



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

Refer to NMFS No:
WCRO-2020-00686

April 29, 2022

Todd Tillinger
Chief, Regulatory Branch
U.S. Army Corps of Engineers, Seattle District
4735 East Marginal Way South, Bldg. 1202
Seattle, Washington 98134-2388

Re: Endangered Species Act Section 7(a)(2) Biological Opinion, and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Response for Stephen C. Grey and Associates' Pier Extension Project in Lake Union, Seattle, Washington (USACE No. NWS-2019-694, HUC: 171100120400 – Lake Union)

Dear Mr. Tillinger:

Thank you for your letter of March 25, 2020, requesting initiation of consultation with NOAA's National Marine Fisheries Service (NMFS) pursuant to section 7 of the Endangered Species Act of 1973 (ESA) (16 U.S.C. 1531 et seq.) for the U.S Army Corps of Engineers' (USACE) authorization of Stephen C. Grey and Associates' (Grey and Associates') Pier Extension Project in Lake Union. This consultation was conducted in accordance with the 2019 revised regulations that implement section 7 of the ESA (50 CFR 402, 84 FR 45016).

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 the NMFS pursuant to section 7 of the ESA on the effects of the proposed action. In this opinion, the NMFS concludes that the proposed action would adversely affect but is not likely to jeopardize the continued existence of Puget Sound (PS) Chinook salmon and PS steelhead. The NMFS also concludes that the proposed action is likely to adversely affect designated critical habitat for PS Chinook salmon but is not likely to result in the destruction or adverse modification of that designated critical habitat. This opinion also documents our conclusion that the proposed action may affect, but is not likely to adversely affect southern resident (SR) killer whales and their designated critical habitat.

This opinion includes an incidental take statement (ITS) that describes reasonable and prudent measures (RPMs) the NMFS considers necessary or appropriate to minimize the incidental take associated with this action, and sets forth nondiscretionary terms and conditions that the USACE 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.

WCRO-2020-00686



Section 3 of this document includes our analysis of the action's likely effects on EFH pursuant to Section 305(b) of the MSA. Based on that analysis, the NMFS concluded that the action would adversely affect designated freshwater EFH for Pacific Coast Salmon. Therefore, we have provided 2 conservation recommendations that can be taken by the USACE to avoid, minimize, or otherwise offset potential adverse effects on EFH. We also concluded that the action would not adversely affect EFH for Pacific Coast groundfish and coastal pelagic species. Therefore, consultation under the MSA is not required for EFH for Pacific Coast groundfish and coastal pelagic species.

Section 305(b) (4) (B) of the MSA requires Federal agencies to provide a detailed written response to the NMFS within 30 days after receiving this recommendation. If the response is inconsistent with the EFH conservation recommendations, the USACE must explain why the recommendations will not be followed, including the scientific justification for any disagreements over the effects of the action and recommendations. In response to increased oversight of overall EFH program effectiveness by the Office of Management and Budget, the 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 request that in your statutory reply to the EFH portion of this consultation you clearly identify the number of conservation recommendations accepted.

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: Colleen Anderson, USACE

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

Stephen C. Grey and Associates' Pier Extension Project in Lake Union
King County, Washington
(USACE Number: NWS-2019-694)

NMFS Consultation Number: WCRO-2020-00686

Action Agency: U.S. Army Corps of Engineers

Affected Species and Critical Habitats, and NMFS' Determinations:

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

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	No	No
Coastal Pelagic Species	No	No

Consultation Conducted By: National Marine Fisheries Service
West Coast Region

Issued By:



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

Date: April 29, 2022

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LIST OF ABBREVIATIONS

ACZA – Ammoniacal Copper Zinc Arsenate (wood preservative)
BE – Biological Evaluation
BMP – Best Management Practices
CFR – Code of Federal Regulations
dB – Decibel (common unit of measure for sound intensity)
DIP – Demographically Independent Population
DPS – Distinct Population Segment
DQA – Data Quality Act
EF – Essential Feature
EFH – Essential Fish Habitat
ESA – Endangered Species Act
ESU – Evolutionarily Significant Unit
FR – Federal Register
FMP – Fishery Management Plan
HAPC – Habitat Area of Particular Concern
HUC – Hydrologic Unit Code
HPA – Hydraulic Project Approval
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
NOAA – National Oceanic and Atmospheric Administration
OHWL – Ordinary High Water Line
PAH – Polycyclic Aromatic Hydrocarbons
PBF – Physical or Biological Feature
PCB – Polychlorinated Biphenyl
PCE – Primary Constituent Element
PFMC – Pacific Fishery Management Council
PS – Puget Sound
PSTRT – Puget Sound Technical Recovery Team
PSSTRT – Puget Sound Steelhead Technical Recovery Team
RL – Received Level
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)
USACE – U.S. Army Corps of Engineers
VSP – Viable Salmonid Population
WCR – West Coast 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 (ITS) portions of this document in accordance with section 7(b) of the Endangered Species Act (ESA) of 1973 (16 U.S.C. 1531 et seq.), as amended, and implementing regulations at 50 CFR part 402.

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

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

1.2 Consultation History

On March 26, 2020, the NMFS received a letter from the U.S. Army Corps of Engineers (USACE) requesting informal consultation for the proposed action (USACE 2020). The request included the applicant's Biological Evaluation (BE; Cedarock 2019a) and project drawings (Grey and Associates 2019).

The NMFS requested additional information on May 6, 2020, and again on July 24, 2021. On September 21, 2021, the USACE sent an email with 5 attachments (USACE 2021) to provide the applicant's answers to the NMFS's questions (KPF 2021), the applicant's aquatic survey report (Echelon 2019) and their compensatory mitigation plan for the project (Cedarock 2019b). The NMFS considers that formal consultation for this action was initiated on September 21, 2021.

This opinion is based on the information in the applicant's BE and the additional information that was provided through the USACE; recovery plans, status reviews, and critical habitat designations for ESA-listed PS Chinook salmon and PS steelhead; published and unpublished scientific information on the biology and ecology of those species; and relevant scientific and gray literature (see Literature Cited).

1.3 Proposed Federal Action

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

The USACE proposes to authorize Grey and Associates (the applicant) to replace a 1,650-square foot, pile supported pier with a 4,200-square foot floating dock in Seattle, Washington, on the northern shore of Lake Union, about mid-way along the Lake Washington Ship Canal (Figure 1).



Figure 1. Google Earth photographs of the Grey and Associates project site. The left image shows the project site relative to the City of Seattle and Puget Sound. The center image shows the project location on the north shore of Lake Union. The right image shows the pier that would be replaced.

The existing 1,650-square foot pier is about 160 feet long and 8 feet wide, and includes no finger piers or ells. It is supported by about 25 untreated timber piles. The shoreward 100 feet is decked with timber planks, and the offshore 60 feet is decked with grating. The existing pier includes no known creosote-treated timber or piles (USACE 2021b). The existing lighting system includes small circular deck-mounted light fixtures that are about 8 inches tall and directed up and away from the water.

The new 4,200-square foot floating dock would consist of a 256 feet long by 10 feet wide walkway with 4 8-foot wide finger piers extending from its west side. The northern 3 finger piers would be about 56 feet long, and the southern finger would be 78 feet long. The shoreward (northern) end of the float would be about 10 feet waterward from the ordinary high water line (OHWL) where the water is about 10 feet deep (Figure 2).

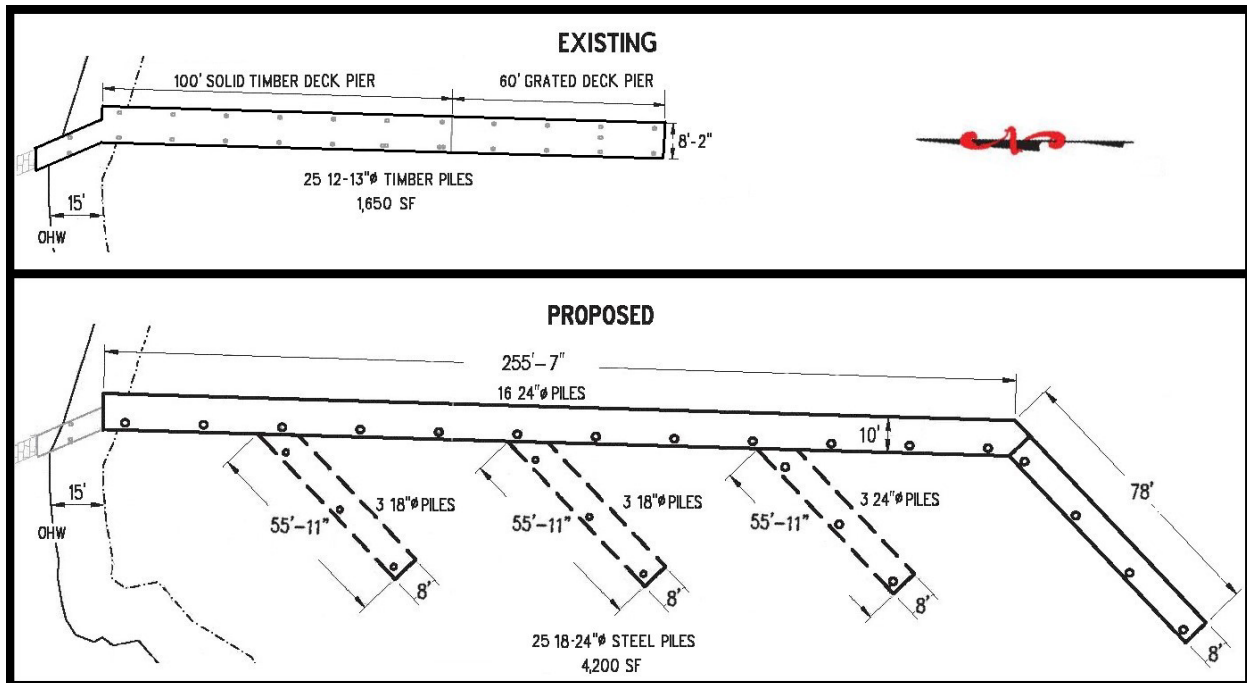


Figure 2. Overhead drawings of Grey and Associates' existing pier and their proposed floating dock on Lake Union (Adapted from Sheets 2 & 3 of 4 in Grey and Associates 2019).

The new floats would be built off-site and barged or towed to the site for installation. The framing would be built with timber that has been preserved with Ammoniacal Copper Zinc Arsenate (AZCA) and then undergone the required post-treatment best management practices (BMPs). All AZCA-treated timber would be limited to above-water applications. The floatation would consist of polyethylene-encapsulated foam tubs. The entire structure would be decked with grating with a minimum of 60% open area. The floats would be attached to 25 epoxy-coated steel pipe piles (6 18-inch diameter, and 19 24-inch diameter) (USACE. 2021b).

The proposed lighting system would consist of small circular (~8 inches in diameter) deck-mounted (~6 inches tall), low-wattage light fixtures that would be aimed to avoid being visible at water level (Cedarock 2019a; KPFF 2021). Additionally, the fixtures would illuminate only when motion is detected on the dock, and would shut off after about 15 minutes (Cedarock 2019a).

The applicant's contractors would operate tugboats, spud-barges, and small utility boats. They would also operate barge-mounted equipment such as a crane, a vibratory pile extraction and installation system, and miscellaneous small power-driven equipment including compressors, generators, drills, saws, welders, and hand tools. All construction materials would be barged to the project site. Similarly, all demolition and construction debris would be barged to the contractor's yard for proper disposal or recycling at approved facilities.

The applicant's contractors would cut away the existing timber pier deck and pile caps from the supporting piles, and using a barge-mounted crane, they would hoist the debris onto a barge for later transportation and upland disposal. The contractors would also use the barge-mounted crane

and direct pull and or vibratory extraction techniques to remove the 25 existing timber piles, which would also be placed on the barge for. For any piles that break off, divers would cut off the piles below the mudline, and cap the holes with clean sand. Demolition, including pile extraction would take no more than 2 weeks of work.

The contractors would also use the barge-mounted crane and the vibratory pile driver to install the 25 epoxy-coated steel piles for the new floating dock. No impact proofing of the piles would be done. The applicant gave no estimate of the number of piles that would be installed per day. However, they estimate that pile installation would last no more than 2 weeks.

The contractors would operate workboats to float the new floating dock sections into place, and use hand-held tools to connect the float sections to each other and to the piles. They would use the barge-mounted crane to install a gangway between the existing access pier and the new floating dock, and then preform above-water work to connect electrical power and water to the new floating dock. No pump-out would be installed on the new dock, so there would be no sewer connections. The applicant estimates that this component would take about 1 week of work.

In addition to the demolition and construction described above, the applicant proposes to remove submerged debris and trash under the City of Seattle's Shoreline Alternative Mitigation Plan (SAMP) to help offset the habitat impacts of the proposed floating dock. Divers would remove debris and trash from the area within 500 feet around the floating dock (Cedarock 2019b).

The applicant reports that the project would require no more than 6 weeks of work at the site, and that operation of power equipment would be limited to normal daylight work hours. All in-water work would be completed during the October 1 through April 15 approved in-water work window for the project area. Additionally, all work would be done in compliance with the BMPs and protective measures identified in the applicant's BE, and their Washington State Department of Fish and Wildlife Hydraulic Project Approval (HPA) when issued. Note that in addition to any work done on structural components that are in the water, this opinion considers any work that includes the use of any vessel (i.e. utility boat, tugboat, barge, or raft) to constitute in-water work, even if the structural component being worked on is above the water's surface.

Other activities that could be caused by the proposed action

The NMFS considered whether or not the proposed action would cause any other activities and determined that it would cause the following activities: In addition to extending the useful life of the applicant's moorage structure by several decades, the proposed action would more than double its overwater footprint, and approximately double the mooring capacity and vessel operations at the site. The existing pier currently supports mooring for about 10 20-foot long boats with the clientele about equally divided between transients and long-term moorage. The new float would accommodate about 18 to 25 vessels, depending on size, and allow for moorage of vessels up to about 50 feet in length (USACE. 2021b). Recreational vessel traffic currently using the pier is expected to double from about 9 to 18 trips per day during the peak summer season, and from about 5 to 10 trips per day during the low winter season (Cedarock 2019a). Therefore, the action would perpetuate and increase vessel mooring and operation at and around the new floating dock for decades to come. Consequently, we have included an analysis of the

effects of the structure and of vessel traffic and moorage at the floating dock in the effects section of this Opinion.

2. ENDANGERED SPECIES ACT BIOLOGICAL OPINION AND INCIDENTAL TAKE STATEMENT

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

The USACE determined that the proposed action is likely to adversely affect PS Chinook salmon and their designated critical habitat, is not likely to adversely affect PS steelhead, and would have no effect on designated critical habitat for PS steelhead, Southern Resident (SR) killer whales, and designated critical habitat for SR killer whales.

Because the NMFS has concluded that the proposed action is likely to adversely affect PS Chinook salmon, PS steelhead, and designated critical habitat for PS Chinook salmon (Table 1), the NMFS has proceeded with formal consultation. Additionally, because of the trophic relationship between PS Chinook salmon and SR killer whales, the NMFS analyzed the action’s potential effects on SR killer whales and their designated critical habitat in the "Not Likely to Adversely Affect" Determinations section (2.12).

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

ESA-listed species and critical habitat likely to be adversely affected (LAA)				
Species	Status	Species	Critical Habitat	Listed / CH Designated
Chinook salmon (<i>Oncorhynchus tshawytscha</i>) Puget Sound	Threatened	LAA	LAA	06/28/05 (70 FR 37160) / 09/02/05 (70 FR 52630)
steelhead (<i>O. mykiss</i>) Puget Sound	Threatened	LAA	N/A	05/11/07 (72 FR 26722) / 02/24/16 (81 FR 9252)
ESA-listed species and critical habitat not likely to be adversely affected (NLAA)				
Species	Status	Species	Critical Habitat	Listed / CH Designated
Killer whales (<i>Orcinus orca</i>) Southern resident (SR)	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 an adverse modification analysis. The jeopardy analysis relies upon the regulatory definition of “jeopardize the continued existence of” a listed species, which is “to engage in an action that reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species” (50 CFR 402.02). Therefore, the jeopardy analysis considers both survival and recovery of the species.

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

The designations of critical habitat for PS Chinook salmon and SR killer whales use the term primary constituent element (PCE). The 2016 final rule (81 FR 7414; February 11, 2016) that revised the critical habitat regulations (50 CFR 424.12) replaced this term with physical or biological features (PBFs). The shift in terminology does not change the approach used in conducting a “destruction or adverse modification” analysis, which is the same regardless of whether the original designation identified PCEs, PBFs, or essential features. In this biological opinion, we use the term PBF to mean PCE the specific critical habitats.

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

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

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

2.2 Range-wide Status of the Species and Critical Habitat

This opinion examines the status of each species that is likely to be adversely affected by the proposed action. The status is determined by the level of extinction risk that the listed species face, based on parameters considered in documents such as recovery plans, status reviews, and listing decisions. This informs the description of the species' likelihood of both survival and recovery. The species status section also helps to inform the description of the species' "reproduction, numbers, or distribution" for the jeopardy analysis. The opinion also examines the condition of 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 function of the PBFs that are essential for the conservation of the species.

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 listing regulations and critical habitat designations published in the Federal Register and in the recovery plans and other sources at: <https://www.fisheries.noaa.gov/species-directory/threatened-endangered>, and are incorporated here by reference.

Listed Species

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

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

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

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

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

For species with multiple populations, we assess the status of the entire species based on the biological status of the constituent populations, using criteria for groups of populations, as

described in recovery plans and guidance documents from technical recovery teams. Considerations for species viability include having multiple populations that are viable, ensuring that populations with unique life histories and phenotypes are viable, and that some viable populations are both widespread to avoid concurrent extinctions from mass catastrophes and spatially close to allow functioning as metapopulations (McElhany et al. 2000).

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

Puget Sound (PS) Chinook Salmon: The PS Chinook salmon evolutionarily significant unit (ESU) was listed as threatened on June 28, 2005 (70 FR 37160). We adopted the recovery plan for this ESU in January 2007. The recovery plan consists of two documents: the Puget Sound salmon recovery plan (SSPS 2007) and the final supplement to the Shared Strategy's Puget Sound salmon recovery plan (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 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.

General Life History: Chinook salmon are anadromous fish that require well-oxygenated water that is typically less than 63° F (17° C), but some tolerance to higher temperatures is documented with acclimation. 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 Chinook salmon tend to 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. Both stream- and ocean-type Chinook salmon are present, but ocean-type Chinook salmon predominate in Puget Sound populations.

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. In Puget Sound, spring-run Chinook salmon tend to enter their natal rivers as early as March, but do not spawn until mid-August through September. Returning summer- and fall-run fish tend to enter the rivers early-June through early-September, with spawning occurring between early August and late-October.

Yearling stream-type fish tend to leave their natal rivers 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 their natal streams beginning in early-March. Those fish rear in the tidal delta estuaries of their natal stream for about two weeks to two 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.

Spatial Structure and Diversity: 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).

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

Abundance and Productivity: Available data on total abundance since 1980 indicate that abundance trends have fluctuated between positive and negative for individual populations, but productivity remains low in most populations, and hatchery-origin spawners are present in high fractions in most populations outside of the Skagit watershed. Available data now show that most populations have declined in abundance over the past 7 to 10 years. Further, escapement

levels for all populations remain well below the PSTRT planning ranges for recovery, and most populations are consistently below the spawner-recruit levels identified by the PSTRT as consistent with recovery (NWFSC 2015). The current information on abundance, productivity, spatial structure and diversity suggest that the Whidbey Basin MPG is at relatively low risk of extinction. The other four MPGs are considered to be at high risk of extinction due to low abundance and productivity (NWFSC 2015). The most recent 5-year status review concluded that the ESU should remain listed as threatened (NMFS 2017).

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	

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 likely to occur in the action area would be fall-run Chinook salmon from the Cedar River population and from the North Lake Washington / Sammamish River population (NWFSC 2015; WDFW 2022a). Both stream- and ocean-type Chinook salmon are present in these populations, with the majority being ocean-types.

The Cedar River population is relatively small, with a total annual abundance fluctuating at close to 1,000 fish (NWFSC 2015; WDFW 2022b). Between 1965 and 2021, the total abundance for PS Chinook salmon in the basin has fluctuated between about 133 and 2,451 individuals, with the average trend being slightly negative. The 2015 status review reported that the 2010 through 2014 5-year geometric mean for natural-origin spawner abundance had shown a positive change since the 2010 status review, with natural-origin spawners accounting for about 82% of the population. WDFW data suggest that natural-origin spawners accounted for about 62% of a combined total return of 963 fish in 2021 (WDFW 2022b).

The North Lake Washington / Sammamish River population is also small, with a total abundance that has fluctuated between about 33 and 2,223 individuals from 1983 through 2021, with the average trend being relatively flat (NWFSC 2015; WDFW 2022b). Natural-origin spawners make up a small proportion of the total population, accounting for about 9% of the 2,186 total return in 2021.

All returning adults and out-migrating juveniles of these two populations, as well as individuals that spawn in the numerous smaller streams across the basin, must pass the action area to complete their life cycles. Adult Chinook salmon pass through Chittenden Locks (aka Ballard Locks) between mid-June through September, with peak migration occurring in mid-August (City of Seattle 2008). Spawning occurs well upstream of the action area between early August and late October. Juvenile Chinook salmon are found in Lake Washington and Lake Sammamish between January and July, primarily in the littoral zone (Tabor et al. 2006). Outmigration through the ship canal and past the action area to the locks occurs between late-May and early-July, with the peak in June (City of Seattle 2008).

Puget Sound (PS) steelhead: The PS steelhead distinct population segment (DPS) was listed as threatened on May 11, 2007 (72 FR 26722). The NMFS adopted the recovery plan for this DPS in December 2019. In 2013, the Puget Sound Steelhead Technical Recovery Team (PSSTRT) identified 32 demographically independent populations (DIPs) within the DPS, based on genetic, environmental, and life history characteristics. Those DIPs are distributed among three geographically-based major population groups (MPGs); Northern Cascades, Central and South Puget Sound; and Hood Canal and Strait de Fuca (Myers et al. 2015) (Table 3).

In 2015, the PSSTRT concluded that the DPS is at “very low” viability; with most of the 32 DIPs and all three MPGs at “low” viability based on widespread diminished abundance, productivity, diversity, and spatial structure when compared with available historical evidence (Hard et al. 2015). Based on the PSSTRT viability criteria, the DPS would be considered viable when all three component MPG are considered viable. A given MPG would be considered viable when: 1) 40 percent or more of its component DIP are viable; 2) mean DIP viability within the MPG exceeds the threshold for viability; and 3) 40 percent or more of the historic life history strategies

(i.e., summer runs and winter runs) within the MPG are viable. For a given DIP to be considered viable, its probability of persistence must exceed 85 percent, as calculated by Hard et al. (2015), based on abundance, productivity, diversity, and spatial structure within the DIP.

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

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

General Life History: PS steelhead exhibit two major life history strategies. Ocean-maturing, or winter-run fish typically enter freshwater from November to April at an advanced stage of maturation, and then spawn from February through June. Stream-maturing, or summer-run fish typically enter freshwater from May to October at an early stage of maturation, migrate to headwater areas, and hold for several months prior to spawning in the following spring. After hatching, juveniles rear in freshwater from one to three years prior to migrating to marine habitats (two years is typical). Smoltification and seaward migration typically occurs from April to mid-May. Smolt lengths vary between watersheds, but typically range from 4.3 to 9.2 inches (109 to 235 mm) (Myers et al. 2015). Juvenile steelhead are generally independent of shallow

nearshore areas soon after entering marine water (Bax et al. 1978, Brennan et al. 2004, Schreiner et al. 1977), and are not commonly caught in beach seine surveys. Recent acoustic tagging studies (Moore et al. 2010) have shown that smolts migrate from rivers to the Strait of Juan de Fuca from one to three weeks. PS steelhead feed in the ocean waters for one to three years (two years is again typical), before returning to their natal streams to spawn. Unlike Chinook salmon, most female steelhead, and some males, return to marine waters following spawning (Myers et al. 2015).

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

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

Limiting Factors: Factors limiting recovery for PS steelhead include:

- The continued destruction and modification of steelhead habitat

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

PS Steelhead within the Action Area: The PS steelhead populations that occur in the action area consist of winter-runs from the Cedar River and North Lake Washington / Lake Sammamish DIPs (NWFSC 2015; WDFW 2022a). Both DIPs are among the smallest within the DPS. WDFW reports that the total PS steelhead abundance in the Cedar River basin has fluctuated between 0 and 900 individuals between 1984 and 2021, with a strong negative trend. Since 2000, the total annual abundance has remained under 50 fish (WDFW 2022c). NWFSC (2015) suggests that the returns may have been above 1,000 individuals during the 1980s, but agrees with the steep decline to less than 100 fish since 2000. It is unclear what proportion of the returns are natural-origin spawners, if any. A total of only 4 adults are thought to have returned in 2021 (WDFW 2022c).

The Sammamish River population is even smaller. WDFW reports that the total abundance for PS steelhead in the North Lake Washington / Lake Sammamish basin fluctuated between 0 and 916 individuals between 1984 and the last survey in 1999, with a strong negative trend. Abundance never exceeded 45 fish after 1992, and was only 4 in 1999 (WDFW 2022c). NWFSC (2015) disagrees with WDFW in that returns may have been above 1,500 individuals during the mid-1980s, but NWFSC agrees with the steep decline to virtually no steelhead in the basin since 2000.

All returning adults and out-migrating juveniles of these two populations must pass the action area to complete their life cycles. Adult steelhead pass through Chittenden Locks (aka Ballard Locks) and the Lake Washington Ship Canal between January and May, and may remain within Lake Washington through June (City of Seattle 2008). The timing of steelhead spawning in the basin is uncertain, but occurs well upstream of the action area. Juvenile steelhead enter Lake Washington in April, and typically migrate through the ship canal and past the action area to the locks between April and May (City of Seattle 2008).

Critical Habitat

This section describes the status of designated critical habitat that would be affected by the proposed action by examining the condition and trends of physical or biological features (PBFs)

that are essential to the conservation of the listed species throughout the designated areas. The PBFs are essential because they support one or more of the species' life stages (e.g., sites with conditions that support spawning, rearing, migration and foraging). The proposed project would affect critical habitat for PS Chinook salmon.

The 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. The PBF for PS Chinook salmon CH are listed in Table 4.

Major tributary river basins in the Puget Sound basin include the Nooksack, Samish, Skagit, Sauk, Stillaguamish, Snohomish, Lake Washington, Cedar, Sammamish, Green, Duwamish, Puyallup, White, Carbon, Nisqually, Deschutes, Skokomish, Duckabush, Dosewallips, Big Quilcene, Elwha, and Dungeness rivers and Soos Creek. Critical habitat throughout the Puget Sound basin has been degraded by numerous activities, including hydropower development, loss of mature riparian forests, increased sediment inputs, removal of large wood 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.

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 large wood recruitment (SSPS 2007).

Table 4. Physical or biological features (PBFs) of designated critical habitat for PS Chinook salmon, and corresponding life history events. Although offshore marine areas were identified in the final rule, none was designated as critical habitat.

Physical or Biological Features		Life History Event
Site Type	Site Attribute	
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

Diking, agriculture, revetments, railroads and roads in lower stream reaches have caused significant loss of secondary channels in major valley floodplains in this region. Confined main channels create high-energy peak flows that remove smaller substrate particles and large wood. The loss of side-channels, oxbow lakes, and backwater habitats has resulted in a significant loss of juvenile salmonid rearing and refuge habitat. When the water level of Lake Washington was lowered 9 feet in the 1910s, thousands of acres of wetlands along the shoreline of Lake Washington, Lake Sammamish and the Sammamish River corridor were drained and converted to agricultural and urban uses. Wetlands play an important role in hydrologic processes, as they

store water which ameliorates high and low flows. The interchange of surface and groundwater in complex stream and wetland systems helps to moderate stream temperatures. 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, changed flow patterns, resulted in elevated temperatures and stranding of juvenile migrants, and degraded downstream spawning and rearing habitat by reducing recruitment of spawning gravel and large wood to downstream areas (SSPS 2007). These actions tend to promote downstream channel incision and simplification (Kondolf 1997), limiting fish habitat. Water withdrawals reduce available fish habitat and alter sediment transport. Hydropower projects often change flow rates, stranding and killing fish, and reducing aquatic invertebrate (food source) productivity (Hunter 1992).

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

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

Degradation of the near-shore environment has occurred in the southeastern areas of Hood Canal in recent years, resulting in late summer marine oxygen depletion and significant fish kills. Circulation of marine waters is naturally limited, and partially driven by freshwater runoff, which is often low in the late summer. However, human development has increased nutrient

loads from failing septic systems along the shoreline, and from use of nitrate and phosphate fertilizers on lawns and farms. Shoreline residential development is widespread and dense in many places. The combination of highways and dense residential development has degraded certain physical and chemical characteristics of the near-shore environment (HCCC 2005; SSPS 2007).

Critical Habitat within the Action Area: Critical habitat has been designated for PS Chinook salmon along the entire length of the Lake Washington Ship Canal, Lake Union, all of Lake Washington, about 950 yards upstream into the Sammamish River, and well upstream into the Cedar River watershed. The critical habitat in the Lake Union and the Lake Washington Ship Canal provides the Freshwater Migration PBF for PS Chinook (NOAA 2021; WDFW 2021a).

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).

The project site is located in Seattle, Washington, on the northern shore of Lake Union, about mid-way along the Lake Washington Ship Canal (Figure 1). As described in section 2.5, work-related water quality effects would be the stressor with the greatest range of direct and indirect effects on fish. Detectable effects would be limited to the waters and substrates within about 300 feet around the project site. However, trophic connectivity between PS Chinook salmon and the SR killer whales that feed on them extends the action area to the marine waters of Puget Sound. The described area overlaps with the geographic ranges of the ESA-listed species and the boundaries of designated critical habitats identified 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” refers to the condition of the listed species or its designated critical habitat in the action area, without the consequences to the listed species or designated critical habitat caused by the proposed action. The environmental baseline includes the past and present impacts of all Federal, State, or private actions and other human activities in the action area, the anticipated impacts of all proposed Federal projects in the action area that have already undergone formal or early section 7 consultations, and the impact of State or private actions which are contemporaneous with the consultation in process. The consequences to listed species or designated critical habitat from ongoing agency activities or existing agency facilities that are not within the agency’s discretion to modify are part of the environmental baseline (50 CFR 402.02).

Environmental conditions at the project sites and the surrounding area: The project site is located in Seattle, Washington, on the northern shore of Lake Union, about mid-way along the Lake Washington Ship Canal (Figure 1). Although the action area includes the marine waters of Puget Sound, all detectable effects of the action would be limited to Lake Union within about

300 feet of the project site (Sections 2.5 & 2.12). Therefore this section focuses on habitat conditions in Lake Union, and does not discuss Puget Sound habitat conditions.

The geography and ecosystems in and adjacent to Lake Union have been dramatically altered by human activity since European settlers first arrived in the 1800s. Historically, a small stream flowed from Lake Union to Shilshole Bay, with no surface water connection between Lake Union and Lake Washington. The waters of Lake Washington flowed south to the Duwamish River via the now absent Black River. The ship canal was created by intense dredging and excavation that began in the 1880s to provide a navigable passage between Lake Washington and the marine waters of Shilshole Bay. It was completed in 1916. As part of this, the Hiram M. Chittenden Locks (aka Ballard Locks) were constructed near the west end of the canal to maintain navigable water levels in the canal and lakes. Flows through canal are highly controlled by the locks, and are typically very slow, and the canal and Lake Union support high levels of commercial and recreational vessel traffic.

Very little natural shoreline or riparian vegetation exists along the banks of Lake Union. Most of the banks are armored, with shoreline water depths typically measured in tens of feet instead of the very shallow, gently sloping banks that are typical of undisturbed streams and lakes. The vast majority of Lake Union is lined by shipyards, large marinas, and boathouse piers. Immediately landward all around the lake, unbroken urban development extends for miles.

Water quality within the area is influenced by the inflow of freshwater from Lake Washington, by point and non-point discharges, and by a saltwater lens that intrudes through the Ballard Locks, underlays the outflowing freshwater, and occasionally extends into Lake Union. Industrial, commercial, and residential development has impacted water quality in the lake since before the canal was completed in 1916. Lumber and plywood mills, machine shops, metal foundries, fuel and oil facilities, concrete and asphalt companies, power plants, shipyards, marinas, commercial docks, and houseboats were quickly developed along the shoreline of the lake and canal. Virtually all of the early industrial, commercial, and residential facilities discharged untreated wastes directly to the lake and canal, some of which persisted into the 1940s and beyond. Stormwater drainage has, and continues to add to pollutant loading. Most of the direct discharge of raw sewage was stopped and the gas plant ceased operation during the 1960s.

Today, the overall water quality in the lake and canal has improved substantially. However, the waters of the project site, along with all of Lake Union, are identified on the current Washington State Department of Ecology (WDOE) 303(d) list of threatened and impaired water bodies for bacteria and temperature (Category 5). Other water quality listings at the project site include chloride (Category 2); as well as total phosphorus, selenium, and chromium (Category 1). Additionally, the bottom sediments at the site exceed the Sediment Quality Standards (SQS) bioassay criterion of Washington State's Sediment Management Standards (WDOE 2021).

Since 1979, water temperatures in the ship canal have increased an average of 1° Celsius (C, 1.8° F) per decade, with temperatures that can reach 20 to 22° C during the summer and early fall, and the number of days that temperatures are in that range is increasing (City of Seattle 2010). The preferred temperature limits for salmon are 13 to 18° C (55-64° F), and temperatures of 23 to 25° C (73-77° F) can be lethal. Saltwater intrusion through the locks creates a wedge of high-

density saltwater that can extend into and past Lake Union during low flow periods. Freshwater typically floats over the saltwater with little mixing between the two water masses, and the saltwater wedge often becomes anoxic early in the summer as bacteria consume organics in the sediment. Dissolved oxygen concentrations range from 9.5 to 12.6 mg/L during the winter and spring, but can decrease to as low as 1 mg/L during the summer months.

The artificial shorelines and widespread presence of overwater structures along the length of the canal and much of Lake Union provide habitat conditions that favor fish species that prey on juvenile salmonids, especially the non-native smallmouth bass. Other predators in the canal include the native northern pikeminnow and the non-native largemouth bass (Celedonia et al. 2008a and b; Tabor et al. 2004 and 2010). Tabor et al. (2004) estimated that about 3,400 smallmouth bass and 2,500 largemouth bass, large enough to consume salmon smolt were in the ship canal. They also estimated that smallmouth bass consumed about 48,000 salmon smolts annually, while largemouth bass consumed about 4,200 smolts. Of those, over half were Chinook salmon. Predation appeared to be highest in June, and near Portage Bay, when smolts made up approximately 50% of the diet for smallmouth bass, and about 45% for northern pikeminnow. Returning adult salmon and steelhead are often exposed to excessive predation by pinniped marine mammals (seals and sea lions) that feed on the fish that accumulate downstream of the fish ladder.

As described in the proposed action section, the applicant's existing 1,650-square foot pier extends about 160 feet south from the north bank of Lake Union, about 1,500 feet west of the Interstate Highway Five bridge. It is supported by about 25 untreated timber piles, and the shoreward 100 feet is decked with timber planks. The pier supports the mooring of about 10 boats in the 5- to 20-foot length range.

The water depth under the shoreward end of the pier section that would be replaced is about 10 feet. The depth at the offshore end of the proposed float is about 35 feet. The applicant's BA describes the aquatic habitat as consisting of a strip of gravelly sand between 5 to 10 feet from the high water mark, and silty sand below that with anthropogenic debris consisting of tires, lumber, cans, empty barrels, concrete rubble, and other miscellaneous materials. Dense aquatic vegetation (milfoil) was observed starting about 10 feet offshore.

The applicant's pier likely induces migratory delays for juvenile salmonids, and provides habitat conditions that favor piscivorous fish such northern pikeminnow, smallmouth bass, and largemouth bass that prey on juvenile salmonids.

The past and ongoing anthropogenic impacts described above have reduced the project area's ability to support migrating PS Chinook salmon and PS steelhead. However, the project area continues to provide migratory habitat for adults and juveniles of both species, and the area has been designated as critical habitat for PS Chinook salmon.

Climate Change: Climate change has affected the environmental baseline of aquatic habitats across the region and within the action area. However, the effects of climate change have not been homogeneous across the region, nor are they likely to be in the future. During the last century, average air temperatures in the Pacific Northwest have increased by 1 to 1.4° F (0.6 to

0.8 °C), and up to 2° F (1.1 °C) in some seasons (based on average linear increase per decade; Abatzoglou et al. 2014; Kunkel et al. 2013). Recent temperatures in all but two years since 1998 ranked above the 20th century average (Mote et al. 2013). Warming is likely to continue during the next century as average temperatures are projected to increase another 3 to 10° F (1.7 to 5.6° C), with the largest increases predicted to occur in the summer (Mote et al. 2014).

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

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

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

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

The adaptive ability of these threatened and endangered species is depressed due to reductions in population size, habitat quantity and diversity, and loss of behavioral and genetic variation. Without these natural sources of resilience, systematic changes in local and regional climatic conditions due to anthropogenic global climate change will likely reduce long-term viability and sustainability of populations in many of these ESUs (NWFSC 2015). New stressors generated by

climate change, or existing stressors with effects that have been amplified by climate change, may also have synergistic impacts on species and ecosystems (Doney et al. 2012). These conditions will possibly intensify the climate change stressors inhibiting recovery of ESA-listed species in the future.

2.5 Effects of the Action

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

The USACE proposes to authorize the applicant to perform up to 6 weeks of in- and over-water work between October 1 and April 15 to replace a 1,650-square foot pile-supported pier with a 4,200-square foot, fully-grated floating dock in Lake Union. As described in the proposed action section of this opinion, the applicant’s contractor would operate barge-mounted heavy equipment, as well as divers and above-water workers with handheld power tools to remove the upper deck and 25 timber piles, and to install 25 steel piles, to which they would connect the pre-fabricated floating dock sections.

The proposed work would cause direct effects on the fish and habitat resources that are present during the in-water work through exposure to construction-related noise, water contamination, and propeller wash. The proposed construction would also cause indirect effects on fish and habitat resources through construction-related forage contamination. The USACE’s authorization of the construction would also have the additional effects of expanding the footprint and extending the operational life of the mooring dock by several decades beyond that of the existing pier. Over that time, the floating dock’s presence and normal operations would cause effects on fish and habitat resources through dock-related water and forage contamination, altered lighting, elevated noise, and propeller wash.

The action’s October 1 through April 15 work window avoids the normal migration seasons for juvenile and adult PS Chinook salmon. As such, PS Chinook salmon are extremely unlikely to present during the proposed in-water work. The work window overlaps slightly with the normal migration seasons for juvenile and adult PS steelhead. However, PS steelhead are very rare in the Lake Washington watershed. Fewer than 10 adults from the North Lake Washington and Lake Sammamish population returned to the watershed between 1994 and 1999 when the last WDFW survey was done. Similarly, 50 adults from the Cedar River population have returned to the watershed since 2000, with 10 or less returning since 2007 (WDFW 2021c). Additionally, the best available information supports the understanding that Lake Union supports no year-round rearing of stream type individuals of either species. Therefore, it is extremely unlikely that PS Chinook salmon and PS steelhead would be exposed to the direct effects of the proposed action. However, over the decades-long life of the new floating dock, juveniles of both species would be exposed to the action’s indirect effects when they pass through the project area during their

annual out-migration seasons. The PBFs of PS Chinook salmon critical habitat would also be exposed to the action's direct and indirect effects.

2.5.1 Effects on Listed Species

Construction-related Direct Effects

Construction-related direct effects (i.e. construction-related noise, water contamination, and propeller wash) is unlikely to adversely affect PS Chinook salmon and PS steelhead because it is extremely unlikely that individuals of either species would be present during the proposed work window.

Construction-related Forage Diminishment

Construction-related forage diminishment is likely to adversely affect juvenile PS Chinook salmon and juvenile PS steelhead. It is extremely unlikely that adults of either species would be exposed to this stressor.

In addition to direct uptake of contaminants through their gills, fish can absorb contaminants through dietary exposure (Meador et al. 2006; Varanasi et al. 1993). Amphipods and copepods uptake contaminants such as Polycyclic Aromatic Hydrocarbons (PAHs) from contaminated sediments (Landrum and Scavia 1983; Landrum et al. 1984; Neff 1982), and pass them to juvenile Chinook salmon and other small fish through the food web. Varanasi et al. (1993) found high levels of PAHs in the stomach contents of juvenile Chinook salmon in the contaminated Duwamish Waterway. They also reported reduced growth, suppressed immune competence, as well as increased mortality in juvenile Chinook salmon that was likely caused by the dietary exposure to PAHs. 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.

The sediments at the project site are documented as contaminated. Although not specifically identified by the State or the applicant, the sediments at the project site likely contain legacy contaminants that include PAHs, Polychlorinated Biphenyls (PCBs), and various metals. The extraction of the existing pier's 25 piles would mobilize small amounts of those contaminated subsurface sediments, which would settle onto the top layer of the substrate, where the contaminants would remain biologically available for years.

Romberg (2005) discusses the spread of contaminated sediments that were mobilized by the removal of creosote-treated piles from the Seattle Ferry Terminal, including digging into the sediment with a clamshell bucket to remove broken piles. Soon after the work, high PAH levels were detected up to 800 feet away, on the surface of a clean sand cap that had been installed less than a year earlier. Contaminant concentrations decreased with distance from the pile removal site, and over 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.

Given the dramatic difference in the scale of disturbance between the planned pile removal and the one described by Romberg (2005), the proposed project's sediment mobilization would be extremely less intense. Most of the mobilized sediment, and therefore the highest concentrations of contaminants, would settle onto the top layer of the substrate within 10s of feet around the pile removal sites. However, tugboat and recreational vessel propeller wash could spread sediments as far as 300 feet around the project site. The contaminated sediments that settle to the bottom would remain biologically available to juvenile PS Chinook salmon and juvenile PS steelhead for years after project completion. While present, some of those contaminants are likely to be taken up by invertebrate prey organisms within the affected area.

The normal behaviors of juvenile Chinook salmon in the freshwater out-migration phase of their life cycle include a strong tendency toward shoreline obligation, which means that they are biologically compelled to follow and stay close to streambanks and shorelines, and likely to pass through and forage within the project area. The normal behaviors of out-migrating juvenile steelhead is much less tied to shoreline habitats. However, over the years-long presence of available contaminants at the site, some out-migrating juvenile steelhead are likely to pass through and forage within the project area.

Additionally, increased contaminant levels from construction activities is likely to kill some prey organisms, reducing the number, size, and diversity of prey species that are available to foraging juvenile salmonids that pass through the affected area. When juvenile fish encounter areas of diminished prey, competition for those limited resources increases, and less competitive individuals are forced into suboptimal foraging areas (Auer et al. 2020). Further, individuals with an inherently higher metabolism tend to be bolder and competitively dominant, and may outcompete other individuals for resources within a microhabitat, potentially increasing interspecific mortality (Biro and Stamps 2010).

The exact number of years that detectable amounts of construction-related contaminants would be biologically available at the site is uncertain, but is expected to be low. Similarly, the annual numbers of juvenile PS Chinook salmon and juvenile PS steelhead that may be exposed to construction-related contaminated forage are uncertain. However, the best available information about the sizes of the affected populations, combined with the numerous routes taken by juvenile salmonids emigrating through the canal and Lake Union support the understanding that the subsets of the juvenile PS Chinook salmon and juvenile PS steelhead that would annually emigrate through the project area would be small and variable.

Similarly, the amounts of contaminated prey that individual fish may consume, or the intensity of effects that exposed individuals may experience are uncertain and likely to be highly variable. However, the small amount of sediment that would be mobilized suggests that the number of years that detectable contaminants would be present would be low. Further, the affected area would be relatively small. This suggests that the probability of trophic connectivity to the contamination would be very low for any individual fish, and that the numbers of juvenile PS Chinook salmon and juvenile PS steelhead that would be annually exposed to project-related contaminated prey would be too small to cause detectable population-level effects.

Dock-related Altered Lighting

Dock-related altered lighting is likely to adversely affect juvenile PS Chinook salmon and juvenile PS steelhead, but cause minor effects in adults of both species.

At the end of the project, the applicant's new floating dock would be fully decked with grating, but it would extend over 300 feet from the shoreline and have an overwater footprint of 4,200 square feet. The water depths under the new dock would range from about 10 at its shoreward end, to about 35 feet at its offshore end.

Despite the grated decking, the dock and the boats moored against it would create unnatural daytime shade over the water and aquatic substrate. The intensity of shadow 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. At night, the dock and vessels would also create over-water artificial illumination.

Shade: Although less intense than the shoreward 100 feet of the existing pier, the shade of the new dock and the vessels moored to it would maintain and extend conditions at and adjacent to the existing pier's footprint that reduce aquatic productivity, alter juvenile salmonid migratory behaviors, and increase juvenile salmonids' exposure and vulnerability to predators.

Shade limits primary productivity and can reduce the diversity of the aquatic communities under over-water structures (Nightingale and Simenstad 2001; Simenstad et al. 1999). Juvenile salmon feed on planktonic organisms such as amphipods, copepods, and euphausiids, as well as the larvae of many benthic species and fish (NMFS 2006). Because the new dock and moored vessels would cast shadows over water and substrate that would otherwise be supportive of submerged aquatic vegetation (SAV) and benthic invertebrates, the shade would continue to reduce the quantity and diversity of natural cover and prey organisms for juvenile salmonids.

If situated alone along a stretch of undisturbed shoreline, the impacts on aquatic productivity from shade related to the applicant's dock might not measurably affect the fitness of migrating juvenile salmonids. However, because the applicant's dock is situated among many bankside over-water structures that also impact aquatic productivity through shade, the combined impacts of shade would act to maintain a long stretch of migratory habitat with diminished shelter and forage resources for juvenile salmonids. Therefore, over the life of the applicant's dock, at least some juvenile Chinook salmon and juvenile steelhead that migrate through the project area would experience some degree of reduced fitness due to diminished shelter and forage resources that would be attributable to the shadow caused by the applicant's dock.

The shade of over-water structures also negatively affects juvenile salmonid migration. Numerous studies demonstrate that juvenile salmonids, in both freshwater and marine habitats, are more likely to avoid an overwater structure's shadow than to pass through it (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; Tabor et al. 2006). Swimming around overwater structures increases the migratory distance, which has been positively correlated with increased mortality in juvenile Chinook salmon (Anderson et al. 2005).

Although the shade of the new dock would be reduced compared to the shoreward 100 feet of the existing pier, it is likely to continue to alter the migratory behavior for at least some of the juvenile Chinook salmon that pass through the project area, and inhibit some from migrating along the shoreline, which is typical behavior for juvenile Chinook salmon at this life stage. The shade would delay the passage under the dock for some, and or induce some individuals to swim around it, effectively forcing them to remain in open and relatively deep waters. Swimming around the dock would increase the migration distance and time for affected fish, and the off-bank migration is likely to increase their energetic costs (Heerhartz and Toft 2015). Additionally, shade and deep water both favor freshwater predatory species, such as smallmouth bass and northern pikeminnow that are known to prey heavily on juvenile salmonids (Celedonia et al. 2008a; Tabor et al. 2010), and deep water increases the risk of predation for migrating juvenile salmonids (Willette 2001). Shade-related altered migratory behaviors would mostly affect juvenile PS Chinook salmon because the juvenile PS steelhead that pass through this waterway are relatively large and shoreline independent, as are the adults of both species. However, shade-related increased exposure to predatory fish species would affect the juveniles of both species.

Artificial Illumination: The new dock and the vessels that moor alongside it would have lighting systems that would cause nighttime artificial illumination of lake waters. Nighttime artificial illumination of the water's surface attracts fish (positive phototaxis) in marine and freshwater environments. It often shifts nocturnal behaviors toward more daylight-like behaviors, and it can affect light-mediated behaviors such as migration timing (Becker et al. 2013; Celedonia and Tabor 2015; Ina et al. 2017; Tabor and Piaskowski 2002; Tabor et al. 2017).

Tabor and Piaskowski (2002) report that juvenile Chinook salmon in lacustrine environments typically feed and migrate during the day, and are inactive at night, residing at the bottom in shallow waters. They tend to move off the bottom and become increasingly active at dawn when light levels reach 0.8 to 2.1 lumens per square meter. Tabor et al. (2017) found that sub-yearling Chinook, coho, and sockeye salmon exhibit strong nocturnal phototactic behavior when exposed to levels of 5.0 to 50.0 lumens per square meter, with phototaxis positively correlated with light intensity. Celedonia and Tabor (2015) found that juvenile Chinook salmon in the Lake Washington Ship Canal were attracted to artificially lit areas at 0.5 to 2.5 lumens per square meter. The authors also reported that attraction to artificial lights may delay the onset of morning migration by up to 25 minutes for some juvenile Chinook salmon migration through the Lake Washington Ship Canal.

The applicant's proposed lighting system would consist of circular deck-mounted light fixtures that would be about 8 inches in diameter, 6 inches tall. The applicant further reported that the fixtures would use "low-wattage lights" that would illuminate only when motion is detected on the dock, and would shut off after about 15 minutes, and be aimed to avoid being visible at water level but gave no maximum luminosity. In the absence of any definitive information to quantify the expected on-water illumination, the NMFS believes that an assumption that the lighting system would illuminate the water's surface within 20 feet of the dock's edge at intensities above 0.5 lumens per square meter, would be adequately protective of listed fish. Moored client vessels are also likely to be episodically illuminated at night, and some may illuminate the water surface at levels above 0.5 lumens. However, most incidences of boat-related nighttime illumination would likely occur during the summer boating season after most juvenile salmon have departed

the lake. Based on the available information, dock-related artificial illumination is likely to episodically cause brief periods (minutes to low numbers of hours) of phototaxis for juvenile Chinook salmon and juvenile steelhead that are within about 20 feet of the new dock.

Summary: Dock-related altered lighting would cause a combination of altered behaviors and increased risk of predation that would reduce fitness or cause mortality for some juvenile PS Chinook salmon and juvenile PS steelhead that pass the site. The annual numbers of either species that would be impacted by this stressor, and the intensity of any effects that an exposed individual may experience are unquantifiable with any degree of certainty. However, for the same reasons expressed earlier for Construction-related Forage Contamination, the numbers of individuals that would be exposed to this stressor are expected to be very low, highly variable over time, and extremely small subsets of their respective cohorts. Therefore, the annual numbers of juvenile PS Chinook salmon and juvenile PS steelhead that would be meaningfully affected by dock-related altered lighting would be too low to cause detectable population-level effects.

Dock-related Pollutants

Dock-related pollutants are likely to adversely affect juvenile PS Chinook salmon and juvenile PS steelhead through direct exposure to pollutants in the water column and through indirect exposure to pollutants through the trophic web and reduced prey availability. This stressor would cause minor effects in adults of both species.

The timber used to construct the new floating dock would be treated with Ammoniacal Copper Zinc Arsenate (ACZA), which contains copper, as does the anti-fouling paint that may coat the hulls of some of the vessels that would moor at the new dock. The new steel pile would be epoxy coated, and therefore very unlikely to leach zinc into the water. Additionally, vessel operation at the new dock is likely to result in the discharge of petroleum-based fuels and lubricants into the water.

As described above, PS Chinook salmon and PS steelhead can uptake contaminants directly through their gills, and through dietary exposure (Karrow et al. 1999; Lee and Dobbs 1972; McCain et al. 1990; Meador et al. 2006; Neff 1982; Varanasi et al. 1993). Direct exposure to water-borne pollutants can cause effects in exposed fish that range from avoidance behaviors, 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 (Beitinger and Freeman 1983; 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).

Beitinger and Freeman (1983) report that fish possess acute chemical discrimination abilities and that very low levels of some water-borne contaminants can trigger strong avoidance behaviors. In freshwater, exposure to dissolved copper at 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 (Giattina et al. 1982; Hecht et al. 2007; McIntyre et al. 2012; Sommers et al. 2016; Tierney et al. 2010). Exposure to petroleum-based chemicals such PAHs can cause reduced growth, increased

susceptibility to infection, and increased mortality in juvenile salmonids (Meador et al. 2006; Varanasi et al. 1993).

Copper: The framing of the applicant's new 4,200-square foot floating dock would be built with ACZA-treated timber. Wet ACZA-treated wood leaches some of the metals used for wood preservation. Of these metals, dissolved copper is of most concern to fish because of its higher leaching rate compared to arsenic and zinc (Poston 2001). Post-treatment BMPs reduce the intensity and duration of copper leaching from ACZA-treated wood. Copper leaching from ACZA-treated wood is highest when the treated wood is immersed in freshwater, but decreases sharply to low levels during the first few weeks after installation. Above-water treated timber episodically releases very small amounts of copper when it is exposed to waves and stormwater. The dissolved copper concentrations that would be attributable to action-related installation of ACZA-treated timber is uncertain but expected to be very low, episodic, brief, and limited to the area immediately adjacent to the new floating dock because all treated timber would be installed above the water.

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). This is most notable under conditions of high boat occupancy in enclosed moorages where water flows are restricted. WDOE (2017) reports that dissolved copper concentrations from anti-fouling paints can be above 5 µg/L in protected moorages, but below 0.5 µg/L in open moorages with high flushing rates. The dissolved copper concentrations that would be attributable to action-related copper-based anti-fouling paints are uncertain, but expected to be relatively low based on the low number of available moorage spots (a maximum of about 25), and the absence of an enclosure around the mooring float.

Neither action-related copper source is expected to cause very high concentrations. However, those sources would be additive to each other and to the numerous nearby moorage structures. Therefore, the NMFS expects that action-related dissolved copper would episodically cause copper concentrations to exceed the threshold for the onset of detectable effects in the area immediately adjacent to the applicant's new mooring dock, and that over the life of that dock, some juvenile Chinook salmon and juvenile steelhead are likely to be exposed to dock-related dissolved copper at levels high enough to measurably alter their normal behaviors and increase their risk of predation.

Petroleum-based fuels and lubricants: The vessels that would utilize the applicant's new mooring dock would periodically discharge petroleum-based fuels and lubricants into the water. As discussed above under construction-related water contamination, petroleum-based fuels and lubricants contain chemicals that are harmful to fish and other aquatic organisms. Vessel discharges would likely occur relatively infrequently, with the majority being very small. Additionally, some of the pollutants may evaporate relatively quickly (Werme et al. 2010), and currents would help to disperse the pollutants. However, those discharges would occur repeatedly over the decades-long life of the mooring dock. Additionally, the action-related petroleum-based pollutants would be additive to the background pollutant concentrations in Lake Union that result from the high levels of vessel operation on the lake and from outfalls around the lake that discharge stormwater from the surrounding roads. Therefore, over the decades-long

life of the new mooring dock, some juvenile PS Chinook salmon and juvenile PS steelhead are likely to be directly exposed to dock-related petroleum-based pollutants at concentrations high enough to measurably alter their normal behaviors and reduce their fitness.

The annual numbers of juveniles of either species that may be exposed to dock-related contaminated water, the contaminant concentration levels that any individual fish may be directly exposed to, and the intensity of any effects that an exposed individual may experience are unquantifiable with any degree of certainty. However, for the same reasons expressed for construction-related forage diminishment, the numbers of individuals that would be detectably affected are expected to be very low and highly variable over time. Further, the majority of their typical emigration seasons are well outside of the typical summer boating season when dock-related contamination levels would be highest. Therefore, the annual numbers of PS Chinook salmon and PS steelhead that may be exposed to dock-related contaminated water would represent extremely small subsets of their respective cohorts, and the numbers of exposed fish that would be meaningfully affected would be too low to cause detectable population-level effects.

Dock-related Forage Diminishment

Dock-related contaminants that settle to the bottom would accumulate on the substrate under and adjacent to the new dock and be biologically available for years (Romberg 2005). As described earlier under Construction-related Forage Diminishment, amphipods and copepods uptake contaminants from contaminated sediments and pass them to fish through the food web, causing reduced growth, suppressed immune competence, and increased mortality in the juvenile fish that consumed them. Dock-related contaminants are also likely to reduce the number, size, and diversity of prey species that are available to foraging juvenile salmonids that pass through the affected area. Based on the available information, the NMFS expects that over the decades-long life of the new dock, some juvenile Chinook salmon and juvenile steelhead are likely to be exposed to dock-related forage diminishment capable of causing some combination of reduced growth, increased susceptibility to infection, and increased mortality.

Summary: Subsets of the juvenile Chinook salmon and juvenile steelhead that annually emigrate through Lake Union are likely to pass through the project area. Individuals that swim through the area are likely to be exposed to some combination of dock-related contaminated water and forage diminishment.

The annual numbers of juveniles of either species that may be exposed to dock-related forage diminishment are unquantifiable with any degree of certainty, as are the contaminant concentrations, the levels of prey reduction, and the intensity of any effects that an exposed individual may experience. However, for the same reasons expressed for construction-related forage diminishment, the numbers of individuals that would be detectably affected are expected to be very low and highly variable over time. Therefore, the annual numbers of PS Chinook salmon and PS steelhead that may be exposed to dock-related forage diminishment would represent extremely small subsets of their respective cohorts, and the numbers of exposed fish that would be meaningfully affected would be too low to cause detectable population-level effects.

Dock-related Noise

Exposure to dock-related noise is likely to adversely affect juvenile PS Chinook salmon and juvenile PS steelhead, but cause minor effects in adults of both species.

The effects caused by a fish's exposure to noise vary with the hearing characteristics of the 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 (Mueller 1980; Picciulin et al. 2010; 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 (Stadler and Woodbury 2009). The metrics are based on exposure to peak sound level and sound exposure level (SEL). 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. Further, 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 potentially experience TTS or PTS from the noise, regardless of accumulation of the sound energy (Stadler and Woodbury 2009). When the range to the 150 dB_{SEL} isopleth exceeds the range to the applicable SEL_{CUM} isopleth, the distance to the 150 dB_{SEL} isopleth is typically considered the range at which detectable behavioral effects would begin, with the applicable SEL_{CUM} isopleth identifying the distance within which sound energy accumulation would intensify effects. However, when the range to the 150 dB_{SEL} isopleth is less than the range to the applicable SEL_{CUM} isopleth, only the 150 dB_{SEL} isopleth would apply because no accumulation effects are expected for noise levels below 150 dB_{SEL}. For all project-related sources, the ranges to the SEL_{CUM} threshold isopleths exceed the range to 150 dB_{SEL} effective quiet isopleth. Therefore, this assessment considers the range to the 150 dB_{SEL} isopleths as the maximum ranges for detectable acoustic effects.

The discussion in Stadler and Woodbury (2009) indicate that these thresholds likely overestimate the potential effects of exposure to impulsive sounds. Further, Stadler and Woodbury's assessment did not consider non-impulsive sound, which is believed to be less injurious to fish than impulsive sound. Therefore, application of the criteria to non-impulsive sounds is also likely to overestimate the potential effects in fish. However, these criteria represent the best available information. Therefore, to avoid underestimating potential effects, this assessment applies these criteria to the non-impulsive sounds that are expected from dock-related noise to gain a conservative idea of the potential effects that fish may experience due to exposure to that noise.

Elevated in-water noise at levels capable of causing detectable effects in exposed fish would be caused by vessel operations at the applicant’s new dock, which would provide mooring for about 25 about vessels. The applicant reports that most vessels that would moor at the dock would be about 20 feet in length, but that boats up to 50 feet in length would be able to moor there as well. They further estimate that about 18 trips would occur per day during the summer, and 10 trips would occur per day during the winter.

The estimated in-water source levels (SL, sound level at 1 meter from the source) used in this assessment are based on numerous sources that describe sound levels for ocean-going ships, tugboats, and recreational vessels (Blackwell and Greene 2006; McKenna et al. 2012; Picciulin et al. 2010; Reine et al. 2014; Richardson et al. 1995). The best available information about the source levels from vessels close in size to those that would operate at the piers is also described in the acoustic assessment done for a similar project (NMFS 2018). In this assessment, we used vessel noise from an 85-foot long ferry, tugboats, and a 23-foot long power boat as surrogates for the mix of vessels likely to moor at the applicant’s new dock. All of the expected peak source levels are below the 206 dB_{peak} threshold for instantaneous injury in fish. In the absence of location-specific transmission loss data, variations of the equation $RL = SL - \# \text{Log}(R)$ are often used to estimate the received sound level at a given range from a source (RL = received level (dB); SL = source level (dB, 1 m from the source); # = spreading loss coefficient; and R = range in meters (m). Numerous acoustic measurements in shallow water environments support the use of a value close to 15 for projects like this one (CalTrans 2015). This value is considered the practical spreading loss coefficient, and was used for all sound attenuation calculations in this assessment.

Application of the practical spreading loss equation to the expected SEL SLs suggests that noise levels above the 150 dB_{SEL} threshold would extend between about 33 feet (10 m) and 207 feet (63 m) from the representative vessels (Table 5).

Table 5. Estimated in-water source levels for vessels with noise levels similar to those likely to moor at the applicant’s new floats, and ranges to effects thresholds for fish.

Source	Acoustic Signature	Source Level	Threshold Range
85 foot Tourist Ferry	< 2 kHz Combination	187 dB _{peak}	206 @ N/A
Episodic periods measured in minutes to hours		177 dB _{SEL}	150 @ 63 m
Tugboat	< 2 kHz Combination	185 dB _{peak}	206 @ N/A
Episodic periods measured in minutes to hours		170 dB _{SEL}	150 @ 22 m
23 foot Boat w/ 2 4~ 100 HP Outboard Engines.	< 2 kHz Combination	175 dB _{peak}	206 @ N/A
Episodic brief periods measures in minutes		165 dB _{SEL}	150 @ 10 m

Individual vessel operations around mooring structures typically consist of brief periods of relatively low-speed movement as boats are driven to the piers and tied up. Their engines are typically shut off within minutes of arrival. The engines of departing vessels are typically started a few minutes before the boats are untied and driven away. Therefore, it is extremely unlikely that vessels would be run at anything close to full speed while near the piers. However, they may briefly use high power settings while maneuvering.

To be protective of fish, this assessment estimates that pier-related in-water vessel noise levels above the 150 dB_{SEL} threshold could routinely extend 72 feet (22 m) around the new dock. Vessel noise levels would be non-injurious. However, juvenile Chinook salmon and steelhead that are within the 150 dB_{SEL} isopleth, are likely to experience behavioral disturbances, such as acoustic masking, startle responses, altered swimming patterns, avoidance, and increased risk of predation. Further, the intensity of these effects would increase with increased proximity to the source and or duration of exposure. Response to this exposure would be non-lethal in most cases, but some individuals may experience stress and fitness effects that could reduce their long-term survival, and individuals that are eaten by predators would obviously be killed.

The annual numbers of juvenile PS Chinook salmon and PS steelhead that would be impacted by this stressor, and the intensity of any effects that an exposed individual may experience are unquantifiable with any degree of certainty. However, for the same reasons expressed for construction-related forage diminishment, the juvenile PS Chinook salmon and juvenile PS steelhead that would annually emigrate through the project area would comprise small and variable subsets of each year's cohort. Further, the typically episodic and short-duration of vessel operations at the dock, combined with the knowledge that the peak boating season occurs after the juveniles have left the ship canal suggests that the probability and duration of exposure would be very low for any individual fish. Therefore, the annual numbers of PS Chinook salmon and PS steelhead that may be exposed to dock-related elevated noise would represent extremely small subsets of their respective cohorts, and the numbers of exposed fish that would be meaningfully affected would be too low to cause detectable population-level effects.

Dock-related Propeller Wash

Dock-related propeller wash is likely to adversely affect juvenile PS Chinook salmon and juvenile PS steelhead, but cause only minor effects in adults of both species.

Spinning boat propellers kill fish and small aquatic organisms (Killgore et al. 2011; VIMS 2011). Spinning propellers also generate fast-moving turbulent water (propeller wash) that can displace and disorient small fish, as well as dislodge benthic aquatic organisms and SAV, particularly in shallow water and or at high power settings (propeller scour).

Juvenile Chinook salmon and steelhead that would be within the project area are likely to remain relatively close to the surface and as close to shore as possible, and they would be too small to effectively swim against most propeller wash. Conversely, adults of both species would tend to stay below the surface. Further, they would be able to swim against most propeller wash they might be exposed to, without experiencing any measurable effect on their fitness or normal behaviors. Juveniles that are struck or very nearly missed by the spinning propellers of boats at the new dock would be injured or killed by the exposure. At greater distances, the boats' propeller wash may displace and disorient fish. Depending on the direction and strength of the thrust plume, displacement could increase energetic costs, reduce feeding success, and may increase the vulnerability to predators for individuals that tumble stunned and or disoriented in the wash. Although the likelihood of this interaction is very low for any individual fish or individual boat trip, it is very likely that over the decades-long life of the new dock, at least some

juvenile PS Chinook salmon and juvenile PS steelhead would experience reduced fitness or mortality from exposure to spinning propellers and or propeller wash at the applicant's dock.

The annual numbers of juvenile PS Chinook salmon and PS steelhead that would be exposed to propeller wash, and the intensity of any effects that an exposed individual may experience are unquantifiable with any degree of certainty. However, for the same reasons expressed for construction-related forage diminishment, the juvenile PS Chinook salmon and juvenile PS steelhead that would annually emigrate through the project area would comprise small and variable subsets of each year's cohort. Further, the typically episodic and short-duration of vessel operations at the dock, combined with the knowledge that the peak boating season occurs after the juveniles have left the ship canal suggests that the probability and duration of exposure would be very low for any individual fish. Therefore, the annual numbers of PS Chinook salmon and PS steelhead that may be exposed to dock-related propeller wash would represent extremely small subsets of their respective cohorts, and the numbers of exposed fish that would be meaningfully affected would be too low to cause detectable population-level effects.

The relatively deep water under the new dock (10 to 35 feet), combined with the expectation that low power settings would typically be used when vessels maneuver near the dock, suggests that propeller scour would cause little to no measurable effects on benthic resources at the site. Therefore, it is extremely unlikely that dock-related benthic propeller scour would cause any detectable effects on the fitness and normal behaviors of Chinook salmon and steelhead.

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, including full application of the planned conservation measures and BMPs, is likely to adversely affect designated critical habitat for PS Chinook salmon 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 free of obstruction and excessive predation:
 - a. Obstruction and excessive predation – The proposed action would cause minor long-term adverse effects on this attribute. The altered light and in-water noise levels related to the presence of the new dock and the moored vessels would maintain conditions at the site that prevent normal migration behaviors, and increase the risk of predation for juvenile Chinook salmon that approach the dock.
 - b. Water quantity – The proposed action would cause no effect on this attribute.

- c. Water quality – The proposed action would cause minor short- and long-term adverse effects on this attribute. Demolition and construction would cause short-term adverse effects on water quality that would persist no more than a low number of hours after work stops. ACZA-treated timber and continued vessel operations would maintain persistent low level inputs of contaminants at the dock. Detectable water quality impacts would be limited to the area within 300 feet around the dock. The action would cause no measurable changes in water temperature or salinity.
 - d. Natural Cover – The proposed action would cause minor long-term adverse effects on this attribute. Over its decades-long life, the new dock would perpetuate conditions that act to limit the growth of SAV despite the conversion of solid plank decking to fully-grated decking that would increase light penetration as compared to the existing pier.
- 4. Estuarine areas free of obstruction and excessive predation: None in the action area.
 - 5. Nearshore marine areas free of obstruction and excessive predation: None in the action area.
 - 6. Offshore marine areas: None in the action area.

2.6 Cumulative Effects

“Cumulative effects” are those effects of future state or private activities, not involving Federal activities, that are reasonably certain to occur within the action area of the Federal action subject to consultation [50 CFR 402.02 and 402.17(a)]. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the ESA.

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

The current conditions of ESA-listed species and designated critical habitat within the action area are described in the Rangewide Status of the Species and Critical Habitat and Environmental Baseline sections above. The non-federal activities in and upstream of the action area that have contributed to those conditions include past and on-going bankside development, vessel activities, and upland urbanization, as well as upstream forest management, agriculture, road construction, water development, subsistence and recreational fishing, and restoration activities. Those actions were, and continue to be, 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 restoration and use of natural amenities, such as cultural inspiration and recreational experiences.

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

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

2.7 Integration and Synthesis

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

As described in more detail above in 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 dissolved oxygen, 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 is 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 and critical habitats 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 or critical habitat through synergistic interactions with the impacts of climate change are expected.

2.7.1 ESA Listed Species

PS Chinook salmon and PS steelhead are both 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, the effects on viability parameters of each species are also likely to be negative. In this context we consider how the proposed action’s impacts on individuals would affect the listed species at the population and ESU/DPS scales.

PS Chinook salmon

The long-term abundance trend of the PS Chinook salmon ESU is slightly negative. Reduced or eliminated accessibility to historically important habitat, combined with degraded conditions in available habitat due to land use activities appear to be the greatest threats to the recovery of PS Chinook salmon. Commercial and recreational fisheries also continue to impact this species.

The PS Chinook salmon most likely to occur in the action area would be fall-run Chinook salmon from the Cedar River and the North Lake Washington/Sammamish River populations, and part of the South Puget Sound MPG. Both populations are considered at high risk of extinction due to low abundance and productivity.

The project site is located in Seattle, Washington, on the northern shore of Lake Union, about mid-way along the Lake Washington Ship Canal (Figure 1), which serves as a freshwater migration route to and from marine waters for adult and juvenile PS Chinook salmon from both affected populations. The environmental baseline within the action area has been degraded by the effects of nearby intense bankside development and maritime activities, and by nearby and upstream industry, urbanization, agriculture, forestry, water diversion, and road building and maintenance.

The timing of the proposed work avoids the normal migration seasons for PS Chinook salmon. However, low numbers of out-migrating juveniles that annually pass through the project area over the next several decades would be exposed to low levels of diminished forage and other altered habitat conditions, that both individually and collectively, would cause some combination of altered behaviors, reduced fitness, and mortality in some of the exposed individuals. However, the annual numbers of individuals that would be detectably affected by action-related stressors would be extremely low.

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

PS Steelhead

The long-term abundance trend of the PS steelhead DPS is negative, especially for natural spawners. Growth rates are currently declining at 3 to 10% annually for all but a few DIPs. The extinction risk for most DIPs is estimated to be moderate to high, and the DPS is currently considered “not viable”. Reduced or eliminated accessibility to historically important habitat, combined with degraded conditions in available habitat due to land use activities appear to be the greatest threats to the recovery of PS steelhead. Fisheries activities also continue to impact this species.

The PS steelhead most likely to occur in the action area would be winter-run fish from the Cedar River and North Lake Washington/Lake Sammamish DIPs. The abundance trends between 1984 and 2016 was strongly negative for both DIPs, and ten or fewer adult natural-spawners are estimated to return to the DIPs annually.

The project site is located in Seattle, Washington, on the northern shore of Lake Union, about mid-way along the Lake Washington Ship Canal (Figure 1), which serves as a freshwater migration route to and from marine waters for adult and juvenile PS steelhead from both affected DIPs. The environmental baseline within the action area has been degraded by the effects of nearby intense bankside development and maritime activities, and by nearby and upstream industry, urbanization, agriculture, forestry, water diversion, and road building and maintenance.

It is extremely unlikely that any PS steelhead would be directly exposed to the proposed work. However, low numbers of out-migrating juveniles that annually pass through the project area over the next several decades would be exposed to low levels of diminished forage and other altered habitat conditions, that both individually and collectively, would cause some combination of altered behaviors, reduced fitness, and mortality in some of the exposed individuals. The annual numbers of individuals that would be detectably affected by action-related stressors would be extremely low.

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

2.7.2 Critical Habitat

Critical habitat was designated for PS Chinook salmon to ensure that specific areas with PBFs that are essential to the conservation of that listed species are appropriately managed or protected. The critical habitat for PS Chinook salmon will be affected over time by cumulative effects, some positive – as restoration efforts 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 trends are negative, the effects on the PBFs of critical habitat for PS Chinook salmon are also

likely to be negative. In this context we consider how the proposed action's impacts on the attributes of the action area's PBFs would affect the designated critical habitat's ability to support the conservation of PS Chinook salmon as a whole.

Past and ongoing land and water use practices have degraded salmonid critical habitat throughout the Puget Sound basin. Hydropower and water management activities have reduced or eliminated access to significant portions of historic spawning habitat. Timber harvests, agriculture, industry, urbanization, and shoreline development have adversely altered floodplain and stream morphology in many watersheds, diminished the availability and quality of estuarine and nearshore marine habitats, and reduced water quality across the region.

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

In the future, non-federal land and water use practices and climate change are likely to increase. The intensity of those influences on salmonid 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 is limited to freshwater migration corridors free of obstruction and excessive predation. The site attributes of that PBF that would be affected by the action are obstruction and excessive predation, water quality, and natural cover. As described above, the project site is located along a heavily impacted waterway, and all three of these site attributes currently function at reduced levels as compared to undisturbed freshwater migratory corridors. The proposed work would increase light penetration under the new dock. However, over the extended life of the applicant's new dock, the dock and dock-related vessel operations would cause minor long term adverse effects on the identified site attributes.

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 freshwater migration corridors PBF in the action area. Therefore, this critical habitat will maintain its current level of functionality, and retain its current ability for PBFs to become functionally established, to serve the intended conservation role for PS Chinook salmon.

2.8 Conclusion

After reviewing and analyzing the current status of the listed species and critical habitat, the environmental baseline within the action area, the effects of the proposed action, the effects of other activities caused by the proposed action, and cumulative effects, it is the NMFS' biological

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

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). “Harass” is further defined by interim guidance as to “create the likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt normal behavioral patterns which include, but are not limited to, breeding, feeding, or sheltering.” “Incidental take” is defined by regulation as takings that result from, but are not the purpose of, carrying out an otherwise lawful activity conducted by the Federal agency or applicant (50 CFR 402.02). Section 7(b)(4) and section 7(o)(2) provide that taking that is incidental to an otherwise lawful agency action is not considered to be prohibited taking under the ESA if that action is performed in compliance with the terms and conditions of this incidental take statement (ITS).

2.9.1 Amount or Extent of Take

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

Harm of PS Chinook salmon and PS steelhead from exposure to:

- Construction-related forage diminishment,
- Dock-related altered lighting,
- Dock-related pollutants,
- Dock-related noise, and
- Dock-related propeller wash.

The NMFS cannot predict with meaningful accuracy the number of PS Chinook salmon and PS steelhead that are reasonably certain to be injured or killed annually by exposure to any of these stressors. The distribution and abundance of the fish that occur within an action area are affected by habitat quality, competition, predation, and the interaction of processes that influence genetic, population, and environmental characteristics. These biotic and environmental processes interact in ways that may be random or directional, and may operate across far broader temporal and spatial scales than are affected by the proposed action. Thus, the distribution and abundance of fish within the action area cannot be attributed entirely to habitat conditions, nor can the NMFS precisely predict the number of fish that are reasonably certain to be injured or killed if their habitat is modified or degraded by the proposed action. Additionally, the NMFS knows of no device or practicable technique that would yield reliable counts of individuals that may

experience these impacts. In such circumstances, the NMFS uses the causal link established between the activity and the likely extent and duration of changes in habitat conditions to describe the extent of take as a numerical level of habitat disturbance. The most appropriate surrogates for take are action-related parameters that are directly related to the magnitude of the expected take.

For this action, the timing of in-water work is applicable because the proposed in-water work window avoids the expected presence of PS Chinook salmon in the project area. Therefore, working outside of the proposed work window would increase the potential that PS Chinook salmon would be exposed to work-related stressors that they otherwise would not be exposed to. Note that in addition to any work done on structural components that are in the water, this opinion considers any work that includes the use of any vessel (i.e. utility boat, tugboat, barge, or raft) to constitute in-water work, even if the structural component being worked on is above the water's surface.

The pile removal method and the extent of the visible turbidity plumes around that work are the best available surrogates for the extent of take of juvenile PS Chinook salmon and juvenile PS steelhead from diminished forage. The method of removal is appropriate because the intensity of surface sediment contamination would be positively correlated with the amount of contaminated subsurface sediments that would be brought to the surface, which is positively correlated with the extraction method. The proposed pulling of piles with a vibratory pile extractor would minimize sediment mobilization compared to other methods such as the use of excavators or water-jetting. As the amount of mobilized contaminated sediments increase, the amount of biologically available contaminants would increase, as would the intensity of prey contamination and prey mortality. The lateral extent of the visible turbidity plumes around pile extraction is appropriate because the size the affected areas would be positively correlated with the extent of the plume, and the amount of prey diminishment and or exposed juvenile salmonids would be positively correlated with the size the affected area. In summary, any increase in the amount of mobilized sediment or the in the size of the affected area would increase the intensity of the exposure and or the number of exposed juvenile PS Chinook salmon and juvenile PS steelhead.

The size and configuration of the new dock are the best available surrogates for the extent of take of juvenile PS Chinook salmon and juvenile PS steelhead from exposure to dock-related altered lighting, pollutants, noise, and propeller wash. Size and configuration are appropriate for altered lighting because, salmonid avoidance and the distance required to swim around the dock would both increase as the size and opacity of the dock increase, and any increase in the artificial illumination would increase nighttime phototaxis.

Size and configuration are also appropriate for dock-related pollutants, noise, and propeller wash because those stressors are all positively correlated with the number of boats that moor at a structure, which is largely a function of the structure's size. As the size of a mooring structure increases, the number of boats that can moor there increases. As the number of boats increase, boating activity increases. As boating activity increases, the potential for, and the intensity of exposure to the related pollutants, noise, and propeller wash would also increase for juvenile PS Chinook salmon and juvenile PS steelhead. Additionally, as the size of the pier increases, the amount of AZCA-treated lumber that would be used for repairs would increase, which would

increase the amount of ACZA-related copper that would enter the water at the project site.

In summary, the extent of PS Chinook salmon and PS steelhead take for this action is defined as:

- In-water work to be completed between October 1 and April 15;
- Vibratory and or direct-pull extraction of 25 piles;
- Visible turbidity plumes extending up to 300 feet from project-related work; and
- The post-construction size and configuration of the applicant's new dock 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.

Although these take surrogates could be construed as partially coextensive with the proposed action, they nevertheless function as effective reinitiation triggers. If any of these take surrogates exceed the proposal, it could still meaningfully trigger reinitiation because the USACE 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 biological opinion, the NMFS determined that the amount or extent of anticipated take, coupled with other effects of the proposed action, is not likely to result in jeopardy to the species or destruction or adverse modification of critical habitat.

2.9.3 Reasonable and Prudent Measures

“Reasonable and prudent measures” are measures that are necessary or appropriate to minimize the impact of the amount or extent of incidental take (50 CFR 402.02).

The USACE shall require the applicant to:

1. Ensure the implementation of monitoring and reporting to confirm that the take exemption for the proposed action is not exceeded.

2.9.4 Terms and Conditions

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

1. The following terms and conditions implement reasonable and prudent measure 1:
 - a. The USACE shall require the applicant to develop and implement plans to collect and report details about the take of listed fish. That plan shall:
 - i. Require the applicant and or their contractor to maintain and submit records to verify that all take indicators are monitored and reported. Minimally, the records should include:
 1. Documentation of the timing of in-water work to ensure that the work is accomplished October 1 through April 15;
 2. Documentation of the method of pile extraction;
 3. Documentation of the lateral extent of the turbidity plumes, and measures taken to maintain them within 300 feet; and
 4. Documentation of the size, and configuration of the new dock to confirm that complies with the characteristics described in this opinion.
 - ii. Require the applicant to establish procedures for the submission of the construction records and other materials to the appropriate USACE office, and to submit an electronic post-construction report to the NMFS within six months of project completion. Send the report to: projectreports.wcr@noaa.gov. Be sure to include Attn: WCRO-2020-00686 in the subject line.

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 USACE should require the use of full-depth sediment curtains around pile extraction work to limit the spread of contaminated sediments; and
2. The USACE should require the applicant to install grated decking on the section of the existing pier that would serve as the access pier to the new floating dock.

2.11 Reinitiation of Consultation

This concludes formal consultation for the U.S. Army Corps of Engineers’ authorization of Grey and Associates’ Pier Extension Project in Lake Union, King County, Washington.

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

2.12 “Not Likely to Adversely Affect” Determinations

This assessment 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.

As described in Section 1.2 and below, the NMFS has concluded that the proposed action is not likely to adversely affect southern resident (SR) killer whales and their designated critical habitat. Detailed information about the biology, habitat, and conservation status and trends of SR killer whales can be found in the listing regulations and critical habitat designations published in the Federal Register, as well as in the recovery plans and other sources at:

<https://www.fisheries.noaa.gov/species-directory/threatened-endangered>, and are 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. The effects analysis in this section relies heavily on the descriptions of the proposed action and project site conditions discussed in Sections 1.3 and 2.4, and on the effects analyses presented in Section 2.5.

2.12.1 Effects on Listed Species

The proposed action will have no direct effects on SR killer whales or their critical habitat because all construction and its impacts would take place in freshwater, and SR killer whales and their designated critical habitat are limited to marine waters.

However, the project may indirectly affect SR killer whales through the trophic web by affecting the quantity and quality of prey available to SR killer whales. We therefore analyze that potential here but conclude that the effects on SR killer whales will be insignificant for at least two reasons.

First, as described in Section 2.5, the action would annually affect an extremely low number of juvenile Chinook salmon. The project’s detectable effects on fish would be limited to an area no more than 300 feet around the project site, where small subsets of each year’s juvenile PS Chinook salmon cohorts from the Cedar River and North Lake Washington populations could be briefly exposed to project-related impacts during the final portion their freshwater migration lifestage, and only very small subsets of the individuals that pass through the area are likely to be detectably affected by the exposure.

The exact Chinook salmon smolt to adult ratios are not known. However, even under natural conditions, individual juvenile Chinook salmon have a very low probability of surviving to adulthood (Bradford 1995). We note that human-caused habitat degradation and other factors such as hatcheries and harvest exacerbate natural causes of low survival such as natural variability in stream and ocean conditions, predator-prey interactions, and natural climate

variability (Adams 1980, Quinones et al., 2014). However, based on the best available information, the annual numbers of project-affected juveniles would be too low to influence any VSP parameters for either population, or to cause any detectable reduction in adult Chinook salmon availability to SR killer whales in marine waters.

Second, as described in Sections 1.3, 2.2, and 2.5, the only PS Chinook populations that would be affected by the project would be the two Lake Washington populations that migrate through the Lake Washington ship canal, and both populations are small. Adult returns in 2019 for the Cedar River and North Lake Washington populations were 855 and 365 individuals, respectively (WDFW 2021b). Consequently, the two populations, combined, make up a very small portion of the adult Chinook that are available to SR killer whales in marine waters. Therefore, based on the best available information, the proposed action is not likely to adversely affect SR killer 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 physical or 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 to last for weeks, and long-term effects are likely to last for months, years or decades.

SR killer whale Critical Habitat: 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 PBFs as described below.

1. Water quality to support growth and development
The proposed action would cause no detectable effects on marine water quality.
2. Prey species of sufficient quantity, quality, and availability to support individual growth, reproduction, and development, as well as overall population growth
The proposed actions would cause long-term undetectable effects on prey availability and quality. Action-related impacts would annually injure or kill extremely low numbers of individual juvenile Chinook salmon (primary prey), during the final portion their freshwater migration lifestage. However, the numbers of affected juvenile Chinook salmon would be too small to cause detectable effects on the numbers of available adult Chinook salmon in marine waters. Therefore, it would cause no detectable reduction in prey availability and quality.
3. Passage conditions to allow for migration, resting, and foraging
The proposed action would cause no detectable effects on passage conditions.

For the reasons expressed immediately above, the NMFS has concluded that the proposed action is not likely to adversely affect ESA-listed SR killer whales and their designated critical habitat.

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

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

This analysis is based, in part, on the EFH assessment provided by the USACE and the descriptions of EFH contained in the fishery management plan for Pacific Coast salmon developed by the Pacific Fishery Management Council and approved by the Secretary of Commerce (PFMC 2014).

3.1 Essential Fish Habitat Affected By the Project

The project site is located in Seattle, Washington, on the northern shore of Lake Union, about mid-way along the Lake Washington Ship Canal (Figure 1). The waters and substrate of Lake Union and the Lake Washington Ship Canal are designated as freshwater EFH for various life-history stages of Pacific Coast Salmon, which within the Lake Washington watershed include Chinook and coho salmon. Due to trophic links between PS Chinook salmon and SR killer whales, the project's action area also overlaps with marine waters that have been designated, under the MSA, as EFH for Pacific Coast Salmon, Pacific Coast Groundfish, and Coastal Pelagic Species. However, the action would cause no detectable effects on any components of marine EFH. Therefore, the action's effects on EFH would be limited to impacts on freshwater EFH for Pacific Coast Salmon, and it would not adversely affect marine EFH for Pacific Coast Salmon, or EFH for Pacific Coast groundfish and coastal pelagic species.

Freshwater EFH for Pacific salmon is identified and described in Appendix A to the Pacific Coast salmon fishery management plan, and consists of four major components: (1) spawning and incubation; (2) juvenile rearing; (3) juvenile migration corridors; and (4) adult migration corridors and holding habitat.

Those components of freshwater EFH for Pacific Coast Salmon depend on habitat conditions for spawning, rearing, and migration that include: (1) water quality (e.g., dissolved oxygen,

nutrients, temperature, etc.); (2) water quantity, depth, and velocity; (3) riparian-stream-marine energy exchanges; (4) channel gradient and stability; (5) prey availability; (6) cover and habitat complexity (e.g., large woody debris, pools, aquatic and terrestrial vegetation, etc.); (7) space; (8) habitat connectivity from headwaters to the ocean (e.g., dispersal corridors); (9) groundwater-stream interactions; and (10) substrate composition.

As part of Pacific Coast Salmon EFH, five Habitat Areas of Particular Concern (HAPCs) have been defined: 1) complex channels and floodplain habitats; 2) thermal refugia; 3) spawning habitat; 4) estuaries; and 5) marine and estuarine submerged aquatic vegetation. The project area provides no known HAPC habitat features.

3.2 Adverse Effects on Essential Fish Habitat

The ESA portion of this document (Sections 1 and 2) describes the proposed action and its adverse effects on ESA-listed species and critical habitat, and is relevant to the effects on EFH for Pacific Coast Salmon. Based on the analysis of effects presented in Section 2.5 the proposed action will cause minor short- and long-term adverse and beneficial effects on EFH for Pacific Coast Salmon as summarized below.

1. Water quality: The proposed action would cause short-term and decades-long minor adverse effects on this attribute. Demolition and construction would cause short-term adverse effects on water quality that would persist no more than a low number of hours after work stops. ACZA-treated timber and continued vessel operations would maintain persistent low level inputs of contaminants at the applicant's dock. Detectable water quality impacts would be limited to the area within 300 feet around the dock. The action would cause no measurable changes in water temperature or salinity.
2. Water quantity, depth, and velocity: No changes expected.
3. Riparian-stream-marine energy exchanges: No changes expected.
4. Channel gradient and stability: No changes expected.
5. Prey availability: The proposed action would cause decades-long minor adverse effects on this attribute. Despite the increase light penetration under the shoreward 100 feet of the new dock from conversion of solid plank decking to fully-grated decking, the new dock would cast over-water shade that would limit SAV growth and reduce the density and diversity of the benthic and planktonic communities under the dock, such as amphipods, copepods, and larvae of benthic species that are important prey resources for juvenile salmonids. Further, the new dock would more than double the footprint of the affected area as compared to the existing pier. Additionally, any contaminants that are mobilized during pile extraction, combined with low-level input of contaminants from the dock and related vessel operations would contaminate some of the available prey. Detectable effects would be limited to the area within about 300 feet around the dock.

6. Cover and habitat complexity: The proposed action would cause decades-long-minor adverse effects on this attribute. The shade-limited SAV growth identified above would reduce cover availability for juvenile salmon under and adjacent to the dock.
7. Water quantity: No changes expected.
8. Space: No changes expected.
9. Habitat connectivity from headwaters to the ocean: No changes expected.
10. Groundwater-stream interactions: No changes expected.
11. Connectivity with terrestrial ecosystems: No changes expected.
12. Substrate composition: No changes expected.

3.3 Essential Fish Habitat Conservation Recommendations

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

To reduce adverse impacts on water quality, prey availability, and cover and habitat complexity the USACE should:

1. Require the use of full-depth sediment curtains around pile extraction work to limit the spread of contaminated sediments; and
2. Require the applicant to install grated decking on the section of the existing pier that would serve as the access pier to the new floating dock.

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

3.4 Statutory Response Requirement

As required by section 305(b)(4)(B) of the MSA, the USACE must provide a detailed written response to the 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 the NMFS' EFH Conservation Recommendations unless the NMFS and the Federal agency have agreed to use alternative time frames for the Federal agency response. The response must include a description of the measures proposed by the agency for avoiding, minimizing, mitigating, or otherwise offsetting the impact of the activity on EFH. In the case of a response that is inconsistent with the Conservation Recommendations, the Federal agency must explain its reasons for not following the recommendations, including the scientific justification for any disagreements with the 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, the 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 USACE must reinitiate EFH consultation with the 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 the NMFS' EFH Conservation Recommendations [50 CFR 600.920(1)].

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 USACE. Other interested users could include the applicant, WDFW, the governments and citizens of King County and the City of Seattle, and Native American tribes. Individual copies of this opinion were provided to the USACE. The document will be available within two weeks at the NOAA Library Institutional Repository [<https://repository.library.noaa.gov/welcome>]. The format and naming adheres to conventional standards for style.

4.2 Integrity

This consultation was completed on a computer system managed by the 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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