconnect the piles from the existing rubber fenders and steel walers. The contractors would use vibratory extraction to remove the timber piles. They estimate about 1 minute of vibratory extraction per pile. The piles will be stacked on the barge for permanent removal from the water.

They would the use the vibratory driver to install 2 30-inch steel pipe piles at each dolphin. The applicant plans to install 2 piles per day, with a daily total of 30 minutes of vibratory driving, and no impact proofing. Following pile installation, they would use a barge-mounted crane to install new fender panels on the steel piles. They would then bolt the new dolphins to existing rubber fenders, and install diagonal chains. About 2 to 3 days of work would be done to replace each dolphin.

Pile Repairs: Over 5 years, the applicant would repair about 150 timber piles that are located at numerous locations under the entire mooring structure. They would repair about 30 piles per year. Prior to work, the applicant's contractors would deploy turbidity curtains around the work area, and install catchment structures around the base of piles. They would clean and empty the catchments as needed. Divers and/or above-water workers would use hydraulic high-pressure washers and hand tools to remove marine growth and loose pile material from the piles.

Where jackets or fiberglass forms would extend to the seafloor, divers would use a handheld induction dredge to excavate bottom sediments to about 2 feet below the mudline around the base of the piles (COE 2019c). Excavated material would be deposited, by pipe, about 6 feet from the piles. The divers would then install clamps on the piles, secure the jackets or fiberglass forms to those clamps, and seal the encapsulation closed. They would install nylon ratchet straps to reinforce against blowouts. Then, starting from the bottom and moving up, they would pump epoxy or grout into the encapsulation. Discharged water would be pumped through a geo sock filter and not allowed to return directly into marine waters. After 48 hours, they would remove supporting equipment, then use an induction dredge to backfill the excavated areas with the previously excavated material.

Work to replace the breasting dolphins would be completed by March 31, 2019. All other in-water work would be limited July 16 through February 15 (COE 2019b). The contractor would also comply with the protective measures identified in the applicant's BE (Petrogas 2018).

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

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

As described above in section 1.2, the COE determined the proposed action is not likely to adversely affect all of the species and critical habitats identified in Table 1, but also requested formal consultation for any species and critical habitats under NMFS jurisdiction that we determined would be adversely affected by the proposed action. NMFS did not concur that the proposed action is not likely to adversely affect PS Chinook salmon and PS/GB bocaccio and designated critical habitat for both of those species, and thus have proceeded with formal consultation for those species and critical habitats. Our concurrence with the COE's "not likely to adversely affect" determinations for the remaining species and critical habitats is documented in the "Not Likely to Adversely Affect" Determinations section (2.12).

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

ESA-listed marine species and critical habitat likely to be adversely affected (LAA)				
Species	**Status**	**Species**	**Critical Habitat**	**Listed / CH Designated**
Chinook salmon (*Oncorhynchus tshawytscha*) Puget Sound	Threatened	LAA	LAA	06/28/05 (70 FR 37160) / 09/02/05 (70 FR 52630)
bocaccio (*Sebastes paucispinis*) Puget Sound/Georgia Basin	Endangered	LAA	LAA	04/28/10 (75 FR 22276) / 11/13/14 (79 FR 68041)
ESA-listed marine species and critical habitat not likely to be adversely affected (NLAA)				
Species	**Status**	**Species**	**Critical Habitat**	**Listed / CH Designated**
steelhead (*O. mykiss*) Puget Sound	Threatened	NLAA	N/A	05/11/07 (72 FR 26722) / 02/24/16 (81 FR 9252)
yelloweye rockfish (*S. ruberrimus*) PS/GB	Threatened	NLAA	NLAA	04/28/10 (75 FR 22276) / 11/13/14 (79 FR 68041)
killer whales (*Orcinus orca*) southern resident	Endangered	NLAA	NLAA	11/18/05 (70 FR 57565) / 11/29/06 (71 FR 69054)

LAA = likely to adversely affect NLAA = not likely to adversely affect
N/A = not applicable. The action area is outside designated critical habitat, or critical habitat has not been designated.

2.1 Analytical Approach

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

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

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

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

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

2.2 Range-wide Status of the Species and Critical Habitat

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

The summaries that follow describe the status of the ESA-listed species, and their designated critical habitats, that occur within the action area and are considered in this opinion. More detailed information on the biology, habitat, and conservation status and trend of these listed resources can be found in the recovery plans and other sources at: http://www.nmfs.noaa.gov/pr/species/fish/ and, and in the listing regulations and critical habitat designations published in the Federal Register and are incorporated here by reference.

2.2.1 Listed Species

Viable Salmonid Population (VSP) Criteria: For Pacific salmonids, we commonly use four VSP criteria (McElhany *et al*. 2000) to assess the viability of the populations that constitute the species. These four criteria (spatial structure, diversity, abundance, and productivity) encompass the species' "reproduction, numbers, or distribution" as described in 50 CFR 402.02. When these parameters are collectively at appropriate levels, they maintain a population's capacity to adapt to various environmental conditions and allow it to sustain itself in the natural environment.

"Spatial structure" refers both to the spatial distributions of individuals in the population and the processes that generate that distribution. A population's spatial structure depends on habitat quality and spatial configuration, and the dynamics and dispersal characteristics of individuals in the population.

"Diversity" refers to the distribution of traits within and among populations. These range in scale from DNA sequence variation in single genes to complex life history traits.

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

"Productivity" refers to the number of naturally-spawning adults produced per parent. When progeny replace or exceed the number of parents, a population is stable or increasing. When progeny fail to replace the number of parents, the population is in decline.

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

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

Puget Sound (PS) Chinook Salmon

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

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

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

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

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

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

biogeographical regions, or major population groups (MPGs), that are based on similarities in hydrographic, biogeographic, and geologic characteristics (Table 2).

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

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

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

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

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

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

PS Chinook Salmon within the Action Area: The PS Chinook salmon that are most likely to occur in the action area would be spring- and fall-run fish from the Nooksack River basin (WDFW 2018a). In the Nooksack River basin, between 1984 and 2012, the total abundance for PS Chinook salmon has fluctuated with the average trend being stable to slightly positive. However, abundance has been dominated by hatchery returns since 1996, with the proportion of natural-origin fish declining (NWFSC 2015; WDFW 2018b).

Between 1984 and 2012, escapement in the North Fork Nooksack River fluctuated between about 10 and 3,748 fish (1990 and 2002, respectively, WDFW 2018b). Between 1996 and 2012, natural-origin spawner abundance wavered between 37 and 334 fish, whereas hatchery-origin spawners exceeded 500 fish for 12 of those 16 years, and accounted for about 94% of the 3,748 fish in 2002. Total abundance was 758 fish in 2012, with natural-origin fish accounting for only 37% of the return. In the South Fork Nooksack River between 1984 and 2010, escapement fluctuated between about 103 and 625 fish (1992 and 2002, respectively, WDFW 2018b). Since origin counts began in 1999, spawning by natural-origin fish in the South Fork Nooksack River has fluctuated between 10 and 159 fish, accounting for about 6 to 38% of the total count for returning adults. Natural-origin strays from the North Fork consistently comprised a significant proportion of the annual counts, and those strays have outnumbered South Fork natural-origin spawners since 2004. Total abundance was 548 fish in 2010, with South Fork natural-origin spawners (24 fish) accounting for only 4% of the return, 49 fish were natural-origin strays from the North Fork.

In this basin, returning adults tend to enter the river and migrate upstream early-June through early-September. Spawning occurs from early August to late-October. Yearling stream-type fish tend to leave the river late winter through spring, and move relatively directly to nearshore marine areas and pocket estuaries. Out-migrating ocean-type fry tend to migrate out of the river beginning in early-March. Those fish rear in the tidal delta estuaries of their natal stream for about 2 weeks to 2 months before migrating to marine nearshore areas and pocket estuaries in late May to June. Out-migrating young of the year parr tend to move relatively directly into marine nearshore areas and pocket estuaries after leaving their natal streams between late spring and the end of summer.

Puget Sound/Georgia Basin (PS/GB) Bocaccio

The PS/GB bocaccio distinct population segment (DPS) was listed as endangered on April 28, 2010 (75 FR 22276). In April 2016, we completed a 5-year status review that recommended the

DPS retain its endangered classification (Tonnes *et al*. 2016), and we released a recovery plan in October 2017 (NMFS 2017b).

The VSP criteria described by McElhaney *et al*. (2000), and summarize at the beginning of Section 2.2, identified spatial structure, diversity, abundance, and productivity as criteria to assess the viability of salmonid species because these criteria encompass a species' "reproduction, numbers, or distribution" as described in 50 CFR 402.02. These viability criteria reflect concepts that are well founded in conservation biology and are generally applicable to a wide variety of species because they describe demographic factors that individually and collectively provide strong indicators of extinction risk for a given species (Drake *et al*. 2010), and are therefore applied here for PS/GB bocaccio.

General Life History: The life history of bocaccio includes a larval/pelagic juvenile stage that is followed by a juvenile stage, and subadult and adult stages. As with other rockfish, bocaccio fertilize their eggs internally and the young are extruded as larvae that are about 4 to 5 mm in length. Females produce from several thousand to over a million offspring per spawning (Love *et al*. 2002). The timing of larval parturition in PS/GB bocaccio is uncertain, but likely occurs within a five to six month window that is centered near March (Greene and Godersky 2012; NMFS 2017b; Palsson *et al*. 2009). Larvae are distributed by prevailing currents until they are large enough to actively swim toward preferred habitats, but they can pursue food within short distances immediately after birth (Tagal *et al*. 2002). Larvae are distributed throughout the water column (Weis 2004), but are also observed under free-floating algae, seagrass, and detached kelp (Love *et al*. 2002; Shaffer *et al*. 1995). Unique oceanographic conditions within Puget Sound likely result in most larvae staying within the basin where they are released rather than being broadly dispersed (Drake *et al*. 2010).

At about 3 to 6 months old and 1.2 to 3.6 inches (3 to 9 cm) long, juvenile bocaccio gravitate to shallow nearshore waters. Rocky or cobble substrates with kelp is most typical, but sandy areas with eelgrass are also utilized for rearing (Carr 1983; Halderson and Richards 1987; Hayden-Spear 2006; Love *et al*. 1991 & 2002; Matthews 1989; NMFS 2017b; Palsson *et al*. 2009). Young of the year rockfish may spend months or more in shallow nearshore rearing habitats before transitioning toward deeper water habitats (Palsson *et al*. 2009). As bocaccio grow, their habitat preference shifts toward deeper waters with high relief and complex bathymetry with rock and boulder-cobble complexes (Love *et al*. 2002), but they also utilize non-rocky substrates such as sand, mud, and other unconsolidated sediments (Miller and Borton 1980; Washington 1977). Adults are most commonly found between 131 to 820 feet (40 to 250 m) (Love *et al*. 2002; Orr *et al*. 2000). The maximum age of bocaccio is unknown, but may exceed 50 years, and they reach reproductive maturity near age six.

Spatial Structure and Diversity: The PS/GB bocaccio DPS includes all bocaccio from inland marine waters east of the central Strait of Juan de Fuca and south of the northern Strait of Georgia. The waters of Puget Sound and Straits of Georgia can be divided into five interconnected basins that are largely hydrologically isolated from each other by relatively shallow sills (Burns 1985; Drake *et al*. 2010). The basins within US waters are: (1) San Juan, (2) Main, (4) South Sound, and (4) Hood Canal. The fifth basin consists of Canadian waters east and north of the San Juan Basin into the Straights of Georgia (Tonnes *et al*. 2016). Although most

individuals of the PS/GB bocaccio DPS are believed to remain within the basin of their origin, including larvae and pelagic juveniles, some movement between basins occurs, and the DPS is currently considered a single population.
Abundance and Productivity: The PS/GB bocaccio DPS exists at very low abundance and observations are relatively rare. No reliable range-wide historical or contemporary population estimates are available for the PS/GB bocaccio DPS. It is believed that prior to contemporary fishery removals, each of the major PS/GB basins likely hosted relatively large, though unevenly distributed, populations of bocaccio. They were likely most common within the South Sound and Main Basin, but were never a predominant segment of the total rockfish abundance within the region (Drake *et al*. 2010). The best available information indicates that between 1965 and 2007, total rockfish populations have declined by about 70 percent in the Puget Sound region, and that bocaccio have declined by an even greater extent (Drake *et al*. 2010; Tonnes *et al*. 2016; NMFS 2017b).

Limiting Factors: Factors limiting recovery for PS/GB bocaccio include:

- Fisheries Removals (commercial and recreational bycatch)
- Derelict fishing gear in nearshore and deep-water environments
- Degraded water quality (chemical contamination, hypoxia, nutrients)
- Climate change
- Habitat disruption

PS/GB Bocaccio within the Action Area: Very little specific information is available to describe PS/GB bocaccio in the action area. The intertidal and shallow subtidal zones within the area of affect for fish consists of shallow low-relief substrate that consists mostly of boulders, cobbles, gravel, and large-grained sand. Patchy macroalgae is present on cobbles and boulders that are deeper than 2 feet above mean lower low water (+2 ft. MLLW). This habitat is suitable for juvenile bocaccio settlement and early growth. No deep-water habitat with steep banks that may support adult bocaccio is present within the area of affect for fish (NOAA 2018). Therefore, the bocaccio that may be present at the project site would likely be limited to pelagic larvae that carried in by the currents and young of the year juveniles that may rear in the shallow subtidal macroalgae at the site. Based on bocaccio life history characteristics, larva and/or young of the year juvenile bocaccio could be present at the project site almost year round, but are most likely to be present between March and October. The best available information suggests that bocaccio were never very common near the action area, and they are now considered rare in Puget Sound, including in the areas where they were historically most common, such as the South Sound (Palsson *et al*. 2009).

2.2.2. Critical Habitat

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

Puget Sound Chinook Salmon Critical Habitat

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

The PBFs of salmonid critical habitat include: (1) Freshwater spawning sites with water quantity and quality conditions and substrate supporting spawning, incubation and larval development; (2) Freshwater rearing sites with: (i) Water quantity and floodplain connectivity to form and maintain physical habitat conditions and support juvenile growth and mobility; (ii) Water quality and forage supporting juvenile development; and (iii) Natural cover such as shade, submerged and overhanging large wood, log jams and beaver dams, aquatic vegetation, large rocks and boulders, side channels, and undercut banks; (3) Freshwater migration corridors free of obstruction and excessive predation with water quantity and quality conditions and natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, side channels, and undercut banks supporting juvenile and adult mobility and survival; (4) Estuarine areas free of obstruction and excessive predation with: (i) Water quality, water quantity, and salinity conditions supporting juvenile and adult physiological transitions between fresh- and saltwater; (ii) Natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, side channels; and (iii) Juvenile and adult forage, including aquatic invertebrates and fishes, supporting growth and maturation; (5) Nearshore marine areas free of obstruction and excessive predation with: (i) Water quality and quantity conditions and forage, including aquatic invertebrates and fishes, supporting growth and maturation; and (ii) Natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, and side channels; and (6) Offshore marine areas with water quality conditions and forage, including aquatic invertebrates and fishes, supporting growth and maturation. Table 3 identifies the PBF for PS Chinook salmon and PS steelhead critical habitat.

Major tributary river basins in the Puget Sound basin include the Nooksack, Samish, Skagit, Sauk, Stillaguamish, Snohomish, Lake Washington, Cedar, Sammamish, Green, Duwamish, Puyallup, White, Carbon, Nisqually, Deschutes, Skokomish, Duckabush, Dosewallips, Big Quilcene, Elwha, and Dungeness rivers and Soos Creek. Critical habitat throughout the Puget Sound basin has been degraded by numerous activities, including hydropower development, loss of mature riparian forests, increased sediment inputs, removal of large woody debris (LWD) from the waterways, intense urbanization, agriculture, alteration of floodplain and stream morphology (i.e., channel modifications and diking), riparian vegetation disturbance, wetland draining and conversion, dredging, armoring of shorelines, marina and port development, road and railroad construction and maintenance, logging, and mining. Changes in habitat quantity, availability, and diversity, and flow, temperature, sediment load and channel instability are common limiting factors of critical habitat throughout the basin.

Table 3. Physical or biological features (PBFs) of PS Chinook salmon critical habitat, and corresponding life history events. Although the final rule identified offshore marine areas as a PBF, none was designated as critical habitat.

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

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

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

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

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

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

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

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

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

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

Puget Sound/Georgia Basin Bocaccio Critical Habitat

NMFS designated critical habitat for PS/GB bocaccio on November 13, 2014 (79 FR 68042). That critical habitat includes marine waters and substrates of the US in Puget Sound east of Green Point in the Strait of Juan de Fuca. Nearshore critical habitat is defined as areas that are contiguous with the shoreline from the line of extreme high water out to a depth no greater than 98 feet (30 m) relative to mean lower low water. The PBF of nearshore critical habitat include settlement habitats with sand, rock, and/or cobble substrates that also support kelp. Important site attributes include: (1) Quantity, quality, and availability of prey species to support individual growth, survival, reproduction, and feeding opportunities; and (2) Water quality and sufficient levels of dissolved oxygen (DO) to support growth, survival, reproduction, and feeding opportunities. Deepwater critical habitat is defined as areas at depths greater than 98 feet (30 m) that possess or are adjacent to complex bathymetry consisting of rock and/or highly rugose habitat. Important site attributes include: (1) Quantity, quality, and availability of prey species to support individual growth, survival, reproduction, and feeding opportunities; (2) Water quality and sufficient levels of DO to support growth, survival, reproduction, and feeding opportunities; and (3) The type and amount of structure and rugosity that supports feeding opportunities and predator avoidance. Both nearshore and deepwater critical habitat include the entire water column above those substrates. Table 4 lists the PBF and corresponding life history events for PS/GB bocaccio critical habitat.

Table 4. Physical or biological features (PBFs) of designated critical habitat for PS/GB bocaccio, and corresponding life history events.

Physical or Biological Features		
Site Type	**Site Attributes**	**Species Life History Event**
Nearshore habitats with substrate that supports kelp	Prey quantity, quality, and availability Water quality and sufficient DO	Juvenile settlement, growth, and development
Deepwater habitats with Complex bathymetry	Prey quantity, quality, and availability Water quality and sufficient DO	Adult growth and reproduction,

Designated critical habitat for PS/GB bocaccio includes about 1,083 square miles (1,743 sq. km) of marine habitat in Puget Sound. Of which, about 438 square miles (706 sq. km) is deepwater habitat. Overall, nearshore critical habitat has been degraded in many areas by shoreline development. Both nearshore and deepwater critical habitat has been degraded by the presence of derelict fishing gear and reduced water quality that is widespread throughout Puget Sound. As of the late 1990s, shoreline development had impacted about 30 percent of the Puget Sound (Broadhurst 1998), and has increased since then (Cornwall and Mayo 2008). Shoreline development has been linked to reductions in invertebrate abundance and diversity, reduced forage fish reproduction, and reductions in eelgrass and kelp.

Thousands of lost fishing nets and shrimp and crab pots (derelict fishing gear) have been documented within Puget Sound. Most derelict gear is found in waters less than 100 feet deep, but several hundred derelict nets have also been documented in waters deeper than 100 feet (NRC 2014). Derelict fishing gear degrades rocky habitat by altering bottom composition and killing encrusting organisms. It also kills rockfish, salmon, and marine mammals, as well as numerous species of fish and invertebrates that are rockfish prey resources (Good *et al*. 2010).

Over the last century, human activities have impacted the water quality in Puget Sound predominantly though the introduction of a variety of pollutants. Pollutants enter via direct and indirect pathways, including surface runoff; inflow from fresh and salt water, aerial deposition, discharges from wastewater treatment plants, oil spills, and migrating biota. In addition to shoreline activities, fourteen major river basins flow into Puget Sound and deliver contaminants that originated from upland activities such as industry, agriculture, and urbanization. Pollutants include oil and grease, heavy metals such as zinc, copper, and lead, organometallic compounds, chlorinated hydrocarbons, phenols, polychlorinated biphenyls (PCBs), polybrominated diphenyl ethers (PBDEs), and Polycyclic Aromatic Hydrocarbons (PAHs) (WDOE 2010; COE 2015). Some of these contaminants are considered persistent bioaccumulative toxics (PBTs) that persist in the environment and can accumulate in animal tissues or fat. The Washington State Department of Ecology (WDOE) estimates that Puget Sound receives between 14 and 94 million pounds of toxic pollutants annually (WDOE 2010).

2.3 Action Area

"Action area" means all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action (50 CFR 402.02). As described in sections 2.5 and 2.12, detectable direct effects from elevated noise would be the project-related stressor with the greatest range of effect. All other project-related effects, including indirect effects would be undetectable beyond the range of acoustic effects. The area where detectable effects may occur in marine mammals would be limited to the marine waters within 13.4 miles (21,544 m) of the project site. For fish, the maximum range of effects would be limited to the marine waters and substrates within about 705 feet (215 m) around the offshore end of the pier. Therefore, the action area for this consultation is limited to the marine waters and substrates within 13.4 miles around the applicant's pier. The action area described above overlaps with the geographic ranges and boundaries of the ESA-listed species and designated critical habitat identified earlier in Table 1. The action area also overlaps with areas that have been designated, under the MSA, as EFH for Pacific Coast salmon, Pacific Coast Groundfish, and Coastal Pelagic Species.

2.4 Environmental Baseline

The "environmental baseline" includes the past and present impacts of all Federal, state, or private actions and other human activities in the action area, the anticipated impacts of all proposed Federal projects in the action area that have already undergone formal or early section

7 consultation, and the impact of state or private actions which are contemporaneous with the consultation in process (50 CFR 402.02).

Environmental conditions at the project site and the surrounding area: The applicant's pier is located along the eastern shore of the Strait of Georgia, south of Cherry Point, and north of Lummi Bay (Figure 1). The area is considered estuarine due to the influence of the numerous rivers. The shoreline is routinely exposed to relatively high waves from the west.

The Strait of Georgia is a major coastal waterway for ships delivering to the refineries north and south of the Petrogas Pier, along with the shipping lanes to Canada on the west edge of the Strait of Georgia. The water area immediately west of the pier is designated as the Department of Natural Resources Cherry Point Aquatic Reserve. Landward of the project area, the area is zoned as Heavy Industrial and characterized by local oil refineries (Petrogas 2018).

The shoreward end of the applicant's pier is connected to a silo pad that is surrounded by large rock rip rap. The pier extends about 1,490 feet from the shore, and is about 943 feet wide between the widest mooring dolphins at the offshore end. A14-foot wide, solid-decked pier extends about 1,437 feet from the MHHW line along the rip rapped shoreline. A 53-foot wide ell extends 426 feet north-northwest from the end of the pier. Walkway-connected mooring dolphins are located off both ends of the ell. The underside of the structure is about +19 ft MLLW and +10 ft MHHW. The water depth under the pier varies from the MHHW line, to about -38 ft MLLW along the offshore end of the pier where ships moor.

Except where rip rap has been installed around the applicant's pier landing, beach sediments along the shore consist of a gravel and sand mix. Between about 2 and 10 feet above mean lower low water (+2 to +10 ft. MLLW), the substrate consists of coarse sand, mixed cobble, and boulders. In the intertidal and shallow subtidal zones to about - 10 ft MLLW, the substrate is dominated by boulders, cobbles, gravel, and large-grained sand. Patchy macroalgae is present on cobbles and boulders below +2 ft MLLW, but no eelgrass is reportedly within 25 feet of the pier (Petrogas 2018). The shoreline at, and well north and south of the project site, are identified by the State as documented herring and surf smelt spawning habitat, with the exception that no smelt spawning occurs where the rip rap has been installed (WDFW 2018c).

Adult PS Chinook salmon from the Strait of Georgia MPG are likely to migrate through the action area to reach their spawning habitats. Juveniles from that MPG are likely to shelter and forage in the action area as they migrate and continue to adapt to the marine environment. Larval PS/GB bocaccio could drift though the action area on the currents, and some juveniles may utilize the macroalgae as rearing habitat before moving into deep-water habitats offshore. The action area has also been designated as critical habitat for PS Chinook salmon, PS/GB bocaccio, and SR killer whales.

The past and ongoing anthropogenic impacts described above have impacted these species and critical habitats through reduced quantity and quality of the migratory and rearing habitat, including reduced water quality caused by the introduction of low levels of pollutants related to upland development and vessel operations.

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

The largest hydrologic responses to climate change have occurred outside of the action area, in upstream basins historically dominated by significant snow accumulation. In those areas, warming has decreased snow pack, increased winter flows, and advanced the timing of spring melt (Mote *et al*. 2014 & 2016). Summer precipitation has also decreased (Mote *et al*. 2014).

In coastal marine waters, temperatures and sea levels have risen over the last century. Snover (*et al*. 2005) report decadal-scale fluctuations and a long-term warming trend of 1.7° F (0.9° C) since 1921, and 1.8° F (1.0°C) since 1950 in the Strait of Juan de Fuca near Victoria, BC, and sea surface temperatures are projected to increase by 6.8° F (3.8° C) by the end of the century (IPCC 2014). Although influenced by many factors, including uplift or subsidence of the adjacent landmass, sea levels have risen in most parts of Puget Sound. Between 1900 and 2008 the sea level rose by 8.6 inches (0.8 inch per decade) at Seattle. Whereas at Neah Bay, where uplift is occurring, the sea level dropped by 5.2 inches between 1934 and 2008 (-0.7 inches per decade) (Mauger *et al*. 2015). Global sea levels are expected to rise by 10 to 32 inches by the end of the century (IPCC 2014).

Globally, the uptake of CO^2 since the beginning of the industrial era, has increased ocean acidification by about 26%, and acidification is expected to increase by 38% to 109% by the end of this century (IPCC 2014). Poorly understood regional factors may be causing ocean acidification to occur earlier and more acutely in marine and estuarine waters of the northwest than in other regions (Barton *et al*. 2012; Feely *et al*. 2012; Sunda and Cai 2012). NMFS knows of no information that describes action area-specific climate change impacts, nor any information that would suggest that conditions within the action area are notably different from the general understanding of regional effects from climate change in the Puget Sound.

2.5 Effects of the Action on Species and Designated Critical Habitat

Under the ESA, "effects of the action" means the direct and indirect effects of an action on the species, together with the effects of other activities that are interrelated or interdependent with that action, that will be added to the environmental baseline (50 CFR 402.02). Direct effects are caused by exposure to action-related stressors that occur at the time of the action. Indirect effects are effects caused by the proposed action that occur later in time but are still reasonably certain to occur.

As described in Section 1.3, the applicant would conduct a 5-year pier maintenance program. They would replace four breasting dolphins, using barge-mounted vibratory equipment to perform pile extraction and installation. They would also annually clean about 30 timber piles and install epoxy/grout-filled jackets/forms to reinforce them. In-water work would be limited to July 16 through February 15, and the applicant would require their contractors to comply with the protective measures identified in the applicant's BE.

PS Chinook salmon utilize the action area. PS steelhead, PS/GB bocaccio, PS/GB yelloweye rockfish, humpback whales, and SR killer whales may also be present in the action area. Also, critical habitat has been designated in the action area for PS Chinook salmon, PS/GB bocaccio, and SR killer whales. As discussed below in section 2.12, the project is not likely to adversely affect PS steelhead, PS/GB yelloweye rockfish, humpback whales, and SR killer whales. It is also not likely to adversely affect designated critical habitat for PS/GB yelloweye rockfish and SR killer whales.

Some PS Chinook salmon reside in the Puget Sound year-round, but they are most plentiful when ocean-going adults return to spawn, and when smolts enter marine waters. Returning adults are likely in the action area between early-June and early-September. Juvenile PS Chinook salmon are likely to pass through the action area between March and the end of summer. PS/GB bocaccio larvae and young of the year juveniles may be present at the project site year-round but are most likely to be present between March and October (Greene and Godersky 2012; NMFS 2017b; Palsson *et al*. 2009). Larvae may be carried in by the currents and young of the year juveniles may rear in the macroalgae at the site.

The planned work is likely to cause direct effects on PS Chinook salmon and PS/GB bocaccio, and on the PBFs of their critical habitats through exposure to construction-related elevated noise, propeller wash, degraded water quality, reduced submerged aquatic vegetation (SAV), and exposure to contaminated forage. The maintenance program would also extend the useful life of the pier several decades beyond that of the existing structure. Over that time, the pier and its interrelated vessel activities are reasonably certain to cause effects on PS Chinook salmon and PS/GB bocaccio, and their critical habitats through impacts on water quality, altered lighting, and commercial vessel noise and propeller wash.

2.5.1 Effects on Listed Species

Construction-related Noise:

Exposure to construction-related noise would cause adverse effects in PS Chinook salmon and PS/GB bocaccio. Vibratory pile installation and extraction, barge spuds, and tugboat operations are likely to cause elevated in-water noise.

The effects of a fishes' exposure to noise vary with the hearing characteristics of the exposed fish, the frequency, intensity, and duration of the exposure, and the context under which the exposure occurs. At low levels, effects may include the onset of behavioral disturbances such as acoustic masking (Codarin *et al*. 2009), startle responses and altered swimming (Neo *et al*. 2014), abandonment or avoidance of the area of acoustic effect (Picciulin *et al*. 2010; Mueller 1980; Sebastianutto *et al*. 2011; Xie *et al*. 2008) and increased vulnerability to predators (Simpson *et al*. 2016). At higher intensities and/or longer exposure durations, the effects may rise to include temporary hearing damage (a.k.a. temporary threshold shift or TTS, Scholik and Yan 2002) and increased stress (Graham and Cooke 2008). At even higher levels, exposure may lead to physical injury that can range from the onset of permanent hearing damage (a.k.a. permanent threshold shift or PTS) and mortality.

The best available information about the auditory capabilities of the fish considered in this Opinion suggest that their hearing capabilities are limited to frequencies below 1,500 Hz, with peak sensitivity between about 200 and 300 Hz (Hastings and Popper 2005; Picciulin *et al*. 2010; Scholik and Yan 2002; Xie *et al*. 2008).

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

The discussion in Stadler and Woodbury (2009) makes it clear that the thresholds likely overestimate the potential effects of exposure to impulsive sounds. Further, the assessment did not consider non-impulsive sound because it is believed to be less injurious to fish than impulsive sound. Therefore, any application of the criteria to non-impulsive sounds is also likely to overestimate the potential effects in fish. However, this assessment applies the criteria to both impulsive and non-impulsive sounds for continuity, and as a tool to gain a conservative idea of the sound energies that fish may be exposed to during the majority of this project.

Based on the best available information, as described in a recent acoustic assessment for similar work (NMFS 2018a), impulsive noise from episodic barge spud deployment would be the loudest construction-related source, followed by vibratory driving 30-inch steel pipe piles, tugboat-related noise, and vibratory pile extraction. Most of the acoustic energy from all of these sources would be under 2,500 Hz.

The expected source levels (SL, sound level at 1 meter from the source) for all construction-related sources are below the 206 dB_{peak} threshold for instantaneous injury in fish. However, the 150 dB_{SEL} isopleth would extend to about 705 feet (215 m) around vibratory installation of the 30-inch steel piles. The 150 dB_{SEL} isopleth would be limited to the area within about 72 feet (22 m) around other in-water work.

During construction, barge spud deployments may cause a low number of impulses (likely less than 10) on any given day. During dolphin replacement, both pile extraction and installation could occur over a 6-day period. The applicant predicts that each timber pile would require 1 minute of vibratory extraction, and each steel pile would require 15 minutes of vibratory installation. Per day, no more than 13 timber piles would be removed, and no more than 2 steel piles would be installed. This assessment assumes that 13 minutes of extraction, and 30 minutes of installation could occur on any of the 6 days of dolphin replacement work, and that the 150 dB_{SEL} threshold would apply. Table 5 summarizes the expected SLs, sound characteristics, and ranges to effects thresholds for fish.

Table 5. Estimated in-water dB_{peak} and dB_{SEL} Source Levels for construction-related sound sources. The ranges to the applicable source-specific effects thresholds for fish are highlighted in grey.

Source	Acoustic Signature	Source Level	Threshold Range
Spuds	< 1,600 Hz Impulsive	201 dB_{peak}	206 @ N/A
Episodic, when barges are moved		176 dB_{SEL}	183 @ N/A
		176 dB_{SEL}	187 @ N/A
		176 dB_{SEL}	150 @ 54 m
Vib. Install 30-inch Steel Pipe Pile	< 2.5 kHz Non-Impulsive	197 dB_{peak}	206 @ N/A
Up to 30 minutes of vibratory noise/day, over 6 days		185 dB_{SEL}	183 @ N/A
		185 dB_{SEL}	187 @ N/A
		185 dB_{SEL}	150 @ 215 m
Vib. Extract 14-inch Timber Pile	< 2.5 kHz Non-Impulsive	181 dB_{peak}	206 @ N/A
About 13 minutes of vibratory noise/day, over 6 days		171 dB_{SEL}	183 @ N/A
		171 dB_{SEL}	187 @ N/A
		171 dB_{SEL}	150 @ 22 m
Tug Propulsion	< 1,000 Hz Combination	185 dB_{peak}	206 @ N/A
Episodic, when the tug is present		170 dB_{SEL}	183 @ N/A
		170 dB_{SEL}	187 @ N/A
		170 dB_{SEL}	150 @ 22 m

Fish beyond the 150 dB_{SEL} isopleth would be unaffected by the exposure. However, fish within the 150 dB_{SEL} isopleth are likely to experience a range of impacts that would depend on their distance from the source and the duration of their exposure. Those at the far limit of the range are likely to experience the onset of temporary behavioral disturbances such as mild acoustic masking, alerting behaviors, and altered swimming patterns. The intensity of effect would increase with proximity to the source and duration of exposure, such that alerting and altered swimming may include avoidance or abandonment of an area, release of stress hormones, and reduced predator avoidance. Prolonged exposure to the sound, such that accumulated sound energy exceeds the 183/187 dB SEL_{cum} thresholds, may cause injuries to auditory tissues.

The first work window extends to March 31, 2019, which overlaps with the expected presence of juvenile Chinook salmon in the action area. The July 16 to early-September portion of subsequent work windows overlaps with the expected presence of adult and juvenile Chinook salmon in the action area. Between July 16 and the end of October, the allowable work window also overlaps with the possible presence of juvenile bocaccio.

Adult Chinook salmon would be far in excess of 2 grams, independent of shallow shoreline waters, highly mobile, migrating past the site in route to their natal streams, and extremely unlikely to remain near enough to the project site to accumulate injurious levels of sound energy. The most likely effect of exposure to project-related noise would be temporary minor behavioral effects, such as avoidance of the area within about 705 feet around the project site. The exposure would cause no measurable effects on the fitness of exposed individuals. Further, it is extremely unlikely that any avoidance of the project site would prevent fish from moving past the area, nor would it prevent them from accessing important habitat resources.

The juvenile Chinook salmon that would be present are likely to exceed 2 grams, but they are highly likely to be largely shoreline obligated and prone to hold in shallow shoreline areas with macroalgae that provide shelter and forage resources. The bocaccio that may be present may include larvae and small juveniles that weigh less than 2 grams, and therefore are likely to be more sensitive to acoustic impacts than larger fish. Bocaccio larvae would likely pass through the area on the currents, and therefore only briefly exposed to project related noises. It is unlikely that construction-related noise would cause any detectable effects in exposed larvae. However, any juvenile bocaccio that may have settled into the macroalgae rearing habitat that is present at the site are likely to remain close to that habitat over the duration of construction.

Juvenile Chinook salmon and/or bocaccio that are within the 150 dB_{SEL} isopleth, are likely to experience behavioral disturbance, such as acoustic masking, startle responses, altered swimming patterns, avoidance, and increased risk of predation. Individuals that remain within the range where accumulated sound energy would exceed 183/187 dB SEL_{cum} may also experience some level of auditory- and non-auditory tissue injury, which could reduce their likelihood of survival. The number of individuals of either species that may be impacted by this stressor is unquantifiable with any degree of certainty. However, the numbers of fish that may be affected by this stressor would comprise such small subsets of their respective cohorts, that their loss would cause no detectable population-level effects.

Construction-related Propeller Wash:

Construction-related propeller wash is likely to adversely affect juvenile PS Chinook salmon, but would cause only minor effects in juvenile PS/GB bocaccio and adults of both species. Spinning boat propellers can kill fish and small aquatic organisms (Killgore *et al*. 2011; VIMS 2011). Spinning propellers also generate fast-moving turbulent water known as propeller wash that can displace and disorient small fish. Propeller wash can also mobilize sediments and dislodge aquatic organisms, including SAV, particularly in shallow water and/or at high power settings. This is called propeller scour.

Adult Chinook salmon are independent of shoreline habitats, and they would likely avoid the area during construction. Further, they would be able to swim against most propeller wash they might be exposed to, without any measurable effect on their fitness of normal behaviors. Adult bocaccio are extremely unlikely to be present in the action area, and are therefore very unlikely to be exposed to this stressor. The water depth where construction-related tugboats would operate (-38 ft MLLW), suggests that any propeller wash that may reach the substrate would lack the power to cause measurable effects on the fitness and normal behaviors of juvenile bocaccio that may be in the action area.

Conversely, juvenile Chinook salmon that migrate around the pier are likely to be at or close to the surface where they may be exposed to spinning propellers and propeller wash from tugboats while they maneuver construction barges. Those juveniles would be too small to effectively swim against the turbulent water. Individuals that are struck or very nearly missed by propeller blades would be injured or killed by the exposure. Exposure to propeller wash alone is likely to cause displacement of migrating individuals that could increase energetic costs, reduce feeding success, and may increase an individual's vulnerability to predators while they tumble stunned and/or disoriented in the wash.

The number of individuals that would be affected by construction-related propeller wash is unquantifiable with any degree of certainty. However, based on the timing and location of the work, and on the relatively low number of tugboat trips that would occur, the numbers of affected individuals would represent such small subsets of their respective cohorts that their loss would cause no detectable population-level effects.

Construction-related Degraded Water Quality:

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

Turbidity: Pile removal, spud lifting, excavation around repaired piles, and propeller wash from the contractor's tugboat are likely to mobilize bottom sediments that would cause episodic, localized, and short-lived turbidity plumes with low concentrations of total suspended sediments (TSS). The intensity of turbidity is typically measured in Nephlometric Turbidity Units (NTU) that describe the opacity caused by the suspended sediments, or by the concentration of TSS as measured in milligrams per liter (mg/L). A strong positive correlation exists between NTU values and TSS concentrations. Depending on the particle sizes, NTU values roughly equal the same number of mg/L for TSS (i.e. 10 NTU = ~ 10 mg/L TSS, and 1,000 NTU = ~ 1,000 mg/L TSS) (Campbell Scientific Inc. 2008; Ellison *et al*. 2010). Therefore, the two units of measure are easily compared.

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

Vibratory removal of hollow 30-inch steel piles in Lake Washington mobilized sediments that adhered to the piles as they were pulled up through the water column, with much of the mobilized sediments being material that fell out of the hollow piles (Bloch 2010). Turbidity reached a peak of about 25 NTU (~25 mg/L) above background levels at 50 feet from the pile, and about 5 NTU (~5 mg/L) above background at 100 feet. Turbidity returned to background levels within 30 to 40 minutes. Pile installation created much lower turbidity. The planned vibratory extraction of timber piles, and spud lifting is likely to mobilize far less sediment than the piles described above, because the timber piles are less than half the size (less surface area for sediments to adhere to) and they are solid (no tube to hold packed-in sediments). Therefore, the mobilization of bottom sediments, and the intensity of resulting turbidity from the planned pile removal is likely to be less than that reported by Bloch, but given the currents and the probability of propeller wash in the area, turbidity plumes may extend 300 feet or more from pile removal.

The applicant's contractors would use induction dredges to remove sediments from around pile repairs (COE 2019c). The typical induction dredge is a handheld underwater excavation tool that consists of a relatively small diameter (inches) metal or hard plastic tube with a small-gage high-velocity water jet aimed inward near its opening. The back flowing water creates suction at the opening. Sediments are drawn into the tube and away from the excavation. For this project, the dredge would include tubing that would be used to deposit excavated sediments about 6 feet from the pile that is being repaired to create a temporary storage pile. Following repair work, the induction dredge would be used to return the spoils to the excavation site. The delivery tube would limit sediment mobilization in the water column. Further, much of the sediment under the pier consists of relatively large-grained material, such as sands and gravels that would settle quickly a short distance from the excavation site. However, finer materials would likely drift father away before settling to seafloor. Given the small size and low number of the excavations on any workday, it is extremely unlikely that the extent and duration of resulting turbidity plumes would exceed that of pile removal discussed above.

Propeller wash from construction-related tugboats is likely to mobilize seafloor sediments. Based on the project description, and on similar projects, construction-related tugboat trips would be low in number, infrequent, and brief. The intensity and duration of resulting turbidity plumes are uncertain. They would depend on a combination of the tugboat's thrust, the water depth under it, and the type of substrate. The higher the thrust and the finer the sediment, the more mobilized sediment. Fine material (silt) remains mobilized longer than coarse material (sand). The shallower the water, the more thrust energy that would reach the substrate. A recent study described the turbidly cause by tugboat operations within an enclosed harbor, in water about 40 feet (12 m) deep (ESTCP 2016). At about 13 minutes, the plume extended about 550 yards (500 m) and had a TSS concentration of about 80 mg/L. The plume persisted for many hours and extend far from the event. However, the TSS concentration fell to 30 mg/L within 1 hour and to 15 mg/L within 3 hours. The water depth at the applicant's pier is similar to the harbor mentioned above, but the sediments at the applicant's pier likely consist of much courser material due the site's routine exposure to large waves and strong currents. Therefore, construction-related tugboat turbidity plumes would consist of lower TSS, and be shorter in duration than described above.

Based on the best available information, construction-related turbidity would be episodic, short-lived, and of TSS concentrations too low to cause more than temporary, non-injurious behavioral effects such as avoidance of the plume, minor gill flaring (coughing), and slightly reduced feeding rates and success. None of these potential responses, individually, or in combination would affect the fitness of exposed individuals.

<u>Dissolved Oxygen (DO):</u> Mobilization of anaerobic sediments can decrease dissolved oxygen (DO) levels (Hicks *et al*. 1991; Morton 1976). The impact on DO is a function of the oxygen

demand of the sediments, the amount of material suspended in the water, the duration of suspension, and the water temperature (Lunz and LaSalle 1986; Lunz *et al*. 1988). Reduced DO can affect salmonid swimming performance (Bjornn and Reiser 1991), as well as cause avoidance of water with low DO levels (Hicks 1999). However, the small amount of sediments that would be mobilized, combined with the relatively low water temperatures, and high level of water exchange in the action area suggests that any impacts on DO would be too small and short-lived to cause detectable effects in exposed fish.

<u>Toxic Materials:</u> Toxic materials may enter the water through construction-related spills and discharges, the mobilization of contaminated sediments, and/or the release of creosote-related PAHs directly from timber piles during their repair and/or removal. PS Chinook salmon and PS/GB bocaccio can uptake contaminants directly through their gills, and through dietary exposure (Karrow *et al*. 1999; Lee and Dobbs 1972; McCain *et al*. 1990; Meador *et al*. 2006; Neff 1982; Varanasi *et al*. 1993). Many of the pollutants that may enter the water column due to project activities can cause effects in exposed fish that range from avoidance of an affected area, to reduced growth, altered immune function, and immediate mortality in exposed individuals. The intensity of effects depends largely on the pollutant, its concentration, and/or the duration of exposure (Brette *et al*. 2014; Feist *et al*. 2011; Gobel *et al*. 2007; Incardona *et al*. 2004, 2005, and 2006; Mcintyre *et al*. 2012; Meadore *et al*. 2006; Sandahl *et al*. 2007; Spromberg *et al*. 2015).

Many of the fuels, lubricants, and other fluids used by common construction-related equipment are petroleum-based hydrocarbons with PAHs that are known to be injurious to fish. However, the project includes comprehensive best management practices (BMPs) to reduce the risk and intensity of discharges and spills from construction-related equipment. In the unlikely event of a construction-related spill or discharge, the event would likely be very small, quickly contained and cleaned, and most of the fuels and lubricants that are used for this type of work would evaporate relatively quickly, and/or be quickly diluted by the tidal currents at the site. Further, non-toxic and/or biodegradable lubricants and fluids are strongly encouraged by the State, and are commonly used by many of the local contractors. Based on the best available information, the in-water presence of construction-related contaminants would be very infrequent, very short-lived, and at concentrations too low to cause detectable effects should a listed fish be exposed to them.

The sediments that would be mobilized during construction very likely contain PAHs from the creosote-treated piles. PAHs may also be released directly from timber piles during their repair and/or removal (Evans *et al*. 2009; Parametrix 2011; Smith 2008; Werme *et al*. 2010). As described above, the amount of sediment that would be mobilized by construction activities would be small. Further, pile repair and removal work would be surrounded by absorbent containment booms, and most lighter-weight PAHs would dissipate within a few hours after their release into the water through evaporation and dilution (Smith 2008; Werme *et al*. 2010). The remaining contaminants would quickly settle out of the water along with the sediments, or be quickly diluted by the high rate of water exchange in the action area. Therefore, listed fish are extremely unlikely to be exposed to in-water contaminants that may be released by construction, and in the unlikely event of fish exposure, the in-water concentration of sediment-related contaminants would be too low and short-lived to cause detectable effects on fitness or normal behaviors in exposed individuals.

Based on the best available information, as described above, any fish that may be exposed to construction-related water quality impacts would experience no more than temporary low-level behavioral effects which, individually, or in combination would not affect the fitness of exposed individuals. Therefore, any PS Chinook salmon and PS/GB bocaccio would experience only minor effects from exposure to construction-related water quality impacts.

Reduced Submerged Aquatic Vegetation (SAV):

Impacts on SAV would cause minor effects in PS Chinook salmon and PS/GB bocaccio. Barge spuds could damage or kill SAV (i.e. macro algae and eelgrass). Although unquantified, spud deployments are expected to be low in number, widespread, and each spud would affect very little substrate. A 24-inch wide spud would affect about 0.4 square yard of substrate. Further, the applicant's conservation measures require that contractors deploy spuds only in areas without SAV. In the unlikely event that a spud damages or kills SAV, the affected area would likely recover fully within 2 years (Boese *et al*. 2009). Based on the best available information, construction-related impacts on SAV would be too small to cause detectable effects on the fitness and/or normal behaviors of any PS Chinook salmon and PS/GB bocaccio in the action area.

Construction-related Contaminated Forage:

Exposure to contaminated forage is likely to adversely affect juvenile PS Chinook salmon and PS/GB bocaccio, but is unlikely to cause detectable effects in adults of either species. In addition to direct uptake of contaminants through their gills, salmonids may absorb contaminants through dietary exposure (Meador *et al*. 2006; Varanasi *et al*. 1993). Pile removal and jetting around pile repairs would mobilize small amounts of contaminated subsurface sediments that would settle onto the top layer of substrate, where contaminants such as PAHs and PCBs may remain biologically available for years.

Romberg (2005) discusses two projects in the Seattle area that mobilized contaminated sediments during the removal and/or repair of creosote-treated piles. In the first, a clamshell bucket was used to remove numerous creosote-treated piles at the Seattle Ferry Terminal, including digging into the sediment to remove broken piles. Large amounts of creosote-laden sediment were mobilized by the work and contaminated a nearby clean sand cap that had been installed less than a year earlier. Based on satellite imagery of the project area, the distance between the work site and the sand cap were about 250 to 800 feet. Soon after work, high PAH levels were detected across the entire surface of the sand cap. Concentrations decreased with distance from the pile removal site, and with time. However, PAH concentrations remained above pre-contamination levels 10 years later. Lead and mercury values also increased on the cap, but the concentrations of both metals decreased to background levels after 3 years.

Amphipods and copepods uptake PAHs from contaminated sediments (Landrum and Scavia 1983; Landrum *et al*. 1984; Neff 1982), and pass them to juvenile Chinook salmon and other fish through the food web. The primary effects of dietary PAH exposure in salmonids include reduced growth, increased susceptibility to infection, and increased mortality. Varanasi *et al*. (1993) found high levels of PAHs in the stomach contents of juvenile Chinook salmon in a contaminated waterway (Duwamish). They also reported reduced growth, suppressed immune competence, as well as increased mortality in juvenile Chinook salmon.

Meador *et al*. (2006) demonstrated that dietary exposure to PAHs caused "toxicant-induced starvation" with reduced growth and reduced lipid stores in juvenile Chinook salmon. The authors surmised that these impacts could severely impact the odds of survival in affected juvenile Chinook salmon. Juvenile PS/GB bocaccio were not specifically addressed in the available literature, but it is reasonable to expect that they may be similarly affected by dietary uptake of action-related contaminants.

The applicant's project would remove up to 24 piles, and jet-mobilize sediments from around the bases of up to 150 piles over 5 years. Although the sediment mobilization due to the planned work would likely be much less severe than was described in Romberg (2005), the sediments that would be mobilized are almost certainly contaminated by PAHs of creosote origin. As discussed above, the turbidity plume from pile removal and jetting could extend as far as 300 feet from individual piles. However, most of the sediment, and therefore the highest concentrations of contaminants would likely remain in the areas immediately adjacent to the piles.

The contaminants would be biologically available for years, at steadily decreasing levels. The benthic invertebrates in the affected areas are likely to take up contaminants. Juvenile Chinook salmon and juvenile bocaccio that forage in the affected area are likely to consume some of those contaminated invertebrates, and as a result may experience reduced growth, increased susceptibility to infection, and increased mortality.

The annual number of juvenile PS Chinook salmon and PS/GB bocaccio that would be exposed to PAH-contaminated forage that would be attributable to this action is unquantifiable with any degree of certainty, as is the amount of contaminated prey that any individual fish may consume, or the intensity of any effects that an exposed individual may experience. However, the relatively small affected area and the low volume of contaminated sediment that would be brought to the surface suggest that the probability of trophic connectivity to the contamination would be very low for any individual fish. Therefore, the numbers of fish that may be annually exposed to contaminated prey would be very low, and no detectable population-level effects are expected.

Structure-related Impacts on Water Quality:

Structure-related impacts on water quality is likely to adversely affect PS Chinook salmon and PS/GB bocaccio. The project would affect water quality through the retention of hundreds of creosote-treated timber piles at the site. Additionally, it is very likely that some of the ships that moor at the pier have hulls with anti-fouling paints that contain copper. Ships moored at the pier may also discharge petroleum-based fuels and lubricants into the water.

Creosote-treated timber piles: The applicant did not quantify the number of piles that support the pier and its mooring dolphins. Nor did they quantify the number of piles that are creosote-treated. However, the project drawings and description suggest that several hundred creosote-treated timber piles support the structure. Of those, 24 would be replaced by 4 steel piles, and an additional 150 would be encased to some degree with epoxy-filled jackets that would reduce the surface area of those piles that would be exposed to marine waters. The hundreds of exposed creosote-treated timber piles that would remain at the site would exude PAHs into the water for years. As described earlier, fish can absorb PAHs directly through their gills. Exposed fish are likely to experience a range of effects that can include avoidance of an affected area, reduced growth, altered immune function, and mortality, depending largely on the concentration, and/or the duration of exposure. The in-water PAH concentrations and durations of exposure any individual fish may experience due to the presence of these piles, along with the intensity of the resulting effects, are unquantifiable with any degree of certainty. However, over the life of the applicant's structure, some Chinook salmon and bocaccio are reasonably likely to be exposed to PAHs at concentrations high enough to measurably reduce their fitness or alter their normal behaviors.

Anti-fouling hull paints: Copper-based anti-fouling paints leach copper into the water at fairly constant levels, and can be a significant source of dissolved copper in harbors and marinas with high boat occupancy and restricted water flows (Schiff *et al*. 2004). Exposure to dissolved copper concentrations between 0.3 to 3.2 μg/L above background levels has been shown to cause avoidance of an area, to reduce salmonid olfaction, and to induce behaviors that increase juvenile salmon's vulnerability to predators in freshwater (Giattina *et al*. 1982; Hecht *et al*. 2007; McIntyre *et al*. 2012; Sommers *et al*. 2016; Tierney *et al*. 2010). However, copper is much less toxic to fish in saltwater than in freshwater. Baldwin (2015) reports that dissolved copper's olfactory toxicity in salmon is greatly diminished with increased salinity. In estuarine waters with a salinity of 10 parts per thousand (ppt), no toxicity was reported for copper concentrations below 50 μg/L, as compared to 0.3 to 3.2 μg/L in freshwater. Sommers *et al*. (2016) report no copper-related impairment of olfactory function in salmon in saltwater. Sub-lethal copper toxicity in bocaccio is not yet understood, but may be similar to that of salmonids.

WDOE (2017) reports that dissolved copper concentrations from anti-fouling paints can range from below 0.5 μg/L in open moorages with high flushing rates, to over 5 μg/L in enclosed moorages. The applicant's pier is located along an open coastline that is regularly exposed to tidal currents. Therefore copper concentrations are likely to trend toward the lower end of the spectrum. Further, the salinity at the project site is likely close to 30 ppt. Therefore, dissolved copper concentrations at the site are expected to be well below the threshold of effect in salmonids and other fish like bocaccio.

Petroleum-based fuels and lubricants: Infrequent and relatively small discharges of petroleum-based fuels and lubricants may occasionally occur from some of the ships that moor at the pier. Many of the fuels and lubricants that could be discharged tend to evaporate quickly (Werme *et al*. 2010). Further, the moorage is nearly 1,500 feet from shore, and exposed to regular tidal currents and strong winds and waves that would facilitate the dilution, evaporation, and/or bioremediation of any petroleum-based chemicals that may be released. Based on the available information, the concentrations and residence times of vessel-related petroleum-based substances would be too low to cause detectable effects in PS Chinook salmon and PS/GB bocaccio.

Based on the best available information, juvenile PS Chinook salmon and PS/GB bocaccio would experience reduced fitness due to exposure to water-borne PAHs from the structure's creosote-treated timber piles, but exposure to copper, fuels and lubricants from structure-related vessel operations would cause no measurable effects. Given the small size of the affected area and the low numbers of juvenile PS Chinook salmon and PS/GB bocaccio that may be present at the project site at any given time, the numbers of individuals that may be exposed to structure-related contaminated water would likely comprise extremely small subsets of the cohorts from their respective populations, and the numbers of exposed fish would be too low to cause any detectable population-level effects.

Structure-related Altered Lighting:

Structure-related altered lighting is likely to adversely affect juvenile PS Chinook salmon and PS/GB bocaccio. The applicant's pier and the vessels that moor alongside it would cast shadows during the day. The pier and ships would be illuminated at night. Therefore, the action may also alter nighttime in-water illumination.

Shade: The applicant's solid-decked pier has a footprint of over an acre. Almost half of that, 2,380 square yards, is from the 14-foot wide pier that extends about 1,480 feet perpendicular to shoreline, over nearshore marine substrate from the MHHW line to -35 feet MLLW. The ships that moor along the west end of the pier would add to the size and intensity of the shade. The pier's shadow reduces productivity. It is also likely to alter the migratory patterns, and may increase vulnerability to predators for juvenile salmon that encounter it. The intensity of shade effects are likely to vary based on the brightness and angle of the sun. They would be most intense on sunny days, and less pronounced to possibly inconsequential on cloudy days.

Shade limits primary production and can reduce the diversity of the aquatic communities under over-water structures (Nightingale and Simenstad 2001; Simenstad *et al*. 1999). Because the pier is solid-decked and casts a hard shadow over water and substrate that is otherwise supportive of submerged aquatic vegetation (SAV) and benthic invertebrates, it is highly likely that the pier's shade reduces the growth of SAV and limits the diversity of the organisms that are prey for juvenile salmonids and rockfish. However, the size of the shade-impacted habitat would be very small compared to the amount of undisturbed habitat along the adjacent shoreline either side of the pier. Further, mixing with the waters from the higher productivity areas adjacent to the applicant's pier would quickly diminish the effects of any prey reduction at the site. Therefore, the effects of shade-related impacts on productivity would be too small to cause detectable effects on the fitness or normal behaviors of juvenile Chinook salmon and bocaccio in the area.

Shade affects juvenile salmon migration. Many of the juvenile Chinook salmon that migrate through the action area would still be largely shoreline obligated, which means that they are biologically compelled to follow the shoreline and would encounter the applicant's pier as they migrate past the site. The pier would create a 1,490-foot long by 14-foot wide (or wider depending on the angle of the sun) shadow across the shallow water routes likely to be followed by juvenile salmon migrating along this section of shoreline.

Numerous studies demonstrate that juvenile salmonids, in both marine and freshwater habitats, are more likely to avoid the shadow of an overwater structure than to pass through the shadow (Celedonia *et al*. 2008a and b; Kemp *et al*. 2005; Moore *et al*. 2013; Munsch *et al*. 2014; Nightingale and Simenstad 2001; Ono *et al*. 2010; Southard *et al*. 2006). The intensity of the effect increases with proximity of the structure to the water and the increased contrast between light and dark areas. Celedonia *et al*. (2008a) report that two thirds of the juvenile Chinook salmon tracked during their study experienced a detectable delay in their migration under the SR 520 Bridge, where there is no option to go around. One-third of the fish experienced an average delay of 15-minutes. One-third experienced delays of under 1 minute, and one-third showed no delay. Although the SR-520 Bridge is an imperfect analog for the applicant's pier, the authors' findings support the understanding that at least some of the juvenile PS Chinook salmon that migrate past the project site would swim around the pier to avoid its shadow.

Swimming around overwater structures increases the migratory distance, which is positively correlated with increased mortality in juvenile Chinook salmon (Anderson *et al*. 2005). The degree to which shade-related altered migration would affect individual juvenile PS Chinook salmon is uncertain, but swimming around the shadow would increase the energetic cost for affected fish. Given that a fish would only travel about 14 feet to pass the pier's location if it was not present, and that the fish must instead swim up to about 3,000 feet to swim around it, avoiding the pier's shadow greatly increases the distance required to pass the project site. Nearly all of the additional distance would be in relatively deep water where foraging is likely to have higher energetic costs than shallow shoreline waters (Heerhartz and Toft 2015). Therefore, juvenile PS Chinook salmon that swim around the breakwater are likely to experience reduced fitness due to increased energetic costs.

Predatory fish such as flatfish, sculpin, and larger salmonids typically occur in waters deeper than the shallow shoreline waters preferred by shoreline-obligated juvenile salmonids. Swimming away from shore to avoid the pier's shadow forces juvenile salmon into deeper water. It also increases their migratory distance (discussed above), which increases the time spent in higher-risk conditions. Willette (2001) found that marine piscivorous predation of juvenile salmon increased fivefold when juvenile salmon left shallow nearshore habitats. Juvenile salmon that follow the shoreline, despite the shadow, must swim past the applicant's rip rapped silo pad. Those fish would also experience increased risk of predation because, in both freshwater and marine habitats, rip rap structures create habitat conditions that favor ambush predators (Edwards and Cunjak 2007; Peters *et al*. 1998; Willette 2001).

Therefore, over the life of the applicant's pier, some juvenile PS Chinook salmon are likely to experience mortality that would be attributable to the pier's shadow. Additionally, individuals that escape predatory attacks would experience reduced fitness due to increased energetic costs and stress-related effects related to their avoidance behaviors, which may reduce their overall likelihood of survival.

Artificial Lighting: The pier and the ships that moor against it would be lit at night. The type and intensity of the lighting are unspecified, but likely increase the nighttime in-water illumination immediately around the pier and moored ships (measured in tens of feet). Artificial lighting attracts fish (positive phototaxis) and often shifts nocturnal behaviors toward more daylight-like behaviors. It may also affect light-mediated behaviors such as migration timing. In lacustrine environments, sub yearling Chinook, coho, and sockeye salmon exhibit strong nocturnal phototaxic behavior toward incandescent light bulbs, with phototaxis positively correlated with light intensity (Tabor *et al*. 2017). Becker *et al*. (2013) found that the abundance of fish increased in artificially illuminated estuarine waters. Ina *et al*. (2017) reported strong positive phototaxis in juvenile Pacific bluefin tuna. Celedonia and Tabor (2015) reported that attraction to artificial lights can delay the onset of early morning migration by up to 25 minutes for juvenile Chinook salmon in freshwater, but didn't alter migration timing in the evening.

The available information to describe the effects of artificial lighting on predator/prey relationships suggests that light-based predatory success in piscivorous fish is probably offset by similar improvements in predator avoidance by juvenile salmonids (Mazur and Beauchamp 2003; Tabor *et al*. 1998).

The applicant did not describe the lightscape in the action area. However, based on the relatively low level of shoreline development in the area, and the high density of the trees along most to the shoreline in the area, ambient nighttime illumination is likely very low. Therefore, it is likely that the artificial illumination from the pier and moored ships would be detectable by fish in the area immediately around the applicant's pier. Exposed fish would likely experience some level of nocturnal phototaxis, and may experience other altered behaviors, such as delayed resumption of migration in the morning. Over the life of the applicant's pier, some of the exposed juvenile PS Chinook salmon and PS/GB bocaccio would experience reduced fitness and/or altered behaviors that are likely to reduce their overall likelihood of survival.

In summary, structure-related altered lighting would cause a combination of altered behaviors that would reduce fitness and/or cause mortality for some juvenile PS Chinook salmon and PS/GB bocaccio. The annual numbers of individuals that would be impacted by this stressor is unquantifiable with any degree of certainty. However, the affected individuals would represent such small subsets of their respective cohorts that the numbers of exposed fish would be too low to cause detectable population-level effects.

Structure-related Noise:

Structure-related noise would cause adverse effects in juvenile PS Chinook salmon and PS/GB bocaccio, and minor effects in adults of both species. Large ocean-going tankers routinely moor at the applicant's pier, and tugboats assist with the arrivals and departures of the larger vessels. Vessel operations typically consist of episodic brief periods of relatively low-speed operations by tugboats that may last a couple hours while the tugs maneuver the larger vessels. The tankers' auxiliary systems would also cause continuous in-water noises while they are moored at the pier. Because vessel operations at the pier may occur at any time during the year, this assessment assumes continuous, year-round vessel operations at the pier, including during peak outmigration season for juvenile PS Chinook salmon.

Numerous sources describe the source levels for ocean-going ships and tugboats operating at transit speeds (Blackwell and Greene 2006; McKenna *et al*. 2012; Reine *et al*. 2014; Richardson *et al*. 1995). Table 6 summarizes the expected sound levels for those vessels, with ranges to applicable effects thresholds.

Table 6. Estimated in-water dB_{peak} and dB_{SEL} Source Levels for tankers and tugboats operating at typical transit speeds, and ranges to effects thresholds for fish.

Source	Acoustic Signature	Source Level	Threshold Range
Tanker	< 2 kHz Combination	191 dB_{peak}	206 @ N/A
Episodic periods measures in low numbers of hours		176 dB_{SEL}	150 @ 54 m
Tugboat	< 2 kHz Combination	185 dB_{peak}	206 @ N/A
Episodic periods measures in low numbers of hours		170 dB_{SEL}	150 @ 22 m

It is extremely unlikely that tankers would operate at anything above minimal speeds when near the pier. However, tugs would briefly use high power settings while maneuvering the tankers, and some of the tankers' auxiliary systems are very loud and operated continuously while moored. To be conservative, NMFS estimates that noise levels approaching that of tugboat operations may be present at the applicant's pier anytime ships are present. Based on the available information, no sound sources would exceed the exposure threshold for peak sound levels. However, the 150 dB_{SEL} isopleth may extend as far as 72 feet (22 m) around the pier, and any juvenile Chinook salmon and bocaccio that are within that isopleth would likely experience behavioral disturbance, such as acoustic masking, startle responses, altered swimming patterns, avoidance, and increased risk of predation. The intensity of these effects would increase with increased proximity to the source and/or duration of exposure.

The annual numbers of individual PS Chinook salmon and PS/GB bocaccio that would be affected by this stressor is unquantifiable with any degree of certainty. However, the affected individuals would represent such small subsets of their respective cohorts that the numbers of exposed fish would be too low to cause detectable population-level effects.

Structure-related Propeller Wash:

Structure-related propeller wash is likely to adversely affect juvenile PS Chinook salmon, but would cause only minor effects in juvenile PS/GB bocaccio and adults of both species, for the same reasons discussed above under construction-related propeller wash.

Annually over the life of the pier, juvenile Chinook salmon that migrate around the pier may be exposed to spinning propellers and propeller wash from tankers and tugboats while they maneuver. Exposed individuals may be injured or killed by the propeller blades, or exposure to propeller wash may cause displacement that could cause some combination of increased energetic costs, reduced feeding success, and increased vulnerability to predators.

Although the likelihood of this interaction is very low for any individual fish, it is likely that over the life of the pier, some juvenile Chinook salmon would experience reduced fitness or mortality from exposure to spinning propellers and/or propeller wash at the site. The annual number of individuals that may be impacted by this stressor is unquantifiable with any degree of certainty. However, the affected individuals would represent such small subsets of their respective cohorts that the numbers of exposed fish would be too low to cause detectable population-level effects.

2.5.2 Effects on Critical Habitat

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

Puget Sound Chinook Salmon Critical Habitat: The proposed action is likely to adversely affect designated critical habitat for PS Chinook salmon. The essential PBFs of PS Chinook salmon critical habitat are listed below. The expected effects on those PBFs from completion of the planned project, including full application of the conservation measures and BMPs, would be limited to the impacts on the PBF of estuarine and nearshore marine areas free of obstruction and excessive predation as described below.

1. Freshwater spawning sites – None in the action area.
2. Freshwater rearing sites – None in the action area.
3. Freshwater migration corridors – None in the action area.
4. Estuarine areas free of obstruction and excessive predation
    a. Free of obstruction and excessive predation – The proposed action would cause long-term minor effects on obstruction and predation. The pier's shadow is likely to cause migratory delays and/or increase migration distances for some of the juvenile Chinook salmon that encounter it. The project would cause no change in the abundance of predators, but migratory impacts may increase the exposure and vulnerability to predators for some juvenile Chinook salmon. Construction and boating noise would cause ephemeral conditions that may act synergistically to increase the intensity of both of these effects.
    b. Water quality – The proposed work would cause ephemeral minor effects, and the structure would cause long-term minor effects on water quality. The action would cause no measurable changes in water temperature or DO, but construction would briefly introduce contaminants. Detectable construction-related effects would be limited to the area within about 300 feet around the project site, and are not expected to persist past several hours after work stops. The pier's remaining creosote-treated timber piles would continue to cause long term PAH contamination. Vessel operations would likely introduce small amounts of petroleum-based pollutants into the foreseeable future.
    c. Water quantity – The proposed action will cause no effect on water quantity, and no change in the quality and function of this PBF.
    d. Salinity – The proposed action will cause no effect on salinity, and no change in the quality and function of this PBF.

  e. Natural Cover – The proposed action would cause long-term minor effects on natural cover. The pier and moored ships would cause long-term shading that may slightly reduce SAV productivity under and near the structure.
  f. Forage – The proposed action would cause long-term minor effects on forage. Construction would mobilize small amounts of PAH-contaminated sediments that could be taken up by benthic invertebrates that are forage resources for juvenile Chinook salmon. Sediment distribution would likely be limited to the area within 300 feet around the pier, but detectable levels of contaminants may last for years. The pier and moored ships would cause long-term shading that may slightly reduce the production and diversity of invertebrate organisms that are prey for juvenile salmonids. The action would not affect forage fish spawning.

5. Nearshore marine areas free of obstruction and excessive predation
   a. Free of obstruction and excessive predation – Same as above.
   b. Water quality – Same as above.
   c. Water quantity – Same as above.
   d. Forage – Same as above.
   e. Natural Cover – Same as above.
6. Offshore marine areas – Does not occur in the action area.

PS/GB Bocaccio Critical Habitat: The proposed action is likely to adversely affect designated critical habitat for PS/GB bocaccio. The essential PBFs of PS/GB bocaccio critical habitat are listed below. The expected effects on those PBFs from completion of the planned project, including full application of the conservation measures and BMPs, would be limited to the impacts on the nearshore juvenile settlement habitats PBF as described below. Benthic habitats and sites deeper than 98 feet (30 m) are outside of the range of expected effects from the proposed action. Therefore, it is highly unlikely that the action would cause any impacts on the deep-water benthic habitat PBF.

1. Juvenile settlement habitats located in the nearshore (shoreline to 98 feet (30 m) deep) with substrates such as sand, rock, and/or cobble compositions that support kelp
   a. Quantity, quality, and availability of prey species – The proposed action would cause minor long-term effects on prey species. Construction would mobilize small amounts of PAH-contaminated sediments that could be taken up by benthic invertebrates that are forage resources for juvenile bocaccio. Sediment distribution would be limited to the area within 300 feet around the pier, but detectable levels of contaminants may persist for years. The pier and moored ships would cause long-term shading that may slightly reduce the production and diversity of invertebrate organisms that are prey for juvenile bocaccio. The action would not affect forage fish spawning.
   b. Water quality – The proposed work would cause ephemeral minor effects, and the structure would cause long-term minor effects on water quality. The action would cause no measurable changes in water temperature, salinity, or DO, but construction would briefly introduce contaminants. Detectable construction-related effects would be limited to the area within about 300 feet around the project site, and are not expected to persist past several hours after work stops. The pier’s remaining creosote-treated timber piles would continue to cause long term PAH contamination. Vessel operations would likely introduce small amounts of petroleum-based pollutants into the foreseeable future.

2. Benthic habitats and sites deeper than 98 feet (30 m) – Does not occur in the action area.

2.6 Cumulative Effects

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

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

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

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

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

2.7 Integration and Synthesis

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

As described in more detail above at Section 2.4, climate change is likely to increasingly affect the abundance and distribution of the ESA-listed species considered in the Opinion. It is also likely to increasingly affect the PBF of designated critical habitats. The exact effects of climate change are both uncertain, and unlikely to be spatially homogeneous. However, climate change is reasonably likely to cause reduced instream flows in some systems, and may impact water quality through elevated in-stream water temperatures and reduced DO, as well as by causing more frequent and more intense flooding events.

Climate change may also impact coastal waters through elevated surface water temperature, increased and variable acidity, increasing storm frequency and magnitude, and rising sea levels. The adaptive ability of listed-species is uncertain, but likely reduced due to reductions in population size, habitat quantity and diversity, and loss of behavioral and genetic variation. The proposed action will cause direct and indirect effects on the ESA-listed species considered in the Opinion well into the foreseeable future. However, the action's effects on water quality, substrate, and the biological environment are expected to be of such a small scale that no detectable effects on ESA-listed species through synergistic interactions with the impacts of climate change are expected.

2.7.1 ESA-listed Species

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

PS Chinook Salmon:

The action area provides nearshore marine habitat that supports adult and juvenile migration, and juvenile growth and adaptation to marine waters for PS Chinook salmon, primarily from populations within the Nooksack River Basin MPGs. The long-term abundance trend for the PS

Chinook salmon ESU is slightly negative, and the extinction risk for two affected MPGs is high due to low abundance and productivity (NWFSC 2015). Reduced or eliminated accessibility to historically important habitat, combined with degraded conditions in available habitat due to land use activities appear to be the greatest threats to the recovery of PS Chinook salmon. Commercial and recreational fisheries also continue to affect this species.

The project site is located in Puget Sound, along the eastern shore of the Strait of Georgia, south of Cherry Point, and north of Lummi Bay. More than 100 years of development, maritime activities, upland urbanization, and road building and maintenance have degraded the environmental baseline within the action area. The Strait of Georgia is a major coastal waterway for shipping. Landward of the project site, the area is a mosaic of oil refineries, forested areas, agricultural fields, and relatively light urbanization that increases with distance inland. However, the action area remains supportive of PS Chinook salmon, and provides migratory habitat for adults and juveniles. The planned work window overlaps with the later stages of out-migration by shoreline-obligated juvenile Chinook salmon that pass through the action area. In-migrating adults may also be present during construction, but they would be independent of the shoreline and unlikely to be measurably affected by the work or by the pier.

During construction, very low numbers of out-migrating juveniles would be exposed to noise. Following construction, very low numbers of juveniles would be exposed annually to structure-related water quality impacts, altered lighting, vessel noise, propeller wash, and contaminated forage. Structure-related effects would persist over the life of the structure. These stressors, both individually and collectively, are likely to cause some combination of altered behaviors, delayed migration, reduced fitness, and mortality in some exposed individuals.

Based on the best available information, the scale of the direct and indirect effects of the proposed action, when considered in combination with the degraded baseline, cumulative effects, and the impacts of climate change, would be too small to cause detectable effects on any of the characteristics of a viable salmon population (abundance, productivity, distribution, or genetic diversity) for the affected populations. Therefore, the proposed action would not appreciably reduce the likelihood of survival and recovery of this listed species.

<u>PS/GB Bocaccio:</u>

The action area provides nearshore marine habitat features that are supportive of juvenile settlement and rearing for PS/GB bocaccio. However, PS/GB bocaccio are relatively rare throughout the range of the DPS, and it is uncertain whether they currently utilize the habitat. No reliable population estimates are available for the DPS, but the best available information indicates that bocaccio were never a predominant segment of the total rockfish abundance in Puget Sound. The best information also suggest that their abundance has declined by more than 70 percent since 1965. Fishing removals and derelict fishing gear, combined with degraded water quality appear to be the greatest threats to the recovery of the DPS.

The project site is located in Puget Sound, along the eastern shore of the Strait of Georgia, south of Cherry Point, and north of Lummi Bay. More than 100 years of development, maritime activities, upland urbanization, and road building and maintenance have degraded the environmental baseline within the action area. The Strait of Georgia is a major coastal waterway for shipping. Landward of the project site, the area is a mosaic of oil refineries, forested areas, agricultural fields, and relatively light urbanization that increases with distance inland. However, the action area remains supportive of PS/GB bocaccio, and provides rearing habitat for juveniles. No adult bocaccio-supportive habitat is present within the action area. The planned work window overlaps with the latter half of the period when benthic juveniles would be expected in shallow nearshore waters.

Should they be present during construction, very low numbers of benthic juveniles may be exposed to noise. Following construction, very low numbers of benthic juveniles may be exposed annually to structure-related water quality impacts, vessel noise, and contaminated forage. Structure-related effects would persist over the life of the structure. These stressors, both individually and collectively, are likely to cause some combination of altered behaviors, delayed migration, reduced fitness, and mortality in some exposed individuals.

Based on the best available information, the scale of the direct and indirect effects of the proposed action, when considered in combination with the degraded baseline, cumulative effects, and the impacts of climate change, would be too small to cause detectable effects on any of the characteristics of a viable population (abundance, productivity, distribution, or genetic diversity) for the PS/GB bocaccio DPS. Therefore, the proposed action would not appreciably reduce the likelihood of survival and recovery of this listed species.

Critical Habitat for PS Chinook Salmon:

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

Global climate change is expected to increase in-stream water temperatures and alter stream flows, possibly exacerbating impacts on baseline conditions in freshwater habitats across the region. Rising sea levels are expected to increase coastal erosion and alter the composition of nearshore habitats, which could further reduce the availability and quality of estuarine habitats. Increased ocean acidification may also reduce the quality of estuarine habitats.

In the future, non-federal land and water use practices and climate change are likely to increase. The intensity of those influences on salmonid critical habitat is uncertain, as is the degree to which those impacts may be tempered by adoption of more environmentally acceptable land use practices, by the implementation of non-federal plans that are intended to benefit salmonids, and by efforts to address the effects of climate change.

The PBF for PS Chinook salmon critical habitat in the action area are limited to estuarine and nearshore marine areas free of obstruction and excessive predation. The site attributes of those PBF that would be affected by the action are limited to obstruction and predation, water quality, natural cover, and forage.

Construction and the presence of the pier would cause conditions under and immediately around the pier that would cause long-term minor effects on obstruction and predation, water quality, natural cover, and forage. Based on the best available information, the scale of the proposed action's effects, when considered in combination with the degraded baseline, cumulative effects, and the impacts of climate change, would be too small to cause any detectable long-term negative changes in the quality or functionality of the estuarine and nearshore marine area PBFs in the action area. Therefore, this critical habitat will maintain its current level of functionality, and retain its current ability for PBF to become functionally established, to serve the intended conservation role for PS Chinook salmon.

Critical Habitat for PS/GB Bocaccio:

Past and ongoing shoreline development combined with upland land and water use practices have degraded nearshore critical habitat for PS/GB bocaccio throughout the Puget Sound basin, including in the action area. Agriculture, industry, urbanization, and maritime activities have reduced water quality throughout Puget Sound. Widespread derelict fishing gear in both nearshore and deep-water critical habitat areas has altered bottom composition, reduced prey availability, and it continues to kill rockfish. Rising sea levels, caused by climate change, will likely increase coastal erosion and alter the composition of nearshore critical habitat for PS/GB bocaccio. Elevated sea surface temperatures and increased ocean acidification may also reduce the quality of nearshore marine habitats, and reduce prey availability by reducing ocean productivity.

Future non-federal actions and climate change are likely to increase and continue acting against the quality of PS/GB bocaccio critical habitat. The intensity of those influences is uncertain, as is the degree to which those impacts may be tempered by adoption of more environmentally acceptable practices, by restoration activities such as efforts to remove derelict fishing gear, and by efforts to address the effects of climate change.

Nearshore settlement habitats with sand, rock, and/or cobble substrates that also support kelp is the PBF for PS/GB bocaccio critical habitat that occurs in the action area. The site attributes of that PBF that would be affected by the action are limited to prey quantity, quality, and availability; and water quality. Construction and the presence of the new pier would cause conditions under and immediately around the pier that would cause long-term minor effects on prey and water quality. Based on the best available information, the scale of the proposed action's effects, when considered in combination with the degraded baseline, cumulative effects, and the impacts of climate change, would be too small to cause any detectable long-term negative changes in the quality or functionality of the nearshore settlement PBF in the action area. Therefore, this critical habitat will maintain its current level of functionality, and retain its current ability for PBF to become functionally established, to serve the intended conservation role for PS/GB bocaccio.

2.8 Conclusion

After reviewing and analyzing the current status of the listed species, the environmental baseline within the action area, the effects of the proposed action, any effects of interrelated and interdependent actions, and cumulative effects, it is NMFS' opinion that the proposed action is not likely to jeopardize the continued existence of PS Chinook salmon or PS/GB bocaccio, nor is it likely to destroy or adversely modify designated critical habitat for either of these species.

2.9 Incidental Take Statement

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

This ITS provides a take exemption for the COE for any take caused by the direct effects of the proposed action, as well as for some of the indirect effects that would be caused by the extended functional life of the applicant's pier. However, this ITS does not include an exemption for any take caused by vessel-related noise and propeller wash from shipping operations that would be interrelated and interdependent to the applicant's pier. Although those stressors are identified in the Opinion and below, an exemption is not provided for that take because there is no way to identify the third-party vessel operators, and because the COE has no jurisdiction over the vessel activities at the applicant's pier. Therefore, we cannot mandate reasonable and prudent measures or terms and conditions to minimize the impacts of take caused by the shipping.

2.9.1 Amount or Extent of Take

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

Harm of juvenile PS Chinook salmon from:

- exposure to construction-related noise,
- exposure to construction-related propeller wash,
- exposure to construction- and structure-related contaminated forage,
- exposure to structure-related contaminated water,
- exposure to structure-related altered lighting,
- exposure to vessel-related noise, and
- exposure to vessel-related propeller wash.

Harm of juvenile PS/GB bocaccio from:

- exposure to construction-related noise,
- exposure to construction- and structure-related contaminated forage,
- exposure to structure-related contaminated water,
- exposure to structure-related altered lighting, and
- exposure to vessel-related noise.

The distribution and abundance of fish within an action area are affected by habitat quality, competition, predation, and the interaction of processes that influence genetic, population, and environmental characteristics. These biotic and environmental processes interact in ways that may be random or directional, and may operate across far broader temporal and spatial scales than are affected by the proposed action. Thus, the distribution and abundance of fish within the action area cannot be attributed entirely to habitat conditions, nor can NMFS precisely predict the number of fish that are reasonably certain to be injured or killed if their habitat is modified or degraded by the proposed action.

Therefore, we cannot predict with meaningful accuracy the number of juvenile PS Chinook salmon and juvenile PS/GB bocaccio that are reasonably certain to be injured or killed by exposure to any of these stressors. Additionally, NMFS knows of no device or practicable technique that would yield reliable counts of individuals that experience these impacts. In such circumstances, NMFS uses the causal link established between the activity and the likely extent and duration of changes in habitat conditions to describe the extent of take as a numerical level of habitat disturbance.

The most appropriate surrogates for take are action-related parameters that directly relate to the magnitude of the expected take. For this action, the timing and duration of work, the type and size of the piles to be removed and installed, and the method of their extraction and installation are the best available surrogates for the extent of take of juvenile PS Chinook salmon and PS/GB bocaccio from exposure to construction-related noise. The timing and duration of work is also the best available surrogate for the extent of take of juvenile PS Chinook salmon from exposure to construction-related propeller wash. Timing and duration of work are applicable because the planned work windows were selected to reduce the potential for juvenile fish presence at the project site. Therefore, working outside of the planned work window and/or working for longer than planned would increase the number of fish likely to be exposed to construction-related impacts that are likley to cause injury or reduce fitness.

The piles and the method of their extraction and installation are the best available surrogates because the intensity of effect is is positively correlated with the loudness of the sound, which is determined by the type and size of the pile and the method of its extraction/installation. Further, the number of fish that would be exposed to the noise is positively correlated with the range of effect and the number of days that the action area would be ensonified. In short, as the sound levels increase, the intensity of effect and the size of the affected area increases, and as the size of the ensonified area increases, and/or as the number of days the area is ensonified increases, the number of PS Chinook salmon that would be exposed to the sound would increase despite the low density and random distribution of individuals of these species in the action area. Based on the best available information about the planned pile extraction and installation, as described in

Section 2.5, the applicable ranges of effect for this project are driven by the type and size of the piles and the method of their extraction and installation, not by the daily duration of vibratory work. Therefore, daily duration of vibratory work is not considered a measure of take for this action.

The number of pile removals and/or excavations and the extent of the turbidity plumes around that work are the best available surrogates for the extent of take of juvenile PS Chinook salmon and PS/GB bocaccio from exposure to construction-related contaminated forage. This is because construction-related contaminated forage would be positively correlated with the amount of contaminated subsurface sediments that would be brought to the substrate's surface and the size of the affected area. The amount of biologically available contaminated sediments would increase as the number of pile removals and/or excavations increases. Also, the size of the area where contaminated sediments would be biologically available would increase as the size of the visible turbidity plume increases. Therefore, as the number of affected piles and/or the size of the visible turbidity plumes increase, the number of prey organisms that may become contaminated and then eaten by juvenile PS Chinook salmon and PS/GB bocaccio would increase, despite the low density and random distribution of juveniles of both of these species in the action area.
The size and configuration of the applicant's pier is the best available surrogate for the extent of take of juvenile PS Chinook salmon and PS/GB bocaccio from exposure to structure-related contaminated forage, contaminated water, and altered lighting.

The number of existing creosote-treated timber piles that support the pier is the best available surrogate for the extent of take of juvenile PS Chinook salmon and PS/GB bocaccio from exposure to structure-related contaminated forage and contaminated water. This is because structure-related contaminated forage and contaminated water would be positively correlated with the number of creosote-treated timber piles that would be present to introduce PAHs into the trophic web and/or into the water. As the number of creosote-treated timber piles increases, the number of contaminated prey organisms and the concentration of water-borne PAHs would increase. As either of those measures increase, the number of juvenile PS Chinook salmon and PS/GB bocaccio that would be exposed and/or the intensity the effects of exposure would increase.

The size of the applicant's pier is the best available surrogate for the extent of take of juvenile PS Chinook salmon and PS/GB bocaccio from exposure to structure-related altered lighting. This is because the size of the area that would be artificially shaded during the day and illuminated at night is positively correlated with size and the pier. As the size of an overwater structure increases, the size its shadow and the artificially illuminated area around structure would also increase. As the size of the shadow increases, the likelihood of avoidance, and the distance required to swim around it would increase, either of which is likely to intensify the effects on exposed by juvenile PS Chinook salmon. As the size of the artificially illuminated area increases, the number of juvenile PS Chinook salmon and PS/GB bocaccio that would be exposed to it would increase.

In summary, the incidental take surrogates for this action are:

Puget Sound Chinook salmon:

- In-water work through March 31, 2019, and July 16 through February 15 subsequent to that, not to exceed February 15, 2024;
- A maximum of 6 days of pile extraction and installation combined;
- Vibratory extraction of 25 timber piles;
- Vibratory installation of 4 steel pipe piles no larger than 30 inches in diameter;
- Excavation around the bases of no more than 50 timber piles per work window;
- A visible turbidity plume not to exceed 300 feet from the project site during any portion of the project, including movement of the contractor's tugboats; and
- The size and configuration of the existing pier, as described in the proposed action section of this biological opinion.

Puget Sound / Georgia Basin bocaccio:

- In-water work through March 31, 2019, and July 16 through February 15, not to exceed February 15, 2024;
- A maximum of 6 days of pile extraction and installation combined;
- Vibratory extraction of 25 timber piles;
- Vibratory installation of 4 steel pipe piles no larger than 30 inches in diameter;
- Excavation around the bases of no more than 50 timber piles per work window;
- A visible turbidity plume not to exceed 300 feet from the project site during any portion of the project, including movement of the contractor's tugboat; and
- The size and configuration of the existing pier, as described in the proposed action section of this biological opinion.

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

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

2.9.2 Effect of the Take

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

2.9.3 Reasonable and Prudent Measures (RPM)

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

The COE shall:

1. Minimize incidental take of PS Chinook salmon and PS/GB bocaccio from exposure to construction-related noise.

2. Minimize incidental take of PS Chinook salmon and/or PS/GB bocaccio from exposure to contaminated forage.

3. Implement monitoring and reporting to confirm that the take exemption for the proposed action is not exceeded.

2.9.4 Terms and Conditions

The terms and conditions described below are non-discretionary. The COE or any applicant must comply with them in order to implement the RPM (50 CFR 402.14). The COE or any applicant has a continuing duty to monitor the impacts of incidental take and must report the progress of the action and its impact on the species as specified in this ITS (50 CFR 402.14). If the entity to whom a term and condition is directed does not comply with the following terms and conditions, protective coverage for the proposed action would likely lapse.

1. To implement RPM Number 1, Minimize incidental take from construction-related noise, the COE shall require the applicant to require their contractors to:
   a. Limit pile extraction and installation work to no later than March 31, 2019, and to conduct all other in-water work from July 16 through February 15, not to exceed February 15, 2024;
   b. Utilize vibratory pile extraction and installation. No impact pile driving shall be done to proof piles;
   c. Limit pile extraction to 25 timber piles, and installation to 4 steel pipe piles no larger than 30 inches in diameter; and
   d. Limit pile extraction and installation work to no more than 6 days.

2. To implement RPM Number 2, Minimize incidental take from exposure to contaminated forage, the COE shall require the applicant to require their contractors to:
   a. Extract piles slowly by pulling. No water-jetting or clamshell digging shall be done during pile extraction;
   b. Ensure that extracted piles are not shaken, hosed off, left hanging to dry, or that any other actions are taken to remove adhering material from piles while they are suspended over the water; and
   c. Adjust work practices, including pile excavation and tugboat operations, to ensure that turbidity does not exceed 300 feet from the project site, and to halt work should the visible turbidity plume approach and that range.

3. To implement RPM Number 3, Implement monitoring and reporting to confirm that the take exemption for the proposed action is not exceeded, the COE shall require the applicant to collect and report details about the take of listed fish. That plan shall:
   a. Require the contractor to maintain and submit construction logs to verify that all take indicators are monitored and reported. Minimally, the logs should include:
      i. The dates (with workday start and stop times) and descriptions of all in-water work;
      ii. The type, size, and number of piles extracted, installed, and/or repaired per day;
      iii. The duration of vibratory pile extraction or installation, per pile; and
      iv. The extent (feet) and duration of visible turbidity plumes around pile work, and during tugboat operations.
   b. Establish procedures for the submission of construction logs and other materials to the appropriate COE office; and
   c. Submit electronic post-construction reports annually to NMFS within six months of the close of the spring work window. Send the reports to: projectreports.wcr@noaa.gov. Be sure to include the NMFS Tracking number for this project in the subject line: Attn: WCR-2018-9371.

2.10 Conservation Recommendations

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

1. The COE and the applicant should encourage tugboat operators to minimize the number of trips, and to use the lowest safe power settings when maneuvering close to the pier, with the intent to minimize propeller wash and mobilization of sediments.

2. The COE should encourage the applicant to require contractors to employ full-depth turbidity curtains to the greatest extent practicable to minimize the spread of contaminated sediments during pile extraction and excavation work.

3. The COE should encourage the applicant to cap mobilized contaminated sediments with clean fill material that is appropriate for the project site.

4. The COE should encourage the applicant to develop a plan to reduce the pier’s migratory impacts on juvenile salmon. As repair or replacement becomes necessary for pier structures near the shore, the applicant should consider installation of replacements that minimize width, maximize height, and incorporate grated decking where practicable.

5. The COE should encourage the applicant to develop a plan to reduce the pier’s impacts on forage resources and water quality. As repair or replacement of piles becomes necessary, the applicant should consider removing or fully enclosing existing timber piles, with the intent to minimize on-going creosote contamination at the site.

2.11 Reinitiation of Consultation

This concludes formal consultation for the U.S. Army Corps of Engineers' authorization of the Petrogas Pacific LLC 5-year Maintenance Program in Whatcom County, Washington. As 50 CFR 402.16 states, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been retained or is authorized by law and if: (1) The amount or extent of incidental taking specified in the ITS is exceeded, (2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this Opinion, (3) the agency action is subsequently modified in a manner that causes an effect on the listed species or critical habitat that was not considered in this Opinion, or (4) a new species is listed or critical habitat designated that may be affected by the action.

2.12 Not Likely to Adversely Affect Determinations

This concurrence was prepared pursuant to section 7(a)(2) of the ESA, implementing regulations at 50 CFR 402 and agency guidance for preparation of letters of concurrence. Refer to the opinion for a description of the proposed action and action area. As described in section 1.2, the COE determined the proposed action is not likely to adversely affect all of the species and critical habitats identified in Table 1. However, as described in the Opinion above, NMFS did nor concur that the proposed action is not likely to adversely affect PS Chinook salmon and PS/GB bocaccio, and designated critical habitat for both of those species.

Our concurrence with the COE's "not likely to adversely affect" determinations for PS steelhead, PS/GB yelloweye rock fish, SR killer whales, and designated critical habitat for PS/GB yelloweye rockfish and SR killer whales follows. Detailed information on the biology, habitat, and conservation status and trend of these listed resources can be found in the recovery plans and other sources at: http://www.nmfs.noaa.gov/pr/species/fish/, http://www.nmfs.noaa.gov/pr/species/mammals/, and in the listing regulations and critical habitat designations published in the Federal Register. That information is incorporated here by reference.

The applicable standard to find that a proposed action is not likely to adversely affect listed species or critical habitat is that all of the effects of the action are expected to be discountable, insignificant, or completely beneficial. Beneficial effects are contemporaneous positive effects without any adverse effects to the species or critical habitat. Insignificant effects relate to the size of the impact and should never reach the scale where take occurs. Discountable effects are those extremely unlikely to occur.

As described above in Section 2.5, the proposed action is likely to affect listed species and/or critical habitat features through construction, structure-related effects, and interrelated vessel activities. For simplicity, the effects analysis in this section relies heavily on the discussions in Section 2.5. As described earlier, action-related stressors would cause no measurable effects in fish beyond about 705 feet (215 m) around the pier. The maximum range to the onset of behavioral disturbance in whales would be about 13.4 miles (21,544 m) during vibratory installation of four 30-inch steel pipe piles, over a 6-day period.

2.12.1 Effects on Listed Species

It is very unlikely that PS steelhead would be within 705 feet of the pier. Juvenile steelhead are generally independent of shallow nearshore areas soon after entering marine water (Bax *et al*. 1978, Brennan *et al*. 2004, Schreiner *et al*. 1977), and are not commonly caught in beach seine surveys. Recent acoustic tagging studies (Moore *et al*. 2010) have shown that smolts migrate from rivers to the Strait of Juan de Fuca from one to three weeks. Returning adults typically migrate in relatively deepwater well away from shore until the near the entrance of their natal streams. It is extremely unlikely that PS/GB yelloweye rockfish would be within 705 feet of the pier. Adult and juvenile PS/GB yelloweye rockfish typically inhabit rocky substrate at depths of 98 feet (30 m) or more. The nearest substrate at depths approaching 98 feet is over 8,000 feet west of the pier (NOAA 2018). In the unlikely event that individuals of either species enter the action area, it is extremely unlikely that they would approach or remain close enough to experience measurable impacts on their fitness or more than minor behavioral effects in the form of temporary avoidance of the area during on-going work.

SR killer whales that are within 13.4 miles of the project site could theoretically detect noise from the vibratory installation of four 30-inch steel pipe piles. Pile installation would cause four 15-minute periods of non-impulsive noise over a 6-day period, with no more than 30 minutes occurring on any single day. Over the same 6 days, extraction of timber piles would cause 24 1-minute periods of additional vibratory noise, with no more than 12 minutes occurring on any single day. That noise may be detectable by whales out to about 1.6 miles from the pier.

The peak noise levels of both sources would be non-injurious to SR killer whales and other marine mammals (NMFS 2018b). Additionally, the loudest project-related noise would attenuate to about 135 dB_{RMS} at about 2,200 yards from the project site. The high levels of shipping and other boat traffic present in the Strait of Georgia, and the relatively high ambient noise levels in the area (Bassett *et al*. 2010) support the expectation that project-related noise would often be nearly undetectable by SR killer whales much beyond that range.

Should any SR killer whales approach close enough to hear and respond to project-related noise, they would, at most, experience brief periods of low-level acoustic masking, and they may exhibit temporary minor avoidance of the area within about 1 mile of the pier. The exposure would cause no impacts on their fitness, and it would cause no meaningful impacts on their normal behaviors. Further, as described in section 2.5, the proposed action would cause no population-level effects on Chinook salmon, which is the main prey resource for SR killer whales. Therefore, the project is not likely to cause measurable trophic effects on these whales.

2.12.2 Effects on Critical Habitat

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

PS/GB Yelloweye Rockfish Critical Habitat: The proposed action is not likely to adversely affect critical habitat that has been designated for PS/GB yelloweye rockfish. The essential PBF of this critical habitat is limited to substrates at depths greater than 98 feet (30 m) and the waters above that substrate. That habitat occurs beyond the expected range of potential effects from the proposed action. Therefore, it is extremely unlikely that the action would cause any detectable effect on any PBF of this critical habitat.

SR killer whale Critical Habitat: The proposed action is not likely to adversely affect critical habitat that has been designated for SR killer whales. Designated critical habitat for SR killer whales includes marine waters of the Puget Sound that are at least 20 feet deep. The expected effects on SR killer whale critical habitat from completion of the proposed action, including full application of the conservation measures and BMP, would be limited to the impacts on the PBF as described below.

1. Water quality to support growth and development
   The proposed work would cause ephemeral minor effects, and the structure would cause long-term minor effects on water quality. It would cause no measurable changes in water temperature and salinity. Construction would briefly introduce low-levels of contaminants that may be detectable within about 300 feet around the project site, but would not persist past several hours after work stops. Legacy creosote-treated timber piles would continue to cause PAH contamination into the foreseeable future.
2. Prey species of sufficient quantity, quality, and availability to support individual growth, reproduction, and development, as well as overall population growth
   The proposed action would cause long-term minor effects on prey. Action-related impacts would injure individual Chinook salmon (primary prey), but the impacts would be too small to cause population-level effects on that species. Therefore, it would cause no detectable reduction in prey availability.
3. Passage conditions to allow for migration, resting, and foraging
   The proposed action would cause ephemeral minor effects on passage conditions. Over 6 days, construction-related noise may radiate 13.4 miles around the project site. Exposure to this noise would, at most, cause brief episodic periods of low-level acoustic masking, and minor avoidance of the area within about 1 mile around the pier. However, the temporary areal avoidance would not hinder migration, or limit access to important habitat resources.

For the reasons expressed immediately above, NMFS concurs with the COE’s determination that the proposed action is not likely to adversely affect ESA-listed PS steelhead, PS/GB yelloweye rockfish and their designated critical habitat, and SR killer whales and their designated critical habitat.

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

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

3.1 Essential Fish Habitat Affected by the Project

The proposed action and action area for this consultation are described in section 1 of this document. The action area includes areas designated as EFH for various life-history stages of Pacific Coast Salmon, Pacific Coast Groundfish, and Coastal Pelagic Species. The PFMC described and identified EFH for Pacific coast groundfish (PFMC 2005), Pacific salmon (PFMC 2014), and coastal pelagic species (PFMC 1998). In addition, the action area is within habitat area of particular concern (HAPC) for estuarine habitat and for eelgrass and kelp.

3.2 Adverse Effects on Essential Fish Habitat

The ESA portion of this document describes the adverse effects of this proposed action on ESA-listed species and critical habitat, and is relevant to the effects on EFH for Pacific Coast Salmon, Pacific Coast Groundfish, and Coastal Pelagic Species. Based on the analysis of effects presented in Section 2.5 the proposed action will cause small scale adverse effects on this EFH through direct or indirect physical, chemical, or biological alteration of the water or substrate, and through alteration of benthic communities, and the reduction in prey availability. Therefore, we have determined that the proposed action would adversely affect the EFH identified above.

3.3 Essential Fish Habitat Conservation Recommendations

Implementation of the following conservation recommendations would minimize and/or avoid adverse effects on EFH for Pacific Coast Salmon, Pacific Coast Groundfish, and Coastal Pelagic Species that are likely to result from the proposed action.

To reduce adverse alteration of the physical, chemical, or biological characteristics of the water and substrate, and to reduce adverse alteration of benthic communities and reduction in prey availability:

1. Require that tugboat operators remain in the deepest water practicable, avoid operating over eelgrass beds, and use the lowest safe power settings when maneuvering in shallow waters close to the shoreline;
2. Require that contractors limit pile removal to vibratory extraction and/or simple pull techniques (no water-jetting or clamshell excavation); and

3. Require that contractors ensure that extracted piles are not shaken, hosed off, left hanging over water, or that any other actions are taken to remove adhering material from piles while they are suspended over the water.

3.4 Statutory Response Requirement

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

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

3.5 Supplemental Consultation

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

4. DATA QUALITY ACT DOCUMENTATION AND PRE-DISSEMINATION REVIEW

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

4.1 Utility

Utility principally refers to ensuring that the information contained in this consultation is helpful, serviceable, and beneficial to the intended users. The intended user of this Opinion is the COE and the applicant. Other users could include WDFW, King County, and the citizens of King County. Individual copies of this Opinion were provided to the COE. The format and naming adheres to conventional standards for style.

4.2 Integrity

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

4.3 Objectivity

Information Product Category: Natural Resource Plan

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

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

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

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

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