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-2021-01519

February 17, 2023

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 the CalPortland Maintenance Dredging Project, King County, Washington (6th Field HUC 171100130305) (NWS-2021-256).

Dear Mr. Tillinger:

Thank you for your email on June 24, 2021, 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' (COE) proposed issuance of a permit for the CalPortland maintenance dredging project. In this opinion, NMFS concludes that the proposed action is not likely to jeopardize the continued existence of Puget Sound (PS) Chinook salmon and PS steelhead. The project is also not likely to result in the destruction or adverse modification of critical habitat designated for PS Chinook salmon or PS steelhead.

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

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

Please contact Lisa Abernathy of the Oregon/Washington Coastal Area Office at Lisa.Abernathy@noaa.gov if you have any questions concerning this Section 7 and EFH consultation, or if you require additional information.

Sincerely,

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

cc: Matthew Bennett, U.S. Army Corps of Engineers
Samantha Stanford, U.S. Army Corps of Engineers

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

CalPortland Maintenance Dredging Project
King County, Washington (6th Field HUC 171100130305)
(NWS-2021-256)

NMFS Consultation Number: WCRO-2021-01519

Action Agency: U.S. Army Corps of Engineers

Affected Species and NMFS' Determinations:

ESA-Listed Species	Status	Is Action Likely to Adversely Affect Species?	Is Action Likely to Jeopardize the Species?	Is Action Likely to Adversely Affect Critical Habitat?	Is Action Likely to Destroy or Adversely Modify Critical Habitat?
Puget Sound (PS) Chinook *(Oncorhynchus tshawytscha)*	Threatened	Yes	No	Yes	No
PS steelhead (*Oncorhynchus mykiss*)	Threatened	Yes	No	Yes	No

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

Consultation Conducted By: National Marine Fisheries Service
West Coast Region

Issued By:

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

Date: February 17, 2023

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1. INTRODUCTION

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

1.1 Background

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

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

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

1.2 Consultation History

This biological opinion is based on the information provided in the June 24, 2021, biological evaluation (BE) and supporting documents. The U.S. Army Corps of Engineers (COE) requested informal consultation at that time. On December 5, 2022, NMFS initiated formal consultation. A complete record of this consultation is on file at the Oregon Washington Coastal Office located in Lacey, Washington.

The COE concluded that the proposed action is likely to adversely affect (LAA) Puget Sound (PS) Chinook (*Oncorhynchus tshawytscha*) and PS steelhead (*Oncorhynchus mykiss*) and their critical habitats. NMFS concurs with the COE’s determination.

NMFS also reviewed the likely effects of the proposed action on EFH, and concluded that the action would adversely affect the EFH of Pacific Coast salmon and Pacific Coast Groundfish.

On July 5, 2022, the U.S. District Court for the Northern District of California issued an order vacating the 2019 regulations that were revised or added to 50 CFR part 402 in 2019 (“2019 Regulations,” see 84 FR 44976, August 27, 2019) without making a finding on the merits. On September 21, 2022, the U.S. Court of Appeals for the Ninth Circuit granted a temporary stay of the district court’s July 5 order. On November 14, 2022, the Northern District of California issued an order granting the government’s request for voluntary remand without vacating the 2019 regulations. The District Court issued a slightly amended order two days later on November 16, 2022. As a result, the 2019 regulations remain in effect, and we are applying the

2019 regulations here. For purposes of this consultation and in an abundance of caution, we considered whether the substantive analysis and conclusions articulated in the biological opinion and incidental take statement would be any different under the pre-2019 regulations. We have determined that our analysis and conclusions would not be any different.

On January 24, 2023, the NMFS biologist indicated that a review of the project's habitat impacts via the Puget Sound nearshore conservation calculator resulted in -49 debits. On January 27, 2023, the project proponent entered into a purchase agreement with the Puget Sound Partnership (PSP) for the purchase of 49 offsetting credits.

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 project includes maintenance dredging activities in the lower Duwamish Waterway (LDW) within the City of Seattle Shoreline Master Program 200-foot Urban Industrial Shoreline District. Maintenance dredging will target the depth of -34 feet mean lower low water (MLLW) with a 0.5-foot over dredge allowance (to -34.5 feet MLLW) determined to be protective of the clean sand cover placed in 2005. The maintenance dredging activities will remove approximately 9,000 cy of sediment in the 2.2-acre berthing area. The purchase agreement of January 27, 2023 date is included in our analysis, as adverse effects are expected to be offset within 3 years.

Construction Methods

The dredging specifications for the project will be performance-based, such that the contractor will select the specific equipment and dredging methodology best suited to project performance requirements. It is anticipated that sediment will be mechanically dredged to the required dredge elevations by a crane or excavator-operated clamshell bucket mounted on a barge. As part of the proposed dredging, the side slope of the dredge cut will be graded to a 1.5H:1V (horizontal to vertical) slope.

Gravity dewatering of the dredged sediment will occur on a flatdeck, sealed barge equipped with sideboards and scuppers within the vicinity of the project limits. The scuppers will be covered by filter media, such as straw bales and/or geotextile fabric. Excess water from the dredge material will be conveyed to the scuppers and filtered to retain suspended sediment while allowing the filtered water to drain back into the LDW.

The dewatered material will then be transferred to a permitted upland transfer station where it will be subsequently transported by truck or rail to an appropriate upland disposal facility. To contain sediment that could be spilled during this transfer process, a spill-prevention apron will be installed that sufficiently prevents material from re-entering the water. Contractor staging will occur on barges and in existing developed upland areas.

Project Timing

The project is expected to be completed in approximately 20 working days (4 weeks). In-water work will be performed consistent with allowable in-water work windows established by regulatory agencies to minimize potential disturbance of sensitive fish and wildlife species. Within the LDW, these work windows are expected to occur between October 1 and February 15, with an approved extension until March 15, 2023. CalPortland has an urgent need to complete this work in order to facilitate continued safe use of the berth area. The in-water work window is conservatively designed to be protective of outmigrating juvenile salmonids. With the one-month extension the work can still be completed by early March when juvenile salmonids are less likely to begin outmigrating from the Duwamish River system. The outmigration period typically occurs April.

Best Management Practices

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

- Work will be completed during regulatory approved work windows, anticipated to be October 1 to February 15, with an approved extension until March 15, 2023.
- Turbidity and other water quality parameters will be monitored to ensure that construction activities are in compliance with Washington State Surface Water Quality Standards per Washington Administrative Code 173-201A.
- Appropriate BMPs will be employed to minimize sediment loss and turbidity generation during dredging. BMPs may include, but are not limited to, the following:
    - Eliminating multiple bites while the bucket is on the bottom
    - No stockpiling of dredged material on the riverbed
    - No riverbed leveling
- The barge will be managed such that the dredged sediment load does not exceed the capacity of the barge. The load will be placed in the barge to maintain an even keel and avoid listing.
- No overtopping of the barge sideboards will be allowed during placement of dredged sediment, and no free water from the dredged sediment will be directly discharged back into the surface waters without passing through the filter media to minimize the release of suspended sediments.
- The dredging contractor will inspect fuel hoses, oil or fuel transfer valves, and fittings on a regular basis for drips or leaks in order to prevent spills into the surface water.
- The contractor shall be responsible for the preparation of a Spill Prevention, Control and Countermeasure Plan to be used for the duration of the project to safeguard against an unintentional release of fuel, lubricants, or hydraulic fluid from construction equipment.

We considered, under the ESA, whether or not the proposed action would cause any other activities and determined that it would not.

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

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

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 CFR402.02). Therefore, the jeopardy analysis considers both survival and recovery of the species.

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

The designations of critical habitat Puget Sound Chinook and Puget Sound Steelhead uses the term primary constituent element (PCE). The 2016 critical habitat regulations (50 CFR 424.12) replaced this term with physical or biological features (PBFs). The shift in terminology does not change the approach used in conducting a ''destruction or adverse modification'' analysis, which is the same regardless of whether the original designation identified PCEs, PBFs, or essential features. In this biological opinion, we use the term PBF to mean PCE or essential feature, as appropriate for the specific critical habitat.

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

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

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

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

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

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

The NHVM is also used to assess critical habitat impacts resulting from dredging. The NHVM quantifies the number of and extent to which PCE's are impacted by the proposed dredging. After dredging, the dredged area starts to silt back in and the habitat functions of the migratory corridor gradually increase. The NHVM only assesses the temporal impacts of critical habitat impacts. Short-term effects, like elevated suspended sediments and re-suspended contaminants, are addressed qualitatively in Section 2.5 (Effects of the Action) below.

Appendix 1 has a summary sheet of debits for the proposed project. A pre-sale agreement between CalPortland the PSP was provided during this consultation and is available with the file in the NMFS Lacey office.

2.2 Rangewide Status of the Species and Critical Habitat

This opinion examines the status of each species that 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.

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

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

Freshwater Environments

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

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

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

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

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

Marine and Estuarine Environments

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

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

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

Climate change effects on salmon and steelhead

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

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

River of Canada. They found that sockeye migrated over a period of more than 50 days, and populations from higher elevation and further inland streams arrived in the estuary later, with different populations encountering distinct prey fields. Carr-Harris et al. (2018) recommended that managers maintain and augment such life-history diversity.

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

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

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

2.2.1 Status of the Critical Habitat

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

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

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

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

Species	Designation Date and Federal Register Citation	Critical Habitat Status Summary
Puget Sound Chinook salmon	9/02/05 70 FR 52630	Critical habitat for Puget Sound Chinook salmon includes 1,683 miles of streams, 41 square mile of lakes, and 2,182 miles of nearshore marine habitat in Puget Sounds. The Puget Sound Chinook salmon evolutionarily significant unit (ESU) has 61 freshwater and 19 marine areas within its range. Of the freshwater watersheds, 41 are rated high conservation value, 12 low conservation value, and eight received a medium rating. Of the marine areas, all 19 are ranked with high conservation value.
Puget Sound Steelhead	2/24/16 81 FR 9251	Critical habitat for PS steelhead includes 2,031 stream miles (3,269 km). Nearshore and offshore marine waters were not designated for this species. There are 66 watersheds within the range of this DPS. Nine watersheds received a low conservation value rating, 16 received a medium rating, and 41 received a high rating to the DPS.

2.2.2 Status of the Species

Table 2, below provides a summary of listing and recovery plan information, status summaries and limiting factors for the species addressed in this opinion. More information can be found in recovery plans and status reviews for these species. Acronyms appearing in the table include DPS (Distinct Population Segment), ESU (Evolutionarily Significant Unit), MPG (Multiple Population Grouping), NWFSC (Northwest Fisheries Science Center), and TRT (Technical Recovery Team).

Table 2. Listing classification and date, recovery plan reference, most recent status review, status summary, and limiting factors for each species considered in this opinion

Species	Listing Classification and Date	Recovery Plan Reference	Most Recent Status Review	Status Summary	Limiting Factors
Puget Sound Chinook salmon	Threatened 6/28/05	Shared Strategy for Puget Sound 2007 NMFS 2006	NWFSC 2015; Ford 2022.	This ESU comprises 22 populations distributed over five geographic areas. Most populations within the ESU have declined in abundance over the past 7 to 10 years, with widespread negative trends in natural-origin spawner abundance, and hatchery-origin spawners present in high fractions in most populations outside of the Skagit watershed. Escapement levels for all populations remain well below the TRT planning ranges for recovery, and most populations are consistently below the spawner-recruit levels identified by the TRT as consistent with recovery.	• Degraded floodplain and in-river channel structure • Degraded estuarine conditions and loss of estuarine habitat • Degraded riparian areas and loss of in-river large woody debris • Excessive fine-grained sediment in spawning gravel • Degraded water quality and temperature • Degraded nearshore conditions • Impaired passage for migrating fish • Severely altered flow regime
Puget Sound Steelhead	Threatened 5/11/07	NMFS, 2019	NWFSC 2015; Ford 2022.	This DPS comprises 32 populations. The DPS is currently at very low viability, with most of the 32 populations and all three population groups at low viability. Information considered during the most recent status review indicates that the biological risks faced by the Puget Sound Steelhead DPS have not substantively changed since the listing in 2007, or since the 2011 status review. Furthermore, the Puget Sound Steelhead TRT recently concluded that the DPS was at very low viability, as were all three of its constituent MPGs, and many of its 32 populations. In the near term, the outlook for environmental conditions affecting Puget Sound steelhead is not optimistic. While harvest and hatchery production of steelhead in Puget Sound are currently at low levels and are not likely to increase substantially in the foreseeable future, some recent environmental trends not favorable to Puget Sound steelhead survival and production are expected to continue.	• Continued destruction and modification of habitat • Widespread declines in adult abundance despite significant reductions in harvest • Threats to diversity posed by use of two hatchery steelhead stocks • Declining diversity in the DPS, including the uncertain but weak status of summer-run fish • A reduction in spatial structure • Reduced habitat quality • Urbanization • Dikes, hardening of banks with riprap, and channelization

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 dredge footprint consists of an area approximately 640 feet long by 150 feet wide, or 2.2 acres. However, the action area for the project also includes the geographic area likely to be affected by the maintenance dredging activities. Potential impacts from maintenance dredging includes both underwater noise, turbidity, entrainment, and changes to prey distribution and abundance.

Noise generated from dredging is not anticipated to exceed typical background noise in the project area, the proposed dredging will occur in and near an active marine transportation zone and industrial facilities. As a result, the farthest-reaching effect from the proposed project activities is likely to be turbidity. In Washington, water quality standards (Washington Administrative Code [WAC] 173-201A) specify a mixing zone in which visible turbidity must not extend more than 150 feet from the bucket location. Based on this point of compliance, a conservative action area could be based on a potential worst-case dispersion of turbidity and any associated contaminants during a single tidal cycle, although it is expected that any turbidity increases would rapidly dissipate. Thus, the boundary of the in-water action area will be defined as the mixing zone at 300 feet (*Figure 1*). This covers approximately 17 acres.

The action area is utilized by PS Chinook salmon and by PS steelhead and is designated critical habitat for both. Based on life history/behavior patterns that show juvenile Chinook salmon to be dependent on estuarine and nearshore habitat to a much greater degree than juvenile steelhead. The action area is also EFH for Pacific Coast Salmon and Pacific Coast Groundfish.

Figure 1: CalPortland maintenance dredging project action area

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).

The LDW is the downstream portion of the Duwamish River and is located along a major shipping route for bulk and containerized cargo. This portion of the Duwamish River is estuarine, where freshwater from the river mixes with the salt water of the Puget Sound Estuary. Habitat conditions for listed salmonids in the action area are degraded. In the early 1900s, the waterway was filled to create uplands that were subsequently developed for industrial and commercial operations, including the dredging and straightening of the original watercourse (Ecology 2011). The site lacks natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, or side channels.

For more than a century, the LDW has facilitated industrial and commercial operations such as shipping and handling of bulk materials, concrete manufacturing, paper and metals fabrication, marine construction, boat manufacturing, marina operations, food processing, and airplane parts manufacturing. The LDW was added to the U.S. Environmental Protection Agency's (EPA) National Priorities List in 2001 and to the Washington State Hazardous Sites List in 2002. The LDW Waterway Group is conducting an ongoing Remedial Investigation and Feasibility Study of the LDW to assess risks to human health and the environment and to evaluate cleanup alternatives.

The LDW receives contaminant inputs from industrial activities and other sources, much of which has ended up in the sediments. Discharges and releases of oil and hazardous substances into the waterway resulted from current and historical industrial and municipal activities and processes since the early 1900s. Facilities released materials through permitted and non-permitted discharges, spills during cargo transfer and refueling, stormwater runoff through contaminated soils at upland facilities, and discharge of contaminated groundwater. The primary exposure pathways of a contaminant from media to receptors are via contaminants that accumulate in the sediments. The sediments in the estuary are contaminated with metals, petroleum products, and other organic materials (ACOE 2000). The organisms that live in and on the sediments, and that are exposed to sediment contamination, form the base of the food web upon which most of the fish, birds, and other wildlife that use the LDW environment depend. Contamination of the sediments affects nearly all aspects of the LDW ecosystem. Contaminants have been found in tissues of benthic invertebrates and fish in the Duwamish Waterway, indicating that contamination from the sediments is being accumulated by organisms. This suggests that juvenile and adult forage, including aquatic invertebrates and fishes, may inadequately support growth and maturation of juvenile Chinook salmon.

The property is located at approximately LDW river mile 3 and is bounded by the LDW on the east, West Marginal Way Southwest to the west, and active industrial properties to the south. The LDW is a major shipping route for bulk and containerized cargo and is therefore fairly routinely dredged at various locations. In addition to industry, the river is used for fishing and recreation, and it provides wildlife habitat.

The property is currently used as a marine terminal where bulk cement is imported, stored, and loaded for truck or rail distribution. The upland property includes actively used, aboveground buildings used for cement storage and distribution. A small guard shack and equipment used to pneumatically offload bulk cement from ships and barges are located adjacent to the shoreline. The in-water portion of the property includes a pier with pneumatic equipment (Docksider™) used to offload bulk cement from vessels berthed in the project area to upland storage silos.

No aquatic vegetation is known to exist in the vicinity of the maintenance dredging area. The shoreline substrate is composed of mostly riprap and a mix of sand and silt, with adjacent offshore areas consisting of a combination of sands, silts, and some gravel.

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

Effects include disturbance of bottom sediments, which will cause water quality impacts, and disturbance of benthic communities (forage).

Water Quality

Water quality is an essential element of both the rearing and migration PBFs, and is likely to be affected during dredging. Dredging operations are to be completed using mechanical (clamshell) dredging methods of approximately 9,000 cubic yards of subtidal material. Effects to water quality due to dredging can include increased suspended sediments leading to increased turbidity, decreased dissolved oxygen (DO), or resuspended toxins.

<u>Turbidity</u>: Temporary and localized increases in turbidity are expected in the immediate vicinity of the clamshell but water quality monitoring at the point of compliance (i.e., 150 feet from activity) is intended to ensure that effects are localized in order to minimize potential effects.

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

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

<u>Resuspended toxins:</u> The project is located within an EPA Superfund site with known contaminated sediments. Maintenance dredging has the potential to expose aquatic species to contaminants within LDW sediments. The berth area is periodically maintained through dredging. The proposed maintenance dredging will remove sediment that has accumulated above the existing clean sand cover that was placed as part of a 2005 maintenance dredging effort.

During dredging, PAHs and other contaminants will be re-suspended in the water column during and immediately following the activity. However, the probability of exposure of individuals to water quality effects is generally low, given that the work windows would mostly preclude the presence of juveniles, and BMPs will be implemented to minimize the mobilization of sediments (e.g., clamshell dredge, sediment reduction devices on barge scuppers). Short-term and intermittent exposure to reduced water quality could result in minor reductions in foraging success, gill damage and/or sublethal toxicity within 150 feet of dredging activities.

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

Benthic Communities and Forage Species Disturbance
Sessile, benthic, and epibenthic organisms within the sediments of the dredge prism that cannot move fast enough to avoid the capture of sediment by the clamshell bucket are entrained and experience high mortalities. Several studies have demonstrated that benthic organisms rapidly recolonize habitats disturbed by dredging (McCabe et al. 1996; Quian et al. 2003; Richardson et al. 1977; Van Dolah et al. 1984). However, the speed of recovery by benthic communities is affected by several factors, including the intensity of the disturbance, with greater disturbance increasing the time to recovery (Dernie et al. 2003). The infaunal community in the river would experience disruption during dredging and for a short time after, expected to recover toward baseline levels within several months, but full recruitment of prey complexity and abundance may take up to 3 years. While prey complexity and benthic diversity may take longer, the dredge

event would not limit forage availability nor the conservation value of habitat beyond weeks to several months. Suspended sediment tolerance generally decreases with increasing temperature or decreasing dissolved oxygen, and the combination of summer temperature and low dissolved oxygen is particularly adverse to benthic prey communities. Where DO is low, effects can persist for many weeks (WES 1978).

2.5.1 Effects on Critical Habitat

As mentioned in Section 2.2.1, critical habitat for PS Chinook salmon and PS steelhead occur within the action area. The NMFS reviews effects on critical habitat affected by a proposed action by examining how the PBFs of critical habitat will be altered, and the duration of such changes.

Chinook Salmon and Steelhead Critical Habitat:
The NMFS reviews the effects on critical habitat affected by the proposed action by examining changes of the project to the condition and trends of physical and biological features identified as essential to the conservation of the listed species. Critical habitat includes the stream channels within the proposed stream reaches, and includes a lateral extent as defined by the ordinary high-water line (33 CFR 319.11). In areas where ordinary high-water line has not been defined, the lateral extent will be defined by the bankfull elevation. Bankfull elevation is the level at which water begins to leave the channel and move into the floodplain and is reached at a discharge which generally has a recurrence interval of 1 to 2 years on the annual flood series. Critical habitat in lake areas is defined by the perimeter of the water body as displayed on standard 1:24,000 scale topographic maps or the elevation of ordinary high water, whichever is greater. In estuarine and nearshore marine areas critical habitat is proposed to include areas contiguous with the shoreline from the line of extreme high water out to a depth no greater than 30 meters relative to mean lower low water.

It should be noted that the lowermost 4.6 miles of the Duwamish River, including this project, are located within an estuary where saltwater from the sound and freshwater from the river mix. Water levels and salinity here fluctuate with the tide and amount of water in the river.

The salmonid PBFs present in the action area are presented below, with the affected features in bold:

> Freshwater rearing sites with water quantity and floodplain connectivity to form and maintain physical habitat conditions and **support juvenile growth and mobility**; **water quality and forage** supporting juvenile development; and 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.
>
> 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.

> 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 invertebrate**s and fishes, supporting growth and maturation.

The project will cause temporary effects to physical and biological features of critical habitat for PS Chinook salmon and PS steelhead. Those effects are:

1. Water Quality/Turbidity and Dissolved Oxygen (DO) - Dredging activities will degrade water quality in the berth and a 150-foot area surrounding the berth by elevating suspended sediments for up to 20 working days (4 weeks) within the in-water work window, and which will return to baseline levels within hours after work ceases. Conditions for juvenile maturation will be disrupted by the water quality degradation. Maintenance dredging would cause no measurable changes in water temperature and salinity, but mobilized contaminants and suspended sediments into the water column, can reduce DO. Both turbidity and DO are expected to return to baseline within hours (turbidity) to days (DO) after work ceases. Based on these factors, the impairment of this PBF will not reduce the conservation value of the habitat for salmon.

2. Water Quality/Pollutants – Increased levels of PAHs, polychlorinated biphenyls (PCBs), and other contaminants re-suspended in the water column will co-occur with the dredging and following briefly after the commencement of activity. This aspect of water quality degradation could temporarily impair the value of critical habitat for growth and maturation of juvenile salmon by exposing them to pollutants with both immediate and latent health effects, and could incrementally impair forage/prey communities that are exposed to the contaminants, delaying the speed that these communities re-establish after being physically disrupted by dredging.

3. Forage and Prey/Reduced Prey Abundance from Dredging – Removing sediment will simultaneously remove the benthic communities that live within those sediments, reducing prey availability in the footprint of the dredge. Among prey fishes, short-term and intermittent exposure to reduced water quality could result in minor reductions in forage species via gill damage of forage fishes. Suspended sediment will eventually settle in the area adjacent to the dredge prism, which can disrupt benthic prey species and if the sediments are contaminated, then sublethal toxicity of benthic prey species could occur within 150 feet of dredging activities. The limited duration of the in-water dredging (20 working days), and low intensity of these effects, and the prompt return to baseline levels (expected to be several months for foraging ability), indicate that the prey reduction is not detrimental over the long term to conservation values of the critical habitat in the action area.

Project Impact Offsets

The NMFS NHVM outputs reflect -49 debits (Appendix 1). The use of the nearshore calculator is to quantify the long-term impact of habitat changes, and identify the need for offsetting activities in order to avoid aggregating and systemic loss of conservation value. The applicant has signed a pre-sale agreement with PSP for 49 credits to achieve no long-term adverse habitat loss from this project.

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

Critical Habitat Summary. The LDW in the vicinity of the project includes degraded critical habitat with water quality conditions that somewhat support salmonid transitions between fresh and saltwater. The project is located in a heavily industrialized portion of the LDW that includes steep slopes, riprap armoring, and creosoted piling; poor riparian and marsh vegetation conditions; and lack of complex shoreline habitat. Fish presence is expected to be transitory as conditions don’t support robust forage or shelter opportunities.

The proposed action temporarily degrades water quality (4 weeks) and prey communities (reduction lasting several months) caused during the dredge in the habitat, the proposed action will not cause any loss of critical habitat in the action area, as all diminished features are affected in a limited footprint, and will return to baseline level within hours (water quality) or months at most (prey communities).

The temporary effects would briefly reduce forage value of the habitat, but at a time when migration use is expected to be quite low, making the influence of the reduction limited. The enduring adverse effects would be completely offset by the proposed compensatory mitigation credits purchased from the HCCC ILF. The reduction in PBFs being temporary and the permanent effects being fully offset, the conservation role of the habitat is considered retained.

2.5.2 Effects on Species

Effects of the proposed action on species are based, in part, on exposure of species to the effects to features of habitat, as described above. Adult PS Chinook salmon and PS steelhead, and juvenile PS Chinook salmon, will be exposed to the modified prey base, and temporary diminishment of water quality from elevated suspended sediment and contaminants described above. Entrainment during the operation of the dredge equipment might also occur. No permanent pathways of fish exposure to effects are expected as a result of the proposed dredging.

2.5.2.1 Species Presence and Exposure

Each of the following species uses the action area with variable presence. In order to determine effects on species, we must evaluate when species will be present and the nature (duration and intensity) of their exposure to those effects of the action in their habitat, which were described above. It should be noted; an effect exists even if only one individual or habitat segment may be affected (Fish and Wildlife Service and the National Marine Fisheries Service 1998). Work is expected to take up to 20 working days (4 weeks), and is allowed to occur at any time within the October 1 to February 15 work window, with an approved extension until March 15, 2023. Life history behaviors influence which life stages could be present during that work window.

Chinook salmon:
Chinook salmon presence is documented within the LDW, and juveniles and adults migrate in the action area (WDFW 2018). Chinook salmon in the action area would primarily be of Green River (Duwamish) stock, although fish from other stocks do use the same area (Nelson et al. 2004).

For these reasons, it is expected that adult and juvenile Chinook salmon may be present in the action area as follows: adults are expected to occur in the deep water areas in the vicinity of the action area during the summer and fall during their upstream spawning migration, and juveniles may occur in the shallow nearshore during typical outmigration periods between February and July. Thus adults may be exposed in the autumn portion of the work window, and juveniles in the winter portion of the work window.

Steelhead
Steelhead that would be present in the action area are winter or summer run steelhead from the Green River (Duwamish) stock (WDFW 2018). Run timing for adult Green River winter steelhead is generally from December through mid-March, with spawning generally from early March through mid-June. Run timing for Green River summer steelhead is generally from August through December with spawning generally from mid-January through mid-March. Juvenile steelhead would be expected to outmigrate between mid-March and early June, and would not be anticipated in the nearshore of the action area in large numbers because the majority of steelhead smolts migrate directly to the open ocean and do not rear extensively in the estuarine or coastal environments (Burgner et al. 1992).

For these reasons, it is expected that adult steelhead may be present in the action area as follows: adults are expected to occur in the deep water areas in the vicinity of the mouth of the LDW during the summer, fall, and winter of their upstream spawning migration, overlapping the fall and winter portion of the work window. The general steelhead life history and available research suggest that steelhead use of the action area is lowest in the winter. Juvenile outmigtation starts in March so we do not expect them to be present when work occurs.

2.5.2.2 Species Response to Temporary Effects

Modified Benthic Prey

Prey communities will be reduced in the action area and are expected to recolonize the dredge footprint within several months (and up to 3 years for complex diversity) following the completion of the in-water work. Salmonids present in the action area would experience reduced forage opportunity for the several weeks of the in-water work, and the period of benthic community recovery.

Adult Chinook salmon in their return migration cease eating as they enter fresh water, so the reduced prey availability in this estuarine area is unlikely to adversely affect them. Adult steelhead are iteroparous, and will continue to consume prey as returning adults, but as larger fish, they are likely to seek out much larger prey than the benthic assemblies would provide, meaning the reduced benthic prey availability is also unlikely to be significant to adult steelhead.

When juvenile salmonids are entering the nearshore or marine environment, they must have abundant prey to allow their growth, development, maturation, and overall fitness. As dredging dislodges bottom sediments, benthic communities are disrupted where the sediment removal occurs and in the locations where sediment falls out of suspension and layers on top of adjacent benthic areas. Benthic communities will be impacted over approximately 17 acres and it can take up to three years to fully re-establish their former abundance and diversity. It should be noted, within the 17 acres of impact the area closest to the dredge prism will experience the most impact with lessening impacts when moving further away from the dredging activity. All 17 acres is expected to be impacted, but on a gradient. Work will occur across one work window so we can expect three years in which benthic prey is less available to juveniles, incrementally diminishing the growth and fitness of four separate cohorts of individual juvenile outmigrants from the ESA listed salmonid species that pass through the action area. Given the relatively small area from within available prey sources in the river system, and the high level of mobility that juvenile migrants have when they reach the marine environment, that many individual fish will experience reduce food or increased competition to a degree that impairs their growth, fitness, or survival. Even if several fish from each cohort of each population had diminished foraging success, we anticipate that this would be a transitory condition as they migrate to more suitable forage locations. The level of reduced growth, fitness, or survival would be impossible to detect numerically, and the reduced abundance in juvenile cohorts would probably be insufficient to be discerned as an influence on productivity of the populations.

Diminished Water Quality

Exposure to water of degraded quality is likely to adversely affect adult PS Chinook salmon and PS steelhead, and juvenile PS Chinook salmon. Water quality will be impaired for roughly 20 days across a period of up to 4 months, by suspended sediments and suspended contaminants.

Suspended sediment

The effects of suspended sediment on fish increase in severity with sediment concentration and exposure time and can progressively include behavioral avoidance and/or disorientation, physiological stress (e.g., coughing), gill abrasion, and death—at extremely high concentrations. Newcombe and Jensen (1996) analyzed numerous reports on documented fish responses to suspended sediment in streams and estuaries and identified a scale of ill effects based on sediment concentration and duration of exposure, or dose. Exposure to concentrations of suspended sediments expected during dredging could elicit sub-lethal effects such as a short-term reduction in feeding rate or success, or minor physiological stress such as coughing or increased respiration. In general, fish are more likely to undergo sublethal stress from suspended sediments rather than lethality because of their ability to move away from or out of an area of higher concentration to a lower concentration versus sessile or less mobile species" (Kjelland et al. 2015).

Several reports summarized dredged material behavior and sediment resuspension due to clamshell dredging and associated open water disposal (Palermo et al. 2009; LaSalle et al. 1991; Havis 1988; McLellan et al. 1989; Herbich and Brahme 1991; Truitt 1988). Laboratory studies have consistently found that the 96-hour median lethal concentration of fine sediments for juvenile salmonids is above 6,000 mg/L (Stober et al. 1981) and 1,097 mg/L for 1 to 3-hour exposure (Newcombe and Jensen 1996). Based on an evaluation of seven clamshell dredge operations in fine silt or clay substrates, LaSalle (1991) determined that the expected concentrations of silty suspended sediment levels was 700 mg/l and 1,100 mg/l at the surface and bottom of the water column, respectively (within approximately 300 feet of the operation). Sediment in the action area consists of silty sands which would settle out of the water column faster than fine silt or clay. Suspended sediment from the proposed dredge operations is expected to not reach levels leading to injury of exposed fishes because salmonids are expected to avoid or promptly vacate areas where sediment concentrations are high enough to cause injury. Studies show that salmonids have an ability to detect and distinguish turbidity and other water quality gradients (Quinn 2005; Simenstad 1988). Also, by the time juvenile salmonids are in the marine environment we expect them to be large, so that even with exposure, injury will not result since studies have shown that larger juvenile salmonids are more tolerant to suspended sediment than smaller juveniles (Servizi and Martens 1991; Newcombe and Jensen 1996). Thus, behavioral responses and perhaps cough or gill irritation are the most likely responses, and lasting injury is unlikely to result. Based on life history behaviors and work window timing, the overlap of adult PS Chinook salmon with potential in-water work is only 2 months, juvenile PS Chinook salmon presence is 1 month, but PS steelhead presence and the work window overlap the whole in-water work window, 4 months. While juvenile salmonids are more vulnerable to suspended sediment than adults, their exposure will be during winter when water temperatures are colder, increasing their level of tolerance (Servizi and Martens, 1991).

Suspended contaminants

Due to the highly industrialized nature of the project area, numerous sites containing hazardous substances exist in and near the project area. Contaminants in sediments and dissolved in-water can have varying levels of toxicity, most often occurring as sub-lethal effects. The LDW was listed as a federal Superfund site in 2001[2]. At least 41 different hazardous chemicals have been found in LDW sediments (Ecology 2023). Elevated concentrations of mercury, polycyclic aromatic hydrocarbons (PAHs), bis(2-ethylhexyl) phthalate, polychlorinated biphenyls (PCBs), and dioxin/furans (D/Fs) have been measured in sediments associated with portions of this source control area (Ecology 2011). Because concentrations of PAHs, PCBs, and dioxins/furans

[2] https://cumulis.epa.gov/supercpad/SiteProfiles/index.cfm?fuseaction=second.Cleanup&id=1002020#bkground

exceeded screening levels, the potential effects of those contaminants are discussed in more detail below. Some of the effects of these contaminants to salmon species include:

- Sublethal effects to fish include external injury such as damage to the skin, fins, and eyes as well as internal organ problems such as liver tumors from exposure to PAH-contaminated sediments and water. Gill tissues are highly susceptible to damage because they actively pass large volumes of water and are thereby exposed to PAHs present in water (SHNIP 2016). Most non-benthic fish tissue contains relatively low concentrations of PAH, and accumulation is usually short term because these organisms can rapidly metabolize and excrete them (Lawrence and Weber 1984 and West et al. 1984, as cited in Eisler 1987).

- Many studies have reported the nature of PAHs in the aquatic environment and their metabolism in fish. Fish exposure to PAHs has been linked to a wide range of physiological dysfunctions in fish, including neoplasia, endocrine disruption, immunotoxicity, reduced reproductive success, embryonic development, post-larval growth, and transgenerational impacts (Tierney et al. 2014).

- Exposure of fish to PAHs is generally associated with narcosis, resulting in a general depression of biological and physiological activities (Van Brummelen et al. 1998). These effects may be linked to reduced immune function, increased mortality after disease challenge, and reduced growth (Karrow et al. 1999; Varanasi et al. 1989; Arkoosh et al. 1991, 1998).

- Dioxin and dioxin-like PCBs act similarly on salmon and other fish species. Reported effects on juvenile salmon include a wide range of sub-lethal outcome including impaired growth and reproduction, hormonal alterations, enzyme induction, alterations to behavior patterns, and mutagenicity (Meador 2002, SHNIP 2016). Eisler (1986) stated that in general, toxicity increased with increasing exposure, crustaceans and younger developmental stages were the most sensitive groups tested, and lower chlorinated biphenyls were more toxic than higher chlorinated biphenyls.

- Exposure to dioxin can result in developmental or reproductive toxicity in fish, birds, and mammals. Fish larvae are among the most sensitive vertebrates to the toxic effects of dioxins/furans (Peterson et al., 1993); and exhibit similar signs of toxicity as other vertebrates including decreased food intake, wasting syndrome, and delayed mortality. Adult fish are less susceptible to dioxin-induced toxicity compared to earlier life stages, requiring considerably higher body burdens to elicit adverse effects (Lanham et al. 2011; Peterson et al. 1993; Walker and Peterson 1992, Walker et al. 1994).

Resuspension of contaminated sediments are proportional to the amount of dredging and the local levels of contamination. Assuming a three percent sediment resuspension rate (SHNIP 2016), approximately 270 cubic yards of material will be resuspended during the course of dredging. In addition, disturbance of the substrate will increase contaminant concentrations by resuspending particulates, thereby allowing more contaminants to transport into the water column. However, measures to limit suspended sediment, such as the dredging techniques, will reduce disturbance of substrate particles and contaminants (SHNIP 2016). Contaminant concentrations will be increased for up to 20 days during the work window (October 1 to February 15, with an approved extension until March 15, 2023), with potentially harmful acute increases contained within the 150-foot compliance boundary. Which species and life stages have the most exposure will be determined by the actual dates of in-water work, which at this time is unspecified. Ultimately, once the contaminated sediment has been removed, the concentration of contaminated material in the surrounding environment will decrease and the pathway of exposure for fish through contamination of prey will be reduced in perpetuity.

PAHs have been found to reduce fitness and have potential to kill juvenile salmonids through the effect of "toxicant-induced starvation" in which lipid stores and biomass are reduced (Meador et al. 2006). Impacts of PAHs on the reproduction and development of wild Puget Sound salmon have not been well characterized, although some laboratory studies have shown abnormal behavioral effects during early development of coho salmon exposed to PAHs (Ostrander et al. 1988). Dioxin exposure can cause detrimental but sublethal effects, described above, among juvenile salmonids. Dioxin toxicity varies dramatically across fish species with salmonids exhibiting the highest sensitivity. Recent studies have shown negative effects to eggs and fry but little is known about toxicity levels to adult salmonids that might be found in the action area (King-Heiden et al. 2011). The period of potential exposure to these contaminants is during the 20 days of dredging.

Dissolved oxygen

DO is discussed in Section 2.5.1. Habitat and prey resources may be affected through temporary decreases in DO contemporaneous with the increased suspended sediment (Mitchell et al, 1999). "Suspended sediments absorb heat energy thereby raising water temperatures … Turbidity can reduce light transmission through the water and decrease photosynthesis by aquatic plants, consequently affecting dissolved oxygen levels …." (Kjelland et al. 2015, internal citations omitted). Reductions in DO will likely be short lived if they occur at all. Because the window for the dredging operation is between October and February (with an approved extension until March 15, 2023), we anticipate both that water temperatures are likely to remain cold, and inflow from the freshwater environment will be strong, both of which should limit reductions in DO. Fish exposure to decreased DO is therefore not expected to have either an intensity or duration that would be expected to injure fish.

Entrainment

Entrainment is the process where objects are enclosed and transported within some form of vessel or where solid particles are drawn-in and transported by the flow of a fluid. In this context, entrainment refers to the uptake of aquatic organisms by dredge equipment. Mechanical (clamshell) dredges entrain organisms that are captured within the clamshell bucket. The likelihood of entrainment increase with a fish's proximity to the dredge, and the frequency of interactions.

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

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

As stated above, the probability of fish entrainment is largely dependent upon the likelihood of fish occurring within the dredge prism, dredge depth, fish densities, the entrainment zone (water column of the clamshell impact), location of dredging within the river, type of equipment operations, time of year, and species life stage. Demersal fish, such as sand lance, sculpins, and pricklebacks are most likely to be entrained as they reside on or in the bottom substrates with life-history strategies of burrowing or hiding in the bottom substrate (Nightingale and Simenstad 2001). Consequently, the risk of entrainment of ESA-listed species by the dredge is extremely low.

To assess the enduring effects of the proposed project, NMFS used the NHVM, as described in Section 2.1, which as currently proposed resulted in a debit (or loss of habitat function) of -49 points (Appendix 1).

Effects of Compensatory Mitigation
To address impacts to aquatic habitats CalPortland would use the PSP program for compensatory mitigation requirements for the dredging project. The purchase of mitigation credits would address the loss of ecosystem functions due to the modification of water bottoms, and water column.

The purchased credits are expected to achieve a no-net-loss of habitat function as a result of this proposed action, which are needed to help ensure that PS Chinook salmon do not continue to drop below the existing 1-2 percent juvenile survival rates (Kilduff et al. 2014, Campbell et al. 2017). PS Chinook salmon juvenile survival is directly linked to the quality and quantity of nearshore habitat. Campbell et al. 2017 has most recently added to the evidence and correlation of higher juvenile survival in areas where there is a greater abundance and quality of intact and restored estuary and nearshore habitat. Relatedly, there is emerging evidence that without sufficient estuary and nearshore habitat, significant life history traits within major population groups are being lost. And specific to this action area, there appear to be higher rates of mortality in the fry life stage in the more urbanized watersheds. By contrast, in watersheds where the estuaries are at least 50 percent functioning, fry out-migrants made up at least 30 percent of the returning adults, compared to the 3 percent in watersheds like the Puyallup and the Green rivers, where 95 percent of the estuary has been lost (Campbell et al. 2017).

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 earlier in the discussion of environmental baseline (Section 2.4). Because LDW is expected to remain in highly industrialized and utilized for several decades, we do expect climate change conditions to become more pronounced over that time, which we anticipate may disrupt important habitat features and ecosystem functions that are critical in salmon survival and recovery.

NMFS does not expect any new non-Federal activities within the action area because the area is already highly developed with industrial activities and work within the water would fall under federal authorities such as the Clean Water Act. However, at the watershed scale, future upland development activities lacking a federal nexus will continue and are expected to lead to increased impervious surface, surface runoff, and non-point discharges. NMFS expects these activities to continue in perpetuity. These activities will degrade water quality and exert a negative influence on ESA-listed species. Any future federal actions will be subject to section 7(a)(2) consultation under ESA.

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.

The two species considered in this opinion are listed as threatened with extinction because of declines in abundance, poor productivity, and reduced spatial structure and diminished diversity. Systemic anthropogenic detriments in fresh and marine habitats are limiting the productivity for PS Chinook salmon and PS steelhead.

The environmental baseline in the action area is a mix of commercial fishing and vessel infrastructure as well as commercial development landward of the highest astronomical tide, or HAT, that degrade habitat conditions for listed species in their nearshore marine life stage. Within the action area there are sources of noise and shade (vessels), water quality impairments (nonpoint sources), and artificial light (marinas and fishing piers). To this context of species status and baseline conditions, we add the temporary effects of the proposed action, together with cumulative effects (which are anticipated to be future nonpoint sources of water quality impairment associated with development and stressors associated with climate change), in order to determine the effect of the project on the likelihood of species' survival and recovery. We also evaluate if the project's habitat effects will appreciably diminish the value of designated critical habitat for the conservation of the listed species. Such alterations may include, but are not limited to, those that alter the physical or biological features essential to the conservation of a species or that preclude or significantly delay development of such features.

Critical Habitat

The temporary effects on features of designated critical habitat for PS Chinook salmon and PS steelhead will be water quality and benthic disturbance. We expect diminishment of water quality based on turbidity, though suspended sediments will remain high several hours after dredging ceases. Turbidity will diminish water quality for up to 20 days in the work window, and will affect approximately 17 acres. Because the duration is brief, primarily occurs when adult fish rather than juveniles are present, occurs when water temperatures are cold, and baseline water quality levels are re-established shortly after the disturbance, the impaired water quality PBF does not diminish conservation values of the action area.

The effects on benthic communities is also temporary, but much more persistent. Recovery time for the affect area is expected to not last longer than three years, with noticeable areas of recovery starting on the outer edges of the dredged area, starting weeks to months after dredging is completed. Despite the duration of this effect, the forage PBF diminishment is not sufficient to diminish conservation values of the action area because only a maximum of three cohorts of juvenile PS Chinook salmon would experience this decline, and the reduced forage base in most notable in the first year, ameliorating as benthic communities re-establish.

The beneficial effects of removing known contaminants will improve water quality and substrate condition of the habitat. These effects will be incremental but permanent improvements to habitat within the action area.

When added to the baseline, and considered together with the anticipated negative cumulative impact of numerous non-federal effects, the temporary effects of the proposed action are not likely to impair long term conservation values of critical habitat designated for PS Chinook salmon and PS steelhead, particularly because sources of prey are not considered limiting for listed species within the lower river. We have determined that the temporary impairments will not reduce conservation values of the critical habitat to serve the recovery goals for the listed species.

Compensatory mitigation, through purchase of PSP credits, is reasonably certain to offset the long-term loss of habitat function from the dredging project resulting in a net zero loss of habitat function. The structure would also impede benthic communities for the foreseeable future and temporarily. The temporary impacts that disrupt benthic environments would diminish juvenile fish rearing habitats and food sources in the action area; however, when scaled up to the designation scale, the effects are not expected to impact the ESU or DPS because it is likely that a very small number of fish would be impacted. Reduced diversity or density of epibenthic mesofauna also reduces prey resources for juvenile salmon – but again would be offset by the proposed compensatory mitigation.

Species

Because the work windows are timed when juvenile salmon migration is largely avoided we expect that juvenile PS Chinook salmon will only minimally be exposed to turbidity in the work window. We do expect adult PS Chinook salmon and PS steelhead will be exposed to turbidity in the work window. These fish are likely to have a behavioral response to this exposure, and any injury (e.g. gill abrasion) is unlikely to impair fitness of the adult fish for spawning.

The most chronic of the temporary effects – reduced benthic prey for up to approximately 3 years – should not affect fitness growth or survival of enough fish to discernibly reduce abundance of any cohort of any population within those 3 years.

Accordingly, NMFS expects only a very small reduction in numbers of PS Chinook salmon and PS steelhead, if any, as a consequence of their exposure to the temporary effects. These effects, even when considered with cumulative effects, are insufficient to alter the productivity, spatial structure, or genetic diversity of any of the species. Therefore, when considered with the environmental baseline in the action area and cumulative effects, the action, as proposed, does not increase risk to the affected populations to a level that would appreciably reduce the likelihood for survival and recovery of the PS Chinook salmon ESU or PS steelhead DPS.

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 NMFS' biological opinion that the proposed action is not likely to jeopardize the continued existence of PS Chinook salmon or PS steelhead, or destroy or adversely modify PS Chinook salmon or PS steelhead designated critical habitats.

2.9 Incidental Take Statement

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

2.9.1 Amount or Extent of Take

In this biological opinion, NMFS determined that listed species will co-occur with the effects of the proposed action and therefore incidental take is reasonably certain to occur, as follows:

Harm from suspended sediments/contaminants
Habitat modified temporarily by suspended solids and contaminants will impair normal patterns of behavior including rearing and migrating in the action area, and causing potential injury such as gill abrasion, cough, or other transitory health effects for juvenile PS Chinook salmon and PS steelhead.

Take in the form of harm from these causes cannot be accurately quantified as a number of fish. The distribution and abundance of fish within the action area cannot be predicted based on existing habitat conditions, and because of temporal and dynamic variability in population dynamics in the action area, nor can NMFS precisely predict the number of fish that are reasonably certain to respond adversely to habitat modified by the proposed action. When NMFS cannot quantify take in numbers of affected animals, instead we consider the likely extent of changes in habitat quantity and quality that are the source of take, and consider that measure of that physical area, and the duration of those changes, to indicate the extent of take,.

For this consultation, the best available indicator for the extent of take from suspended contaminants are the *temporal and physical extent* within contaminant levels increase from project activities to levels that can injure or kill fish in the action area while in-water work is occurring from the proposed actions. The levels of suspended contaminants are expected to be proportional to the amount of injury that the proposed action is likely to cause through physiological stress from elevated suspended sediments and contaminants throughout the duration of the projects' in water activities and throughout the compliance boundary of 150 feet from ongoing activities.

The temporal extent of take in the form of harm from suspended sediments during in-water work is 20 working days (4 weeks) within the in-water work window, between the dates of October 1 and February 15, with an approved extension until March 15, 2023. Work for more days, or beyond this extended work window would expose a greater number of fish to harm from suspended sediment.

The maximum physical extent of take in the form of harm from suspended sediments is defined by the dredge area plus the compliance area for turbidity monitoring within the 150-foot buffer around the project, approximately 17 acres in total. Within the compliance boundary, injury may occur to listed species present in the area due to increased contaminant exposure, gill abrasion, and behavioral changes.

Harm from reduced prey availability
Habitat modified for up to 3 years by reduced prey abundance and complexity is likely to injure some juvenile individuals of the PS Chinook salmon ESU in each year by decreasing growth, fitness, and or survival. As above, the number of fish so harmed cannot be predicted due to variability in their abundance, presence, and behavioral patterns, and an extent of take is provided instead. For this source of harm, the best indicator for the extent of take is spatial extent of the modified river bed, the 17 acres in which dredging will occur and dredge material 'fall back' settles, where benthic prey communities will be disrupted.

2.9.2 Effect of the Take

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

2.9.3 Reasonable and Prudent Measures

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

1. Minimize incidental take during dredging.

2. Monitor incidental take caused by elevated turbidity and suspended sediments during construction.

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

2.9.4 Terms and Conditions

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

   The COE shall require the applicant to ensure the proposed action is in accordance with permit conditions, which set timing restrictions for 20 working days, 4 weeks, consecutive or non-consecutive, during the October 1 to February 15 for in-water work, with an approved extension until March 15, 2023.

2. The following terms and conditions implement reasonable and prudent measure 2:

   The COE shall require the applicant/contractor to monitor turbidity levels in the action area during sediment-generating activities when contaminated materials are involved. Monitoring shall be performed 150 feet upstream and downstream from dredging operations. Project activities will be modified or reduced as necessary when turbidity conditions exceed water quality monitoring standards as described in the Water Quality Certification issued for this project.

3. The following terms and conditions implement reasonable and prudent measure 3:

   a. Reporting. The COE and contractor must report all monitoring items, including turbidity observations, size of the dredged area, amount of sediment removed, and dates of initiation and completion of dredging to NMFS within 60 days following completion of dredging activities. The contractor must report any exceedance of take covered by this opinion to NMFS immediately. The report must include a discussion of implementation of the terms and conditions in T&C's 1 and 2, above.
   b. The contractor must submit monitoring reports to:
      ProjectReports.wcr@noaa.gov
      Reference project #: WCRO-2021-01519
      CC: Lisa.Abernathy@noaa.gov

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).

> The COE should work with the NNMFs to identify more restrictive work windows for dredging activities to protect the biological integrity of jurisdictional waters and promote species conservation.

2.11 Reinitiation of Consultation

This concludes formal consultation for CalPortland Maintenance Dredging Project.

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

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

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

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

3.1 Essential Fish Habitat Affected by the Project

The entire action area fully overlaps with identified EFH for Pacific Coast salmon and Pacific Coast Groundfish. The property is located within the Green-Duwamish estuary, where aquatic conditions consist of marine waters from Elliott Bay transitioning with freshwater from the Duwamish River. Groundfish EFH extends to where the salinity drops below 0.5 parts per thousand during the period of average annual low flow within the Green River. The Washington Department of Fish and Wildlife Priority Habitats and Species map indicated usage of the LDW by priority species within the vicinity of the property, including Chinook (*Oncorhynchus tshawytscha*), sockeye (*O. nerka*), and chum (*O. keta*) salmon, steelhead (*O. mykiss*) and residential coastal cutthroat (*O. clorkil*) trout, as well as bull trout (*Salvelinus malma*) (WDFW 2019).

3.2 Adverse Effects on Essential Fish Habitat

The proposed actions will cause negative impacts on the quality of habitat by increasing suspended sediment, benthic disturbance, and increased concentrations of waterborne contaminants.

These effects will occur during the work window with negative impacts on water quality quickly fading after the 4-week project is complete, and benthic prey reductions will quickly begin to improve, but full recovery to baseline levels of abundance and prey species complexity may take up to 3 years across the affected area. There will be improvement of habitat quality and ecological function over the long term with the removal of contaminated sediments.

Conservation Actions

The proposed project would have temporary and enduring effects on EFH water bottoms and water columns. These effects culminate in short-term (construction-related) and long-term adverse effects on Pacific Coast groundfish, and Pacific Coast salmon EFH. The proposed action incorporates a number of minimization measures to avoid, reduce, and minimize the adverse effects of the action on EFH. To offset the remaining negative habitat effects, the applicant purchased mitigation though the PSP program. NMFS ran the NHVM which can be found in Appendix 1.

3.3 Essential Fish Habitat Conservation Recommendations

Several effects-minimization measures are being implemented as part of the proposed action:

- Use of a clamshell dredge. A clamshell dredge is the best available technique to minimize sediment input into the water column, reducing the likelihood of significant increases in turbidity/suspended sediment.

- Turbidity and other water quality parameters will be monitored to ensure that construction activities are in compliance with Washington State Surface Water Quality Standards per Washington Administrative Code 173-201A.

- Appropriate BMPs will be employed to minimize sediment loss and turbidity generation during dredging. BMPs may include, but are not limited to, the following:
  - Eliminating multiple bites while the bucket is on the bottom
  - No stockpiling of dredged material on the river bed
  - No river bed leveling

- The barge will be managed such that the dredged sediment load does not exceed the capacity of the barge. The load will be placed in the barge to maintain an even keel and avoid listing.

- The dredging contractor will inspect fuel hoses, oil or fuel transfer valves, and fittings on a regular basis for drips or leaks in order to prevent spills into the surface water.

- No overtopping of the barge sideboards will be allowed during placement of dredged sediment, and no free water from the dredged sediment will be directly discharged back into the surface waters without passing through the filter media to minimize the release of suspended sediments.

- The contractor shall be responsible for the preparation of a Spill Prevention, Control and Countermeasure Plan to be used for the duration of the project to safeguard against an unintentional release of fuel, lubricants, or hydraulic fluid from construction equipment.

- Dredged materials will be disposed of in an approved upland site.

Implementation of these minimization measures would avoid or minimize potential adverse effects of the proposed action.

In addition to the minimization measures described above, NMFS provides additional conservation recommendations here. Implementation of the following conservation recommendations would further minimize and/or avoid adverse effects on EFH for Pacific Coast salmon and Pacific Coast groundfish that are likely to result from the proposed action.

1) Compliance of water quality standards by conducting water quality monitoring during dredging activities. At the point of compliance, turbidity shall not exceed 5 NTUs more than background turbidity when the background turbidity is 50 NTUs or less, or there shall not be more than a 10 percent increase in turbidity when the background turbidity is more than 50 NTUs.
2) Dredging should be carried out in a manner that minimizes spillage of excess sediments from the bucket and minimizes the potential entrainment of fish. This includes, but is not limited to:
   a) Using effective materials such as hay bales or filter fabric on the barge to avoid contaminated sediment and water from being deposited back into the river.

b) Avoiding the practice of washing contaminated material off the barge and back into the water. This can be accomplished by the use of hay bale and/or filter fabric.
c) Using filter fabric or some other device (hay bales, eco-blocks, etc.) to minimize spillage of material into the water during the unloading of the barge to the upland facility.

3) Contractor should have the most current, accurate Global Positioning System (GPS) dredge positioning to control the horizontal and vertical extent of the dredge. A horizontal and vertical control plan will be prepared, submitted to the contractor, and adhered to by the dredge contractor to ensure dredging does not occur outside the limits of the dredge prism.

4) Ensure that an emergency cleanup plan is in place in the event the barge, truck, or railcar has an incident where contaminated material is spilled. This plan will be on-board the vehicle at all times.

3.4 Statutory Response Requirement

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

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

3.5 Supplemental Consultation

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

4. DATA QUALITY ACT DOCUMENTATION AND PRE-DISSEMINATION REVIEW

The Data Quality Act (DQA) specifies three components contributing to the quality of a document. They are utility, integrity, and objectivity. This section of the opinion addresses these

DQA components, documents compliance with the DQA, and certifies that this opinion has undergone pre-dissemination review.

4.1 Utility

Utility principally refers to ensuring that the information contained in this consultation is helpful, serviceable, and beneficial to the intended users. The intended users of this opinion are the COE and CalPortland. Individual copies of this opinion were provided to the COE. The format and naming adheres to conventional standards for style.

4.2 Integrity

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

4.3 Objectivity

Information Product Category: Natural Resource Plan

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

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

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

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

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APPENDIX 1

Action Agency Reference #	NWS-2021-256
FWS or NMFS #	WCRO-2021-01519
Project Name:	CalPortland Maintenance Dredge
Prepared on and by:	Lisa Abernathy 1/26/2023 Final Calc

Puget Sound Nearshore Habitat Conservation Calculator

Version 1.4 — 6/22/2022

This tool determines long-term habitat impacts and benefits for projects in the Salish Sea nearshore. Details about the use of this Conservation Calculator can be found in the User Guide, FAQs, and training materials, which are all available

Puget Sound Nearshore Habitat Conservation Calculator Webpage

		Conservation Credits/Debits	DSAYs (Discounted Service Acre Years)
Overwater Structures	Debit	0	0.00
	Credit (includes creosote removal)	0	0.00
	Balance	**0**	0.00
Shoreline Armoring	Debit	0	0.00
	Credit from Armor Removal	0	0.00
	Credit from Creosote Removal	0	0.00
	Balance	**0**	0.00
Maintenance Dredging	**Balance**	-49	-0.49
Boatramps, Jetties, Rubble	Debit	0	0.00
	Credit	0	0.00
	Balance	**0**	0.00
Beach Nourishment	**Conservation Offsets**	**0**	0.00
Riparian Enhancement/Degradation	**Balance**	**0**	0.00
SAV Planting	**Conservation Credit**	**0**	0.00
Habitat Loss / Remaining Conservation Offsets Needed		-49	-0.49
Is this a standalone restoration project?*	**No**		

* Standalone restoration actions are actions that can be executed outside of a replacement or construction of new structures. They have no negative long term habitat impacts. A standalone restoration action solely restores or improves habitat functions. It does not introduce new or

Summary | ProjectD | RZ | Overwater Structures | InputShorel | ShorelStab | MDredging

oject Description:	The proposed action is to maintain the 2.2-acre berthing area by dredging up to 9,000 cubic yards (CY) of accumulated sediment. Dredging would target an authorized depth of -34 feet mean lower low water (MLLW) with a 0.5-foot over-dredge allowance (to -34.5 feet MLLW).			
Elements entered in this				

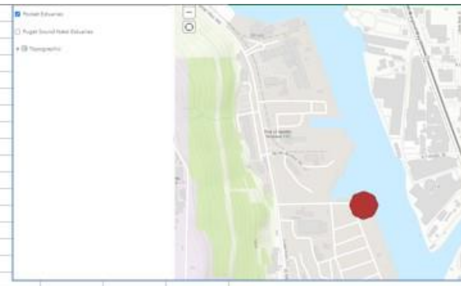
Site Specific Factors

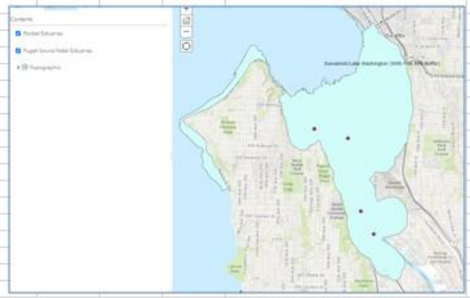
Enter site specific credit factors and submerged aquatic vegetation (SAV) scenarios in the yellow boxes below. They will auto-apply to all tabs. If more than one project location exists, enter each location in a separate calculator file and submit

	Yes or	% Change	Applicable to:	Ref: Application of Factors
Natal Estuary	Yes	50%	All tabs	
Is the project within 5 miles of a Puget Sound Chinook natal estuary or 1 mile of a Hood Canal summer-chum natal estuary? If yes, a factor of 50% applies. A project in both natal estuary and pocket estuary/embayment receives a combined 90%				
Pocket Estuary or Embaym	No	0%	All tabs	Ref: Pocket Estuaries and Embayments
Is the project located within a pocket estuary/embayment? If yes, a factor of 30% applies. If also within a natal estuary zone, a factor of 40% applies.				
Forage Fish Spawning	No	0%	USZ for all tabs	
Is there sand lance or surf smelt spawning on the project site (as mapped or determined by WDFW)? If yes, a factor of 50% ap				
Same Drift Cell and Updrift of Forage Fish	No	0%	USZ for ShorelStab, BoatRJetty, Beach	Use Coastal Atlas "Drift Cells" map layer along with WDFW Forage Fish Spawning map
Is the project within the same drift cell *and* updrift of sand lance or surf smelt spawning? If yes, a factor of 20% applies *if* there is no forage fish spawning documented.				
Herring Spawning	No	0%	LSZ and DSZ structures in all tabs except RZ	Overwater structures in DSZ herring spawning and holding areas may have herring spawning factor applied depending on size and design. See the User Guide for more information.
Does the project site have documented herring spawning (as mapped or determined by WDFW)? If yes, a factor of 50% applie				
Feeder Bluff	No	0%	RZ, ShorelStab	Use Coastal Atlas "Coastal Landforms" map layer
Is the project located at a feeder bluff? If yes, a factor of 50% applies.				

Submerged Aquatic Vegetation (SAV) Scenario

Upper Shore Zone	0	Select a number 1 - 3. SAV scenarios should be based on the average SAV
Lower Shore Zone	0	density in the footprint of the structure including a 25-foot buffer around the





Document additional project information below.

2.2 acres = 95,832 sq ft

"Change pocket estuar to "no" due to seasonal , intermittent floe' the nature of the project, and not meeting the definition in the May 2021 Pocket Estuaries memo

Summary | ProjectD | RZ | Overwater Structures | InputShorel | ShorelStab | MDredging | BoatR, Jetty | Beach N | SAV Planting

Impact Determination from Maintenance Dredging

Enter **every maintenance dredging event** to determine debits. Add dredged events and enter the sum of these areas for a combined assessment.

Dredging in USZ			Habitat Loss	Notes
Dredged Area	Enter the square footage proposed to be dredged	0	0.00	50% more debits apply in areas with sand lance or surf smelt fish spawning
Dredging in LSZ			**Habitat Loss**	
Dredged Area	Enter the square footage proposed to be dredged	0	0.00	50% more debits apply in areas with herring spawning
Dredging in DZ			**Habitat Loss**	
Dredged Area	Enter the square footage proposed to be dredged	95,832	-48.87432	
Summary: habitat loss due to maintenance dredging			**-48.87**	

Summary | ProjectD | RZ | Overwater Structures | InputShorel | ShorelStab | MDredging | BoatR, Jetty | Beach N | SAV Planting | Ref.