MAINTENANCE DREDGING
COMBINED-PROJECTS BIOLOGICAL ASSESSMENT

Fiscal Year 2017 through 2042 Maintenance Dredging of Selected Federal Authorized Navigation Channels, with Disposal of Dredged Material at Designated Disposal Sites

December 2016

(Photo credit: Washington Department of Ecology)

US Army Corps
of Engineers®
Seattle District

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EXECUTIVE SUMMARY

This document is a combined-projects biological assessment (BA) that evaluates the effects of the U.S. Army Corps of Engineers Seattle District's (USACE) maintenance dredging program and beneficial-use disposal of dredged material from USACE maintenance dredging and disposal activities on Endangered Species Act (ESA) listed species and their designated and proposed critical habitat. This BA will initiate Section 7 consultation with the National Marine Fisheries Service (NMFS) and the U.S. Fish and Wildlife Service (USFWS) (hereafter referred to as "the Services"). The maintenance dredging program encompasses periodic removal of accumulated material from Federal authorized navigation channels. Disposal encompasses a variety of alternatives for placement of dredged material, including in authorized multi-user open-water disposal sites, such as Dredged Material Management Program (DMMP) managed sites. These sites include both non-dispersive (where dredged material remains in the disposal site) and dispersive (material is dispersed via currents). Disposal of dredged material derived from Federal navigation channel maintenance in multi-user aquatic sites is the subject of an independent BA and consultation, previously concluded. This BA describes the dredging techniques, maintenance dredging sites, placement at beneficial use disposal sites, baseline conditions, effects of maintenance dredging of navigation channels, effects of material placement at beneficial use disposal sites, and effects to ESA-listed species and designated or proposed critical habitat in authorized navigation channels and disposal sites. In addition, the BA evaluates effects of maintenance dredging and disposal on essential fish habitat (EFH) under Public Law 104-267 (the Sustainable Fisheries Act of 1996), which amended the Magnuson-Stevens Fisheries Conservation and Management and Act of 1976.

The majority of maintenance dredging in Western Washington is conducted with mechanical (clamshell) dredges. Other techniques are used under narrow circumstances; examples include the outer Grays Harbor reaches (hopper dredge) and the placement of material for beneficial use (hydraulic cutterhead).

Taking into consideration the effects of maintenance dredging, disposal, baseline conditions, and interrelated, interdependent, and cumulative effects, the USACE's effect determination for the maintenance dredging program and dredged material disposal for Federal navigation projects is "may affect, not likely to adversely affect" ESA-listed species and their designated or proposed critical habitat. There are potential adverse effects to EFH, but proposed conservation measures will minimize and mitigate those adverse effects.

The USACE intends for this consultation to cover a term of 25 years of Federal action.

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ACRONYMS AND ABBREVIATIONS

BA	Biological Assessment
C	Celsius
CFR	Code of Federal Regulations
cm	centimeter
cy	cubic yards
dB	decibel
DMMP	Dredged Material Management Program
DO	Dissolved Oxygen
DPS	Distinct Population Segment
Ecology	Washington State Department of Ecology
EPA	Environmental Protection Agency
EFH	Essential Fish Habitat
ESA	Endangered Species Act
ESU	Evolutionarily Significant Unit
F	Fahrenheit
FR	Federal Register
Hz	Hertz
kHz	kilohertz
km	kilometer
m	meter
MHHW	Mean Higher High Water
MLLW	Mean Lower Low Water
µPA	micropascal
MSA	Magnuson-Stevens Fishery Conservation and Management Act
NMFS	National Marine Fisheries Service
NTU	Nephelometric Turbidity Unit
ODFW	Oregon Department of Fish and Wildlife
PBDE	Polychlorinated Diphenyl Ethers
PBT	Persistent Bioaccumulative Toxin
PCB	Polychlorinated Biphenyl
PCDD/F	Polychlorinated 2,3,7,8 substituted Dioxins and Furans
PCE	Primary Constituent Element
PSDDA	Puget Sound Dredged Disposal Analysis
RM	River Mile
Services	National Marine Fisheries Service and U.S. Fish and Wildlife Service
TSS	Total Suspended Solids
USACE	U.S. Army Corps of Engineers
USCG	U.S. Coast Guard
USFWS	U.S. Fish and Wildlife Service
WDFW	Washington Department of Fish and Wildlife

1 INTRODUCTION

In accordance with Section 7(a)(2) of the Endangered Species Act (ESA) of 1973, as amended, and Section 305 of the Magnuson-Stevens Fishery Conservation and Management Act (MSA) of 1976, as amended in 1996 with the Sustainable Fisheries Act and reauthorization in 2006, this Combined-Projects Biological Assessment (BA) examines the effects of conducting maintenance dredging of congressionally authorized Federal navigation channels and associated disposal of dredged material in designated placement sites by the U.S. Army Corps of Engineers, Seattle District (USACE). Maintenance dredging and disposal will to continue throughout the 25-year period examined by this Combined-Projects BA. The BA focuses on the effects of maintenance dredging and disposal of dredged material on ESA-listed species, their designated and proposed critical habitat, and essential fish habitat (EFH) in the project areas. The purpose of this BA is to streamline the ESA Section 7 and the EFH consultation processes, reduce paperwork for the Federal agencies involved, and consequently reduce the amount of time necessary to complete environmental coordination for individual dredging projects.

1.1 Scope of Consultation

The scope of this Section 7 consultation encompasses periodically recurring maintenance dredging of sediments from eight Federal navigation channels in Western Washington, as described in section 4 of this BA. The scope also encompasses the associated placement of dredged material for beneficial use purposes, derived from the eight maintenance-dredging projects, into sites described in section 5 of this BA. Excluded from the scope of this BA is disposal of dredged material from Federal navigation channel projects in multi-user unconfined aquatic sites, which is the subject of an independent consultation. Other items that are not included in this consultation, but that generally involve the navigation features at the Federal projects, are actions such as jetty or breakwater repair, land-based sediment excavation, or other structural maintenance.

1.2 Navigation Program Mission

The USACE Navigation Program's mission is to provide safe, reliable, efficient, cost-effective, and environmentally sustainable waterborne transportation systems for movement of commerce, national security needs, and recreation in federally authorized navigation projects. The objective of the USACE's maintenance dredging program is to maintain authorized navigation channels to facilitate safe vessel access to port facilities. To accomplish this task, the USACE periodically removes sediment from various navigation projects (channels) throughout Western Washington.

Material to be dredged is tested according to Dredged Material Management Program (DMMP) protocols and is typically deposited in designated disposal sites located in reasonable proximity to maintenance dredging project sites. Dredged material is disposed of not only in dispersive and non-dispersive open-water sites, but also is placed for a variety of beneficial use purposes in designated locations in or adjacent to the marine environment.

1.3 Program Jurisdiction and Responsibilities

The USACE is authorized to maintain over 40 Federal navigation projects in Western Washington. The USACE navigation program conducts maintenance dredging at projects in the Puget Sound

basin, the Quillayute River, and Grays Harbor. Eight of these navigation channel projects undergo maintenance on a routine schedule and fall within the scope of this BA (Figure 1). The navigation channels vary widely in their characteristics such as length, depth maintained, quantities dredged, and intervals for dredging. Navigation channel lengths range from several hundred yards to over 23 miles with depths ranging from 8 feet below (-8) mean lower low water (MLLW) to -46 feet MLLW. The amount of material removed during a maintenance dredge event ranges from thousands of cubic yards (cy) to up to three million cy per maintenance dredging event. The interval between maintenance dredging events ranges from annual to over 10 years.

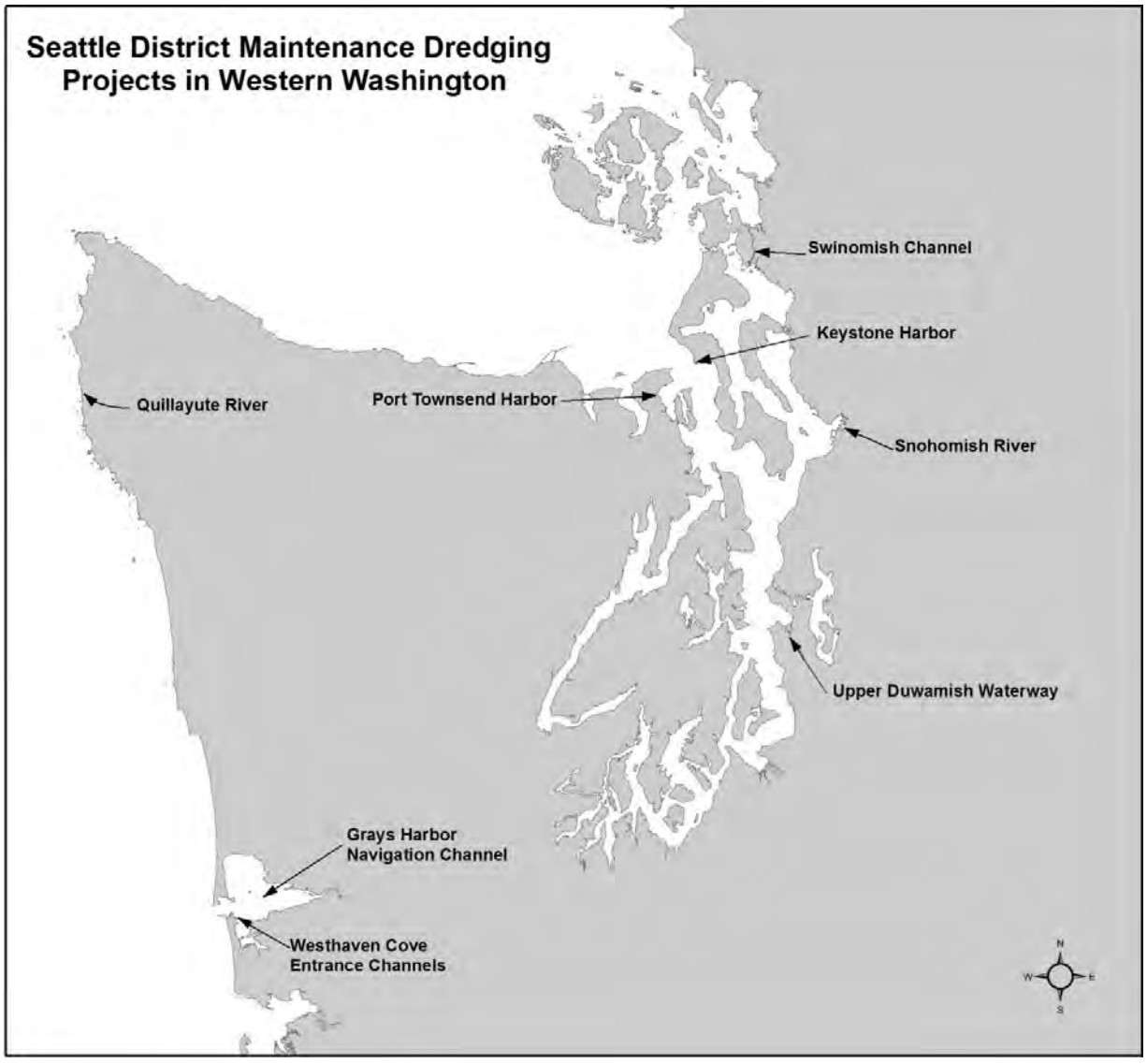

Figure 1. Navigation channels in Washington State with authorized USACE maintenance dredging within the scope of this BA.

The USACE Navigation Section exercises the authority to maintain the authorized dimensions of each legislatively authorized navigation channel in Western Washington. The frequency and amount of material removed is dependent on prioritization considerations that can include

sedimentation rates and funding. The USACE itself does not conduct most of the maintenance dredging with its own facilities, but contracts with commercial dredging companies to perform the work. The USACE determines the amount and location of the material to be dredged using hydroacoustic survey methods (typically sidescan sonar) and oversees the commercial dredge companies once dredge contracts are awarded. Prior to dredging, the material to be dredged is tested according to DMMP requirements and guidelines to determine its suitability for unconfined aquatic disposal in the marine environment. Any removal of unsuitable dredged material and its subsequent disposal that triggers Section 7 obligations would be subject to separate consultation and therefore does not fall within the scope of this BA. This BA addresses only the dredging and disposal of material derived from Federal navigation projects deemed suitable for aquatic disposal under the DMMP's protocols and standards.

1.4 Purpose and Analytical Approach of the Combined-Projects Biological Assessment

The purpose of combining the eight maintenance dredging projects described in this BA is to streamline the ESA Section 7 and EFH consultation processes by grouping similar actions, methods, species, and impacts to reduce the work of the action agency as well as the work for the National Marine Fisheries Service (NMFS) and the U.S. Fish and Wildlife Service (USFWS; collectively, the Services). Paperwork reduction is another benefit achieved by combining the projects and the environmental impacts analyses.

Each maintenance dredging and disposal site is described individually, but the effects of maintenance dredging and disposal on ESA-listed species and their designated or proposed critical habitat, which are similar in nature regardless of the site, are evaluated collectively for all maintenance dredging and disposal activities that are within the scope of this BA. Disposal at multi-user aquatic sites is the subject of independent consultation.

1.5 Action Area

The "action area" relevant to ESA Section 7 consultations is defined as "all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action" (50 CFR 504.02). Each navigation project in this document has been analyzed for the area of effects. Effects analyzed are primarily the extent of sediment, turbidity, noise, and disturbance due to the presence of machinery and disposal operations. Action areas are described for each project in Chapter 4.

1.6 Endangered Species and their Designated Critical Habitat Found in Western Washington Navigation Channels and Disposal Sites

There are 25 ESA-listed species and their designated or proposed critical habitat occurring in areas where maintenance dredging and disposal are conducted or in nearby areas of Western Washington (Table 1). Species life histories and status of each listed species appear in Appendix A. Most of the whales and sea turtle species listed in Table 1 typically occur only along the Washington coast offshore of the maintenance dredging projects and are not found in coastal embayments, Puget Sound, the Strait of Juan de Fuca, or the San Juan Islands. They are included because on rare occasions they can occur near the outer extreme extension of the Grays Harbor

and Chehalis River Navigation Channel, or enter coastal embayments. The major exception to this is the Southern Resident killer whale, which occurs in Puget Sound and on occasion in the coastal estuaries, and thus may traverse maintenance dredging and disposal sites.

Table 1. Endangered Species Act listed species and designated or proposed critical habitat found in the action area of the maintenance dredging and beneficial use disposal sites.

Common Name	Scientific Name	Designated Critical Habitat
Coastal/Puget Sound Bull Trout	*Salvelinus confluentus*	Yes
Lower Columbia River Chinook salmon	*Oncorhynchus tshawytscha*	Yes*
Upper Willamette River Chinook salmon	*Oncorhynchus tshawytscha*	Yes*
Puget Sound steelhead	*Oncorhynchus mykiss*	Yes
Puget Sound Chinook salmon	*Oncorhynchus tshawytscha*	Yes
Columbia River chum salmon	*Oncorhynchus keta*	Yes*
Hood Canal summer-run chum salmon	*Oncorhynchus keta*	Yes
Bocaccio rockfish	*Sebastes paucispinis*	Yes
Yelloweye rockfish	*Sebastes ruberrimus*	Yes
Canary rockfish	*Sebastes pinniger*	Yes
Southern DPS Pacific Eulachon	*Thaleichthys pacificus*	Yes
Southern DPS North American Green Sturgeon	*Acipenser medirostris*	Yes
Western Snowy Plover	*Charadrius alexandrius nivosus*	Yes
Marbled Murrelet	*Brachyramphus marmoratus*	Yes*
Streaked horned lark	*Eremophila alpestris strigata*	Yes
Southern Resident Killer Whale	*Orcinus orca*	Yes
Humpback Whale	*Megaptera novaeangliae*	No
Blue Whale	*Balaenoptera musculus*	No
Fin Whale	*Balaenoptera physalus*	No
Sei Whale	*Balaenoptera borealis*	No
Sperm Whale	*Physeter macrocephalus*	No
Leatherback Sea Turtle	*Dermochelys coriacea*	Yes
Loggerhead Sea Turtle	*Caretta caretta*	No
Green Sea Turtle	*Chelonia mydas*	Yes*
Olive Ridley Sea Turtle	*Lepidochelys olivacea*	No

* Critical habitat is designated for this species, but does not occur in the action area of this BA.

2 MAINTENANCE DREDGING PROGRAM OVERVIEW

The USACE's Seattle District Navigation Section is responsible for conducting the channel-maintenance mission for the USACE. The following sections give a brief description of the maintenance-dredging program. For a complete description of the maintenance-dredging program, please see Appendix B.

The USACE's navigation mission is to provide safe, reliable, efficient, cost-effective, and environmentally sustainable waterborne transportation systems for movement of commerce, national security needs, and recreation in federally authorized navigation projects. The Navigation Section maintains channels and other structural features for safe navigation. Maintaining navigation channels requires maintaining serviceable and reliable depths and widths by dredging and other means (such as channel re-alignment). The maintenance-dredging program conducts preliminary activities such as hydrographic surveys and testing of material to be dredged. The dredging, disposal sites, and their associated pre- and post-dredging activities are essential parts of the dredging program. In addition to dredging, maintenance work includes removing navigation hazards and underwater obstructions incidental to scheduled maintenance dredging, using dredged material for beneficial uses (e.g. beach nourishment, shoreline stabilization, erosion protection, containment of contaminated substrate, creation of shallow water habitat, placing material in longshore drift cells, etc.), and conducting hydrographic surveys of navigation channels (these data are used by the navigation community and public).

2.1 Program Goals

The intent of the program is to maintain federally authorized navigation channels to meet the following goals:

- There are no delays in commercial navigation due to channel maintenance in USACE-maintained harbors, rivers, and inland waterways if full project funding is appropriated.
- There are reliably no significant draft restrictions if full project funding is appropriated.
- There is increased competition among contractors to achieve a fair and reasonable price for dredging contracts.
- To improve and maintain the waterways' suitability for navigation and other purposes, the USACE shall dredge in an efficient, cost-effective, and environmentally acceptable manner consistent with Federal laws and regulations.
- The USACE shall, after taking into consideration economics, engineering, and environmental requirements in accordance with applicable Federal laws and regulations (33 CFR Parts 335-338), seek the maximum practicable beneficial uses of materials dredged from authorized Federal navigation projects in accordance with Federal laws.
- In accordance with 33 USC §628, dredging shoreward of harbor lines shall not use funds appropriated for navigation projects.

2.2 Hydrographic Evaluation

Hydrographic surveys conducted prior to dredging determine the amount of material, if any, that needs to be dredged to ensure continuing vessel operation in authorized navigation channels. The USACE uses several small vessels specifically equipped with hydroacoustic technology for surveying navigation channels. For consistency, the hydrographic surveys strictly adhere to the procedures, policies and guidelines established in accordance with the USACE's Engineering Manual 1110-2-1003, Hydrographic Surveying and Engineering Procedure 1130-2-520, Navigation and Dredging Operations and Maintenance Guidance and Procedures. Strict procedures and activities include the following:

- Surveying active waterways and harbor projects at a frequency sufficient to maintain adequate information on project dimensions.
- Performing pre-dredge and post-dredge surveys to ensure the work is performed in accordance with the contract plans and specifications. Pre-dredging surveys are conducted as close to the start of dredging as possible, typically within two weeks prior to commencement of maintenance dredging in the reach to be dredged. After the contractor indicates the work is complete, the USACE conducts acceptance surveys as soon as possible, usually within five days after completion of maintenance dredging.

2.3 Evaluation of Maintenance Dredged Material

All material that the USACE dredges undergoes evaluation for suitability for open-water disposal prior to dredging. The suitability determination process is conducted so as to cover a prescribed period encompassing several dredging episodes, to evaluate the characteristics of the dredged material that will be discharged into waters of the United States, and the sediment surface that will be left exposed to marine waters once maintenance dredging is complete. The DMMP agencies document the outcome of the dredged material evaluation process in a suitability determination for each proposed disposal episode. The suitability determination is a memorandum for record that provides the DMMP agencies' consensus evaluation of all chemical and biological testing data relative to the suitability/unsuitability of dredged material for open-water disposal (See Appendix D for a description of the sampling approach to determine the substances and level of testing for each site). The suitability determination is signed by all four DMMP agencies. All suitability determinations are subsequently posted on the USACE's Dredged Material Management Office website.

Through the suitability determination process, the DMMP agencies assess whether sediments to be dredged have potential to adversely affect biological resources. Based on this analysis, if materials are determined to have potential to adversely affect biological resources, the material is considered unsuitable for open-water disposal and must be disposed of by other means (e.g., disposal at licensed landfills).

Most of the eight dredging projects in this BA include one or more disposal alternatives in which all or part of the dredging material is placed at unconfined aquatic sites; this open-water disposal is addressed in an independent BA. Many of the eight projects also involve beneficial use disposal alternatives in which dredged sediments are placed in upland or nearshore sites and the water

contained in the dredged material is decanted and returns to marine waters. The term "nearshore zone" refers to elevations along the shoreline that are supratidal (i.e. the splash zone above Mean Higher High Water [MHHW]) and inundated only in extreme tides, intertidal as in wet and dry once per day, and subtidal (below MLLW to a depth of approximately 30 meters). Any material designated for removal that is not suitable for open-water disposal is subject to separate Section 7 consultation. Sediment testing typically occurs every six years in any given location, but intervals may vary based on historical findings (i.e. areas previously found to have unsuitable material will undergo testing prior to each dredge event).

3 PROPOSED ACTION: DREDGING METHODS

Three different dredge types (technologies) accomplish the majority of maintenance dredging in the Federal navigation channels in Western Washington: (1) mechanical (also known as a clamshell) dredge, (2) hydraulic pipeline dredge, and (3) hopper dredge. One additional dredge technique occasionally used is an excavator or backhoe operated from a barge for breaking up consolidated material for removal by a clamshell dredge, or direct removal by the excavator onto a barge. The dredge type selected for use is generally the best suited and most economical for the specific requirements of each navigation project.

3.1 Mechanical Dredge

One method of mechanical dredging is the bucket, or clamshell dredge. The mechanical dredge uses a bucket attached to cables deployed by a barge-mounted crane (dredge barge). The crane can execute other tasks such as loading and offloading operations. The dredge bucket has two jaws hinged in such a fashion that the bucket is open while descending through the water column (Figure 2). The bucket hangs beneath the crane boom by a winch cable allowing the bucket to be raised or lowered. The dredger suspends the bucket over the dredge position and lowers it to the substrate. Because the bucket is only suspended by a cable, gravity is the only downward force exerted on the bucket. The dredger cannot force the bucket into the substrate. The “controlled lowering” of the bucket reduces turbulence and the amount of suspended sediment generated. The bucket is sufficiently heavy to cause the bucket to sink into the substrate or weights can be added to the bucket if needed. After the bucket penetrates the substrate, the bucket is closed, taking a “bite” out of the substrate. Once closed, the top portion of the bucket remains open as the bucket is retrieved. With the top and/or bottom of the bucket open, the probability of catching and retaining mobile organisms is minimal. The dredger retrieves the bucket and swings it over to a transport barge where the sediment is placed for transport to a disposal site.

The dredge barge is equipped with vertical steel pipes, called spuds. The spuds are driven into the substrate, anchoring the dredge barge in one location. To move the dredge barge, the spuds are retrieved and a tug moves the dredge barge to a new location. The spuds are driven into the substrate and dredging continues. Dredge barges are not self-propelled, but some dredge barges can move short distances by setting the dredge bucket into the substrate, retrieving the one or more spuds, then pulling on the dredge bucket cable. Longer distance movements require tug assist. Once repositioned, the spuds are lowered in the new location. During active dredging, the transport barge is tied to the dredge barge. When the transport barge is full, a tug takes it to the disposal site where the sediment is released or to an offload site for transloading to an upland facility. For open-water disposal, the transport barge releases its load by opening the bottom along the long dimension of the barge (split hull barge) or opening bottom hatches (bottom dump barge). In both cases, the material is released below the surface of the water.

Another type of mechanical dredge uses a barge-mounted excavator. Excavators are heavy construction equipment consisting of a boom, dipper (or stick), bucket and cab on a rotating platform known as the "house." The house sits atop an undercarriage with tracks or wheels. The excavator “reaches” down to the substrate, where the bucket provides the digging force needed

to remove the sediment. Similar to the clamshell dredge, the barge utilizes spuds, and occasionally anchors, for positioning. Dredged material is placed in a transport barge.

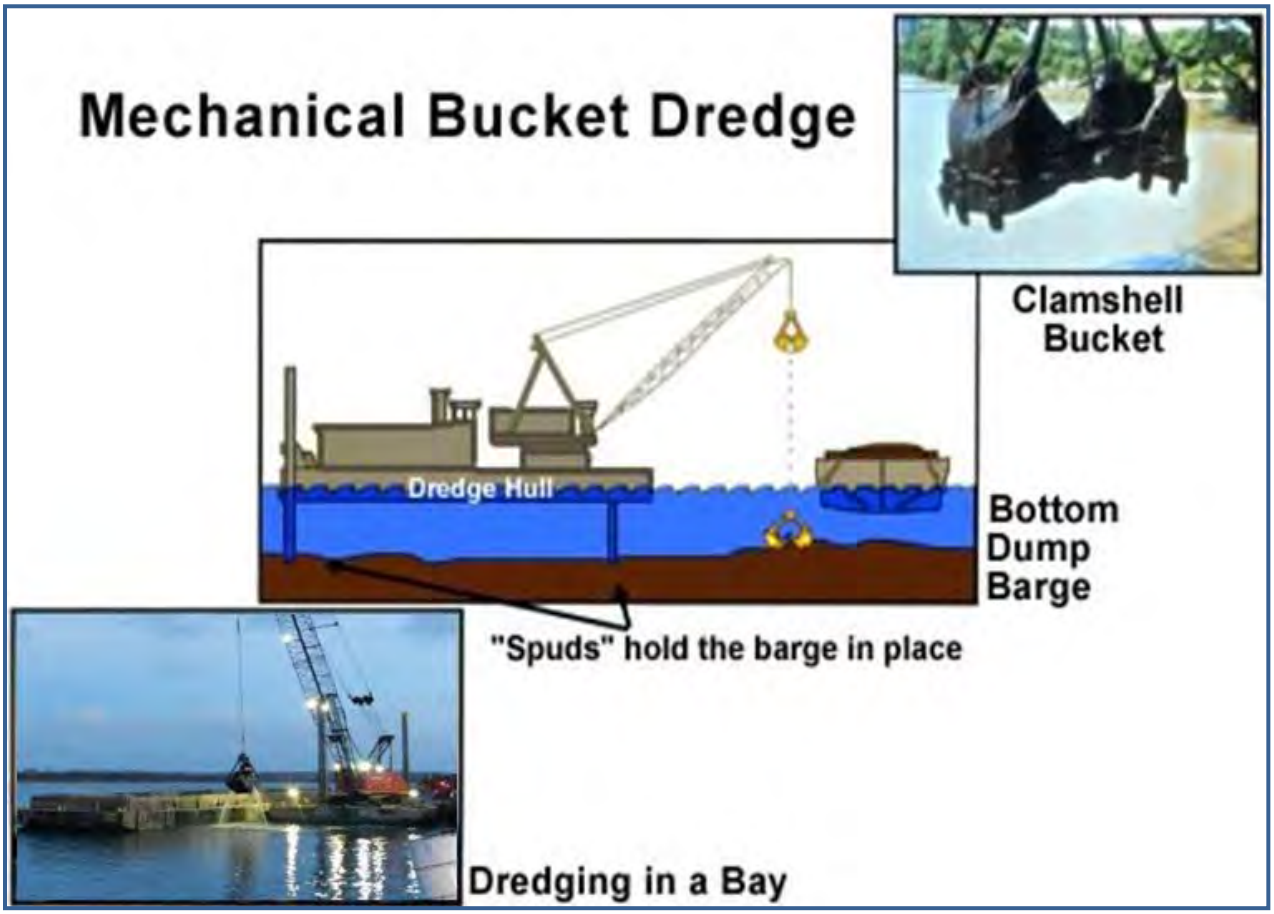

Figure 2. Rendering of a mechanical dredge barge and bottom dump barge, with photographs of a mechanical (clamshell) dredge bucket and an operating mechanical dredge barge.

Transport barges have seals on the operable surfaces to minimize sediment loss during transport. The USACE does not allow dredge contractors to fill transport barges to the point where dredged material and water are spilling over the sides of the transport barge or allow excessive loss through faulty seals. Thus, the dredge contractor has an incentive to maintain the seals on operable surfaces for two reasons: (1) to minimize the amount of water that enters the transport barge before dredged material is put into the barge; and (2) minimize loss of sediment to the water during transport via faulty seals. Transporting water back and forth between the dredge site and the disposal site adds to the number of transport round trips and thus increases the cost of the operation.

To summarize, a mechanical dredge operation includes a barge with crane and clamshell bucket, or a barge mounted excavator, at least one tugboat, and at least one sediment transport barge.

3.2 Hydraulic Pipeline Dredge

A hydraulic pipeline dredge (Figure 3) consists of a suction pipe, typically outfitted with some kind of sediment cutting implement or agitator (Figure 4) at the intake end of the pipe attached to an "A" frame that supports the intake pipe (the industry terms the "A" frame as a ladder). The cutter or agitator and intake pipe are lowered to, and in some cases, into the substrate; thus the ladder length and the pumping (lifting) capability determine the depth a hydraulic pipeline dredge can reach. The size of a hydraulic dredge is determined by the inside diameter of the outlet pipe of the dredge. Hydraulic dredges come in sizes from 8-inch to 36-inch. A 12-inch dredge might have a 36-inch to 48-inch diameter cutterhead.

The hydraulic dredge uses sediment cutting or agitation mechanisms at the suction inlet. The three main types are cutterhead, hydraulic water jets, and auger head. These mechanisms loosen bed material and transport it to the suction mouth. The dredged material is sucked up through a wear-resistant centrifugal pump and discharged either through a pipeline or to a barge. The machinery that powers the hydraulic pipeline dredge is located in the support barge (Figure 3).

The cutter suction dredger is equipped with a rotating, conical (basket) type cutter device (cutterhead) with several teeth that cut through the sediment before it is sucked up by the flow of the dredge pump. The cutterhead is generally three to four times the diameter of the intake to the pipeline. As the cutterhead rotates and cuts into the substrate, the dredged material is forced toward the intake pipe. Cutterhead dredges work best with hard and consolidated material such as hard clay, hard silt, and sand and gravels.

Auger dredges function like a cutter suction dredger, but the cutting tool is a rotating Archimedean screw set at right angles to the suction pipe. The turbidity shroud on auger dredge systems creates a strong suction vacuum, causing much less turbidity than conical (basket) type cutterheads. However, the auger dredge does not cut through hard sediment such as clay, consolidated sands and gravels and rock.

Hydraulic water jets use concentrated high-speed streams of water to pull the nearby water and bed material into the intake pipe. These dredges work best on loose, unconsolidated sediment.

Dredge material is pumped through the pump and out the discharge pipe to the disposal location. The distance the material can be pumped is determined by the sediment type and number of intermediate pumps in the outlet pipeline. Distances of several miles can be achieved and the material can be pumped to an upland location. Sediment alone cannot be forced through the pipeline. To function properly, the hydraulic pipeline dredge must take in a slurry of water and sediment. The slurry can be pumped about a mile without additional pumps, but pumps are needed at intervals of about 1 mile to move the slurry greater distances.

Hydraulic dredges can deposit dredged material upland or in the nearshore zone and therefore can place dredged material without re-handling the material from a transport barge used in mechanical dredging operations. If material is placed upland, the slurry is decanted into a settling basin where the solid fraction is allowed to settle out before the water fraction returns to local receiving waters (this minimizes the amount of turbidity in the receiving waters).

The dredge barge is not self-propelled but can move short distances using anchors and spuds. Depending on the size of the dredge barge, transportation to a dredge site is by truck or tug. A small tender vessel sets the anchors. A spud at the opposite end of the support barge from the intake pipe is set and the anchor winches retrieve the anchor lines in such a way that the cutterhead is swept across the area to be dredged by pivoting on the set spud. At the end of the sweep, another spud is set, the first spud is retrieved, and the anchor line process is repeated, sweeping the cutterhead across the work area in the opposite direction. In this fashion, the dredge moves forward. A tender vessel redeploys the anchors as needed, again facilitating forward movement of the support dredge. A variation on this theme is a barge with a “walking” spud. In this case, a spud is located in a slot along the centerline of the barge at the end opposite the cutterhead. To move the barge forward or backward, the spud serves as a stationary point and the barge pushes or pulls against the spud. The anchors and anchor lines are still necessary to pivot the support barge during maintenance dredging.

Figure 3. Photograph of a small hydraulic dredge and its barge with the machinery that powers the hydraulic dredge. The cutterhead is the red object at left.

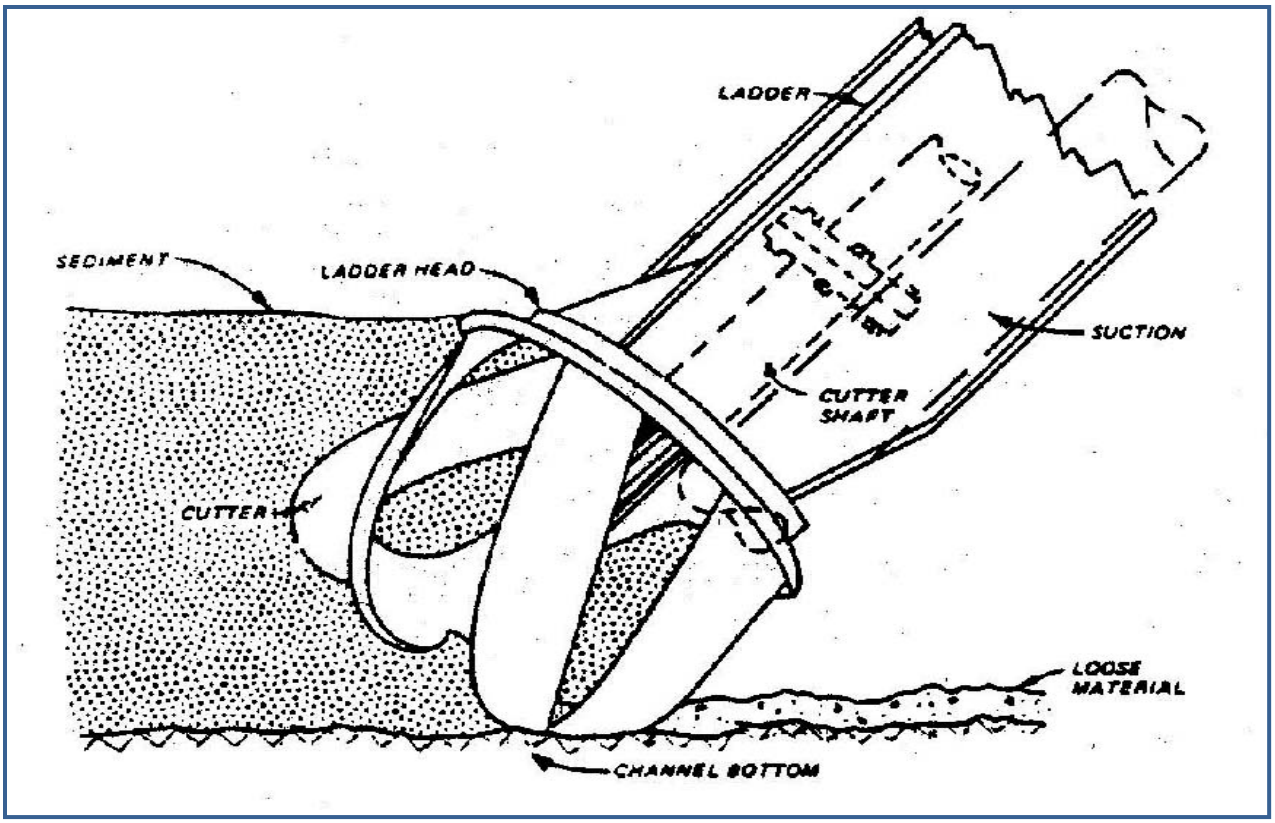

Figure 4. Drawing of a cutterhead in operation including the major components.

The discharge pipeline carrying the dredged material can float with the assistance of attached flotation or sit on the bottom. Bottom deployment can keep the pipeline from being hit by passing vessels.

At an upland outlet of the pipeline, one or more settling ponds are constructed to capture the sediment and minimize the amount of suspended sediment that gets into the adjacent aquatic environment. Settling ponds are typically constructed from native material where the dredged material, usually sand, will be deposited by using a bulldozer or excavator to push up perimeter berms. The water fraction in the slurry filters through the berms surrounding the settling basin, often equipped with engineered weirs, and flows into the adjacent water body. In situations where environmental risk is low, the dredger may do direct placement in the nearshore zone.

To summarize, a hydraulic pipeline dredge operation includes a support barge with an “A” frame (ladder), a tender vessel, and a tugboat to move the support barge into position. Dredged material transports continuously to a specified site located up to several miles from the dredging operation.

3.3 Hopper Dredge

Hopper dredging in the Seattle District is typically with USACE-owned and operated hopper dredges. Occasionally, the USACE contracts with a private hopper dredge operator. A hopper dredge is a self-propelled ocean-going vessel designed and constructed with powerful vacuum pumps that apply suction force to sediment (Figure 5). The intakes to the vacuum system, called drag arms, descend from each side of the ship. The ship travels in a specific direction and vacuums material to a specific depth. The drag arm heads lift a specific thickness of material depending on type of material, the water depth, and power of the vacuum system. Once material is collected, it is deposited in the hopper, a series of large tanks located in the central portion of the ship. When the hopper is full, the ship lifts the drag arms and proceeds to a disposal site. Subsurface doors in the bottom of the ship split a portion of the vessel hull open and deposit the material in the disposal location. Some hopper dredges have the auxiliary equipment to pump dredged material from the hopper via a pipeline, to a nearshore and/or upland destination. However, none of the USACE's hopper dredges stationed on the U.S. West Coast has this capability. A hopper dredge is used in situations where the sea state requires a large vessel and/or the capability to operate in the ocean. Hopper dredges typically are deep draft and cannot operate in shallow waters, unlike hydraulic pipeline or mechanical dredges.

A hopper dredge has characteristics that make it desirable under certain conditions: (1) the intake is located on the substrate and acts like a vacuum, resulting in little or no suspended sediment at the intake; and (2) the vessels are large and can operate in sea states far heavier than a clamshell barge or hydraulic pipeline dredge. In the Seattle District, hopper dredges are used only in outer Grays Harbor where the sea state mandates a vessel with ocean going capabilities.

A hopper dredge has sufficient vacuum power to pick up debris such as bottles, garbage, etc. Much of this debris is mechanically sorted from the incoming stream and not returned to the aquatic environment.

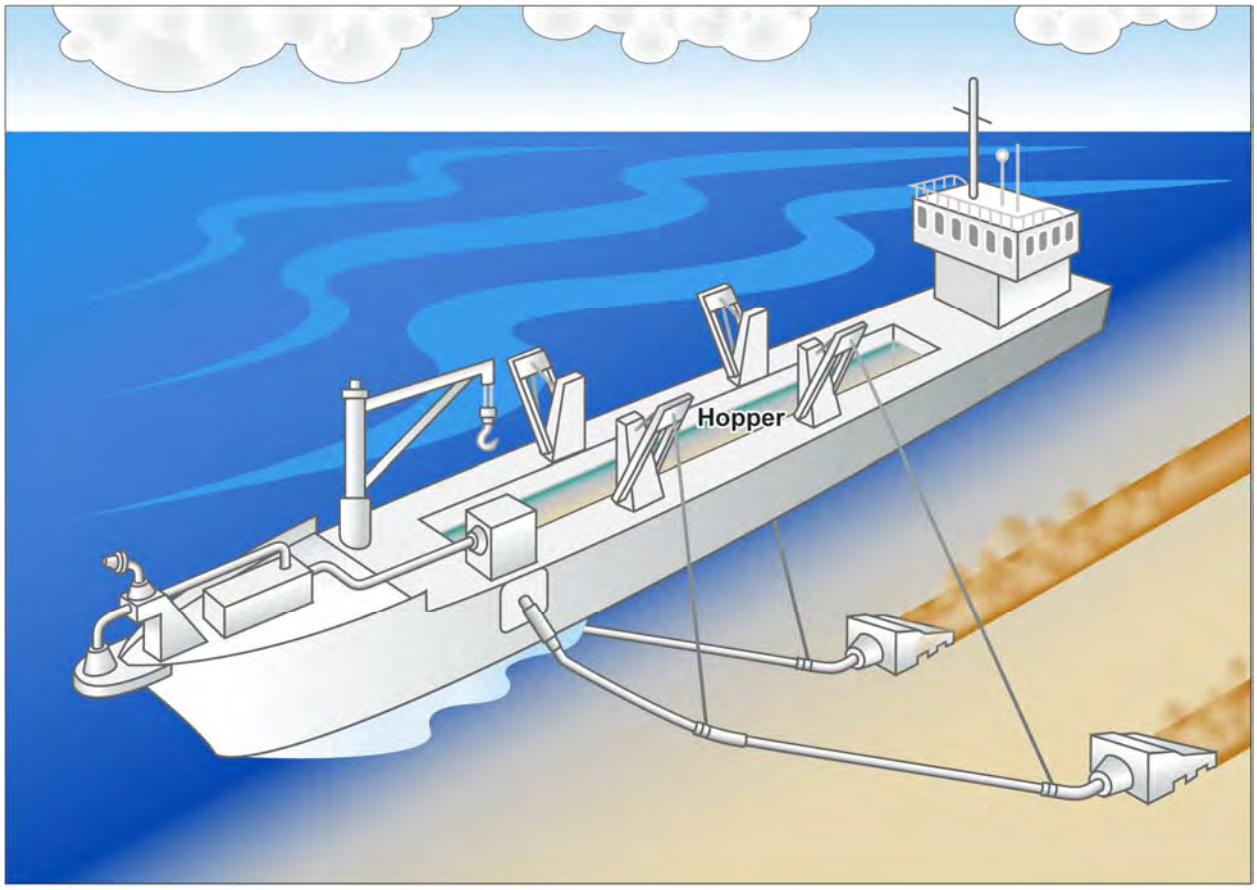

Figure 5. Diagrammatic picture of a hopper dredge with drag arms deployed. Note: the hopper dredges used in Western Washington are large vessels several hundred feet long.

To summarize, a hopper dredge is a large, self-propelled, ocean-going vessel that acts as an enormous vacuum that lifts sediment from the substrate via drag arms and disposes of the material in designated in-water disposal locations.

4 PROPOSED ACTION: MAINTENANCE DREDGING SITES

The sections below describe each of the eight maintenance-dredging projects and disposal site(s) used, volumes dredged, consultation history, maintenance dredging history, and project area for assessment of environmental effects.

To assess effects of maintenance dredging on the pelagic species, the spatial and temporal scales of analysis are adjusted according to the specific life histories, home ranges, and habitat needs of each species under analysis.

To assess effects of maintenance dredging on the benthic community, the area of each navigation channel was compared to the surrounding area using a 1-mile radius. Navigation channel depths for the included projects do not exceed -50 feet MLLW in maintained depth. The assessment area in each case was defined by the upper intertidal (upper limit) out to -50 feet MLLW and laterally to nearby headlands or 1 mile distant. The rationale for this spatial scale is based on evidence that the infauna and epifauna are generally similar throughout the defined depth range in Western Washington, and the larval life history stages of infauna and epifauna move with currents and can arrive in a navigation channel by water currents, migration, and/or settlement of planktonic larvae. Although the actual distance that larvae can be transported could be greater than 1 mile, the USACE chose 1 mile as a reasonable estimate. Re-colonization of dredged areas by infauna and epifauna has been shown to be complete within six months (Desprez 2000). The larger members of the demersal (epibenthic) community are highly mobile and will move into newly dredged areas within hours to days (R. Burkle, pers. comm., 2013).

Maintenance dredging sites that are the subject of this BA are all located within authorized Federal navigation channels. Table 2 lists the authorized maintenance dredging sites addressed in this BA. Each of these channels has an authorized depth associated with its specific project authorization. Since there is inherent imprecision in a typical maintenance dredging process, the USACE may dredge, or authorize its contractor to dredge, up to two feet of allowable overdepth beyond the authorized depth in coastal regions (ER-1130-2-520). Additionally, a USACE District office may request approval from their Division office for up to two feet of advance maintenance dredging for a given project. Advance maintenance is dredging to a specified depth and/or width beyond the authorized channel dimensions, typically occurs in critical and fast-shoaling areas, and may occur during each dredge cycle. Advance maintenance allows the USACE to avoid frequent re-dredging, and ensures the reliability and least overall cost of maintaining projects to meet authorized and implemented dimensions. Table 3 lists the beneficial use disposal sites, which are covered in detail in Chapter 5. Transportation to, and placement at, multi-user open-water disposal sites are covered by a separate consultation.

Table 2. Authorized maintenance dredging sites in Western Washington and associated water bodies falling within the scope of this BA.

Federal Navigation Channel Maintenance Dredge Site	Water Body or Basin
Swinomish Navigation Channel	Puget Sound
Keystone Harbor	Puget Sound
Snohomish River Navigation Channel	Puget Sound
Upper Duwamish Waterway	Puget Sound
Port Townsend Navigation Channel	Puget Sound
Quillayute River Navigation Channel	Pacific Coast
Grays Harbor Navigation Channel	Grays Harbor
Westhaven Cove Entrance Channels	Grays Harbor

Table 3. Beneficial use disposal sites falling within the scope of this BA, including site type and associated water bodies.

Disposal Site	Site Type	Water Body	Associated Federal Navigation Channel
Jetty Island	Upland and nearshore zone	Puget Sound	Snohomish River
Site "O"	Upland	Puget Sound	Snohomish River
Riverside	Upland	Puget Sound	Snohomish River
Keystone Beach	Upland and nearshore zone	Puget Sound/Admiralty Bay	Keystone Harbor
Site A	Upland	Pacific Ocean nearshore	Quillayute River
Site B	Upland and nearshore zone	Pacific Ocean nearshore	Quillayute River
First Beach	Upland and nearshore zone	Pacific Ocean nearshore	Quillayute River
Half Moon Bay	Nearshore zone	Grays Harbor	Grays Harbor and Chehalis River
South Beach	Nearshore zone	Pacific Ocean adjacent to Grays Harbor	Grays Harbor and Chehalis River
Point Chehalis Revetment Extension Mitigation Site	Upland	Grays Harbor	Grays Harbor and Chehalis River

4.1 Swinomish Federal Navigation Channel

4.1.1 PROJECT NAME

Swinomish Federal Navigation Channel

4.1.2 AUTHORIZATION

The Swinomish Channel project and maintenance dredging by the Army Corps of Engineers were authorized by the River and Harbor Act of 13 July 1892 (House Document 31, 52nd Congress, 1st Session), as amended by the River and Harbor Improvement Act of 30 August 1935 (74th Congress, 1st Session, Ch. 831).

4.1.3 LOCATION

The Swinomish Channel is located on the western side of the Skagit River Delta in Skagit County, Washington and forms the eastern border of the Swinomish Indian Reservation and Island County. The channel connects Padilla Bay and Skagit Bay. State Highway 20 crosses the channel at the north end (Figure 6).

4.1.4 PROJECT DESCRIPTION

Project Area and Action Area

The Swinomish Channel is an 11-mile long human-made canal that connects Saratoga Passage in Skagit Bay to Padilla Bay in northern Puget Sound. This channel separates Fidalgo Island from mainland Skagit County. Shoaling material in the Swinomish Channel originates in the Skagit River and Padilla Bay filling the south and north ends, respectively. Before dredging, the area was primarily shallow tidal sloughs, salt marshes, and mudflats known as Swinomish Slough. Today, fishing boats, tug boats, recreational craft, and shallow-draft freight vessels heavily use the Channel. In some areas, the channel is closer to shore and with banks reinforced with riprap and bulkheads for erosion protection. The saltwater channel is surrounded by areas of farmland, small communities, and the town of La Conner. Marinas and associated boat repair operations are based in La Conner. The affected action area is the entire length of the channel and a one-mile radius at each outlet of the channel. This distance is the maximum distance for underwater sound attenuation of dredging equipment, and potential effects of sediment in a transit area for listed salmon and rockfish. Intertidal areas found near the shore of Padilla Bay and northern Skagit Bay consist of marshlands, sandflats, and mudflats, and contain a diverse assemblage of infaunal and epibenthic organisms.

Purpose

The Swinomish Channel provides a sheltered route for vessels transiting from central Puget Sound to Anacortes, Bellingham, and other locations north and east of Guemes Channel. In addition to its commercial value, the channel provides safe passage between Puget Sound and the San Juan Islands for fishing vessels and pleasure boaters who wish to avoid heavy seas that prevail, at times, in the waters west of Whidbey Island. When shoaling creates shallow areas within the channel, it presents a safety hazard to deep draft vessels, or deep draft vessels must wait for high tide to transit. Pleasure craft moored in Shelter Bay and the marinas in La Conner, depending on vessel draft, may only be able to leave and return during high tides. The purpose

of dredging this channel is to maintain the safe access for vessels to transit between Skagit and Padilla Bays and points along the channel.

Navigation Features

The navigation channel is 11 miles long, 100-125 feet wide, and -12 feet MLLW. Two feet of allowable overdepth may occur during dredging; routine maintenance dredging may include an additional two feet of advance maintenance. The authorized navigation channel dimensions allow safe navigation during all tide levels. A jetty and dike system was constructed and improved between 1897 and 1973 to reduce siltation of the channel from the Skagit River delta and to protect the southern entrance from high waves.

4.1.5 DREDGE AND DISPOSAL METHODS, QUANTITIES, FREQUENCY, AND DURATION

Dredging removes sediments that accumulate along the length of the channel. Dredgers execute the work with a mechanical (clamshell) dredge and transport the material via barge for placement. Once arriving at the disposal site, a bottom-dump barge drops the material into its intended location.

The project consists of removing up to 230,000 cy of material dredged from station 0+00 to station 690+00 (Figure 7); however, typical volumes are around 90,000 cy depending on accumulation of sediments and funding available. The USACE has been dredging the Swinomish Channel every four to seven years. If the entire navigation channel were dredged at one time, over 230,000 cy of material would be removed to address an accumulation of up to seven years. Over the course of the project period, maintenance dredging is expected on four- to seven-year intervals with 10 to 30 percent of the channel dredged in any given year depending on funding and the amount of shoaling that has occurred. Dredging may take up to 150 days, depending on total quantity of material removed during each dredge event, mechanical breakdowns, and weather conditions. Quantities have been estimated conservatively for environmental impacts analysis and would include the amount dredged for two feet of advance maintenance in any dredging episode in which the need is executed.

4.1.6 DISPOSAL SITES

The maintenance dredging substrate is composed of clean sandy material and is ideal for capping contaminated bottom sediments, for habitat creation, and longshore drift system placement. Any proposed beneficial use of dredged material would be the subject of reinitiated supplemental consultation. Any dredged material not identified for a beneficial use will be placed at one of the DMMP open-water disposal sites, such as the Rosario Strait dispersive site and/or in the Port Gardner disposal site.

4.1.7 IN-WATER WORK WINDOW

The in-water work window in the Swinomish Channel is 16 July through 15 February. Other timing constraints include avoidance of tribal fisheries, which is coordinated each year prior to dredging. One example is a smelt fishery that can occur 15 November through 15 February.

4.1.8 CONSULTATION HISTORY

The maintenance dredging was originally covered under a consultation that was completed in 1999 (USFWS Reference #1-3-99-1- 1353). The consultation was revised in 2000 (USFWS Reference #1-3-00-IR-0150) and renewed in 2003 (FWS Reference #1-3-03-1-0772; NMFS #2002/01374). A memorandum was added in 2005 (USFWS Reference #1-3-06-I-0061; NMFS #2005/06920). Consultation was renewed again in 2008 for a 5-year period (USFWS Reference #13410-2008-I-0368; NMFS #2008/03628). The last consultations were informal and occurred with NMFS on 24 February 2012 (NMFS #2012/00354) and with the USFWS on 11 April 2012 (USFWS #13410-2008-I-0368-R001). The results of these consultations are that the Services concur with the USACE determination of "may affect, not likely to adversely affect" bull trout (*Salvelinus confluentus*) and its critical habitat, marbled murrelet (*Brachyramphus marmoratus*), Puget Sound Chinook salmon (*Oncorhynchus tshawytscha*) and its critical habitat, Puget Sound steelhead (*O. mykiss*), Southern Resident killer whale (*Orcinus orca*) and its critical habitat, and the eastern Distinct Population Segment (DPS) of Steller sea lions (*Eumetopias jubatus*).

The EFH consultations occurred concurrently with the ESA consultations; the conclusion is that ESA conservation measures are adequate to avoid, minimize, or otherwise offset potential adverse effects to the EFH of the species protected by the MSA.

4.1.9 ACTION CONSULTED UPON

The USACE is consulting on routine maintenance dredging of the Swinomish Channel prism as described above at an interval of as little as two years but typically approximately four to seven years. The volume may be up to 230,000 cy per year and removed via clamshell dredge with dredged material placed at one of the DMMP multi-user open-water disposal sites, such as the Rosario Strait dispersive site.

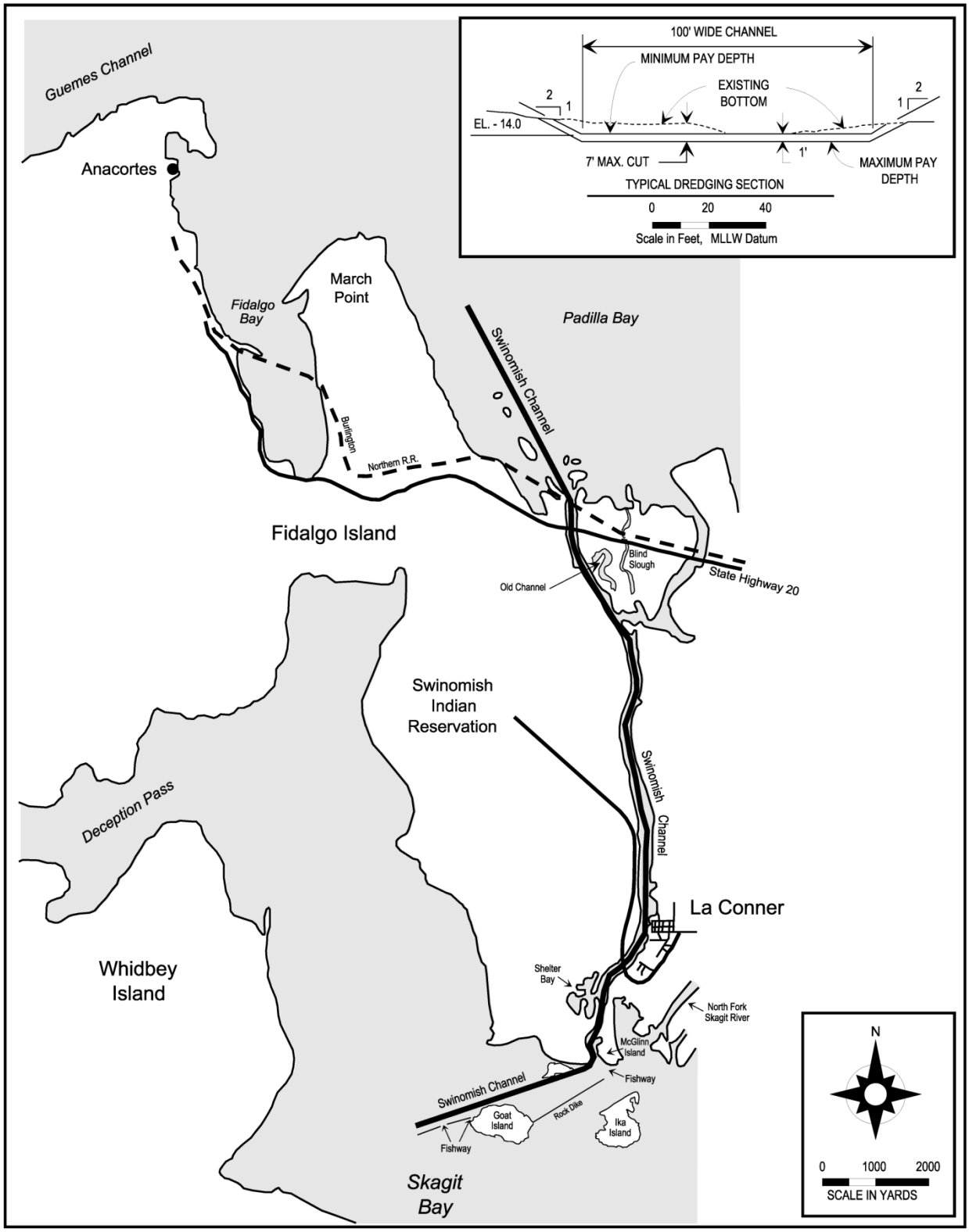

Figure 6. Location of Swinomish Channel between Skagit Bay and Padilla Bay.

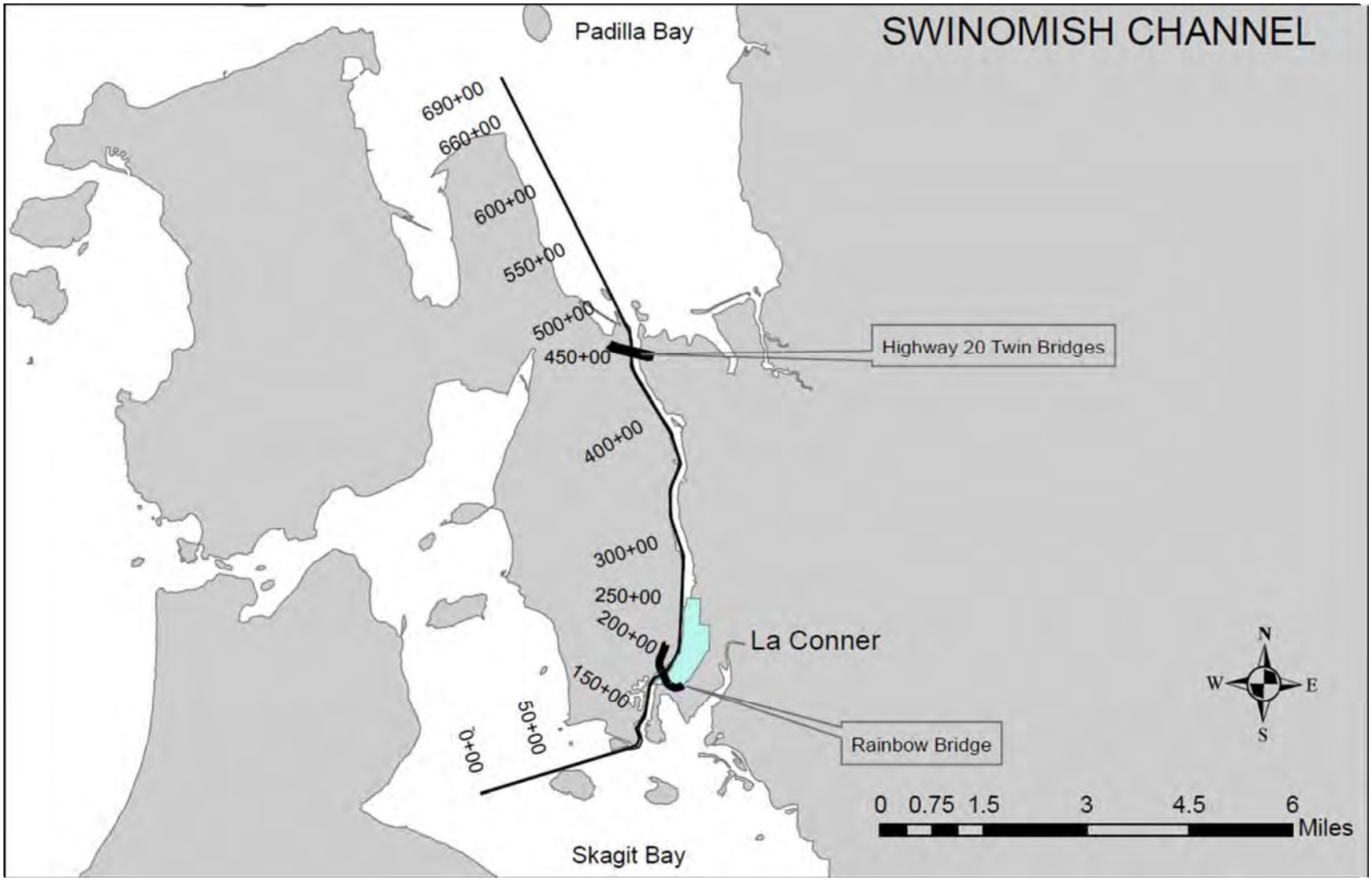

Figure 7. Authorized length of Swinomish Federal Navigation Channel with station locations.

4.2 Keystone Harbor

4.2.1 PROJECT NAME

Keystone Harbor Federal Navigation Channel

4.2.2 AUTHORIZATION

The Keystone Harbor Project is authorized by several acts that together created the current authorized project scope. The Lake Crockett navigation project and maintenance dredging by the Department of the Army was authorized by the River and Harbor Act of March 2, 1945 (House Document 303, 77th Congress, 1st Session). In 1971, the project was widened under authority of Section 107 of the 1960 Water Resources Development Act. In 1993, the project was deepened by authority of Section 107 of the 1960 Water Resources Development Act as amended by Section 915 of the Water Resources Development Act of November 17, 1986 (Public Law 99-662). The finished project is named Keystone Harbor.

4.2.3 LOCATION

Situated at the north end of Admiralty Bay on the west side of Whidbey Island, Keystone Harbor is immediately west of Lake Crockett and surrounded by Fort Casey State Park in Island County, Washington. It lies to the northeast across Puget Sound from Port Townsend. The Washington State Ferry terminal within Keystone Harbor provides access to State Highway 20 (Figure 8).

4.2.4 PROJECT DESCRIPTION

Project Area and Action Area

Keystone Harbor is on the central western shore of Whidbey Island, which forms the eastern border of Admiralty Inlet, the strait between Puget Sound and the Strait of Juan de Fuca. Port Townsend and Marrowstone Island form the western landmasses creating the entrance to Puget Sound. The landward portion of the project area is located within the 25-square-mile Ebey's Landing National Historic Reserve. The Reserve encompasses a mixture of Federal, state, county, and private property, which are all managed in a way that preserves the Reserve's historic essence. Offshore from Keystone Harbor and Fort Casey State Park are the Fort Casey Underwater Park popular with divers and the Admiralty Head Marine Preserve to the northwest. A bull kelp bed stands just offshore to the east of the jetty/diving area. Construction of the navigation channel and the associated jetty interrupted sediment transport in the littoral drift cell that moves sediment from west to east along this shoreline (Figure 9); therefore, the channel fills with sediment and erosion occurs to the west of the channel. The affected action area is the area within a roughly 1-mile radius around Keystone Harbor and the drift cell along the shore to the southeast. One mile is the expected distance for underwater sound attenuation of dredging equipment, and the maximum distance that effects of sediment can be detected within the affected transit area for listed salmon, rockfish, and killer whales.

Purpose

Keystone Harbor provides a terminal (known as the Coupeville ferry terminal) for the Washington State ferry run between the city of Port Townsend and Whidbey Island, a refuge for boaters from rough seas, and a boat launch ramp. Construction of the harbor, entrance channel, and adjacent

rock jetty interrupted the natural eastward transport of beach material. Consequently, shoaling of the entrance channel requires maintenance dredging to ensure safe navigation. When the channel and ferry slip have become too shallow, the ferry has run aground during landings at low tide, which limits service on the Port Townsend/Coupeville run. The purpose of this project is to provide safe navigation conditions for the Washington State Ferry System vessels to dock at Keystone Harbor for uninterrupted service on the Port Townsend/Coupeville ferry route, and to ensure continuity of the sediment transport processes along the shoreline in the project area. The purpose of the beach disposal component of the project is to prevent erosion to the point of undermining the jetty and losing park infrastructure.

Navigation Features

This artificial inlet consists of the six-acre keystone-shaped harbor and entrance channel. The channel is designed to be 1,800 feet long, 200 feet wide from Station 0+00 to Station 10+00, and -25 feet MLLW with two feet allowable overdepth during dredging as authorized (Figure 8); routine maintenance dredging may include an additional two feet of advance maintenance. This allows safe navigation for the ferries to dock during tides as low as -4.5 feet MLLW. A breakwater stands on the east side of the entrance channel to protect the ferry from strong currents when entering the channel and harbor.

4.2.5 DREDGE AND DISPOSAL METHODS, QUANTITIES, FREQUENCY, AND DURATION

Dredging will occur either by a mechanical (clamshell) dredge from a barge or by a hydraulic dredge (cutterhead with a pipeline). The type of dredge employed is the choice of the dredging contractor.

Disposal of dredged material occurs on the adjacent designated beach disposal site to re-nourish a section of the beach east of the breakwater (See section 5.2). The method used to deposit material on the beach depends on the dredge equipment. Hydraulic pipeline dredging pumps material from the channel to the beach area behind temporary berms constructed of local material. This prevents effluent from flowing directly into receiving water without first filtering through the berms. This minimizes effects to water quality and protects the offshore diving park. The berms are then pushed down and graded to match the beach profile when material placement is complete. With mechanical dredging, sediment is excavated by a clamshell bucket from a derrick barge and loaded onto a flatdeck barge. For placement, both barges move as close to the harbor's shoreline as possible without running aground. The derrick barge offloads the sediment from the flatdeck barge onto high ground at the parking lot. Bucket loaders on shore scoop up the sediment, travel along the edge of the parking area to the beach placement area, and place the sand on the beach to the east of the jetty. Berms are not required in this case because the material decants primarily on the flatdeck barge before being rehandled to the shore and then transported to the beach for placement and final grading to match the beach profile.

The USACE anticipates removing up to 75,000 cy per dredging episode. Quantities have been estimated conservatively for environmental impacts analysis and would include the amount dredged for two feet of advance maintenance in any dredging episode in which the need is executed. Keystone Harbor typically requires maintenance dredging every 5 years; however,

execution is dependent on funding. Dredging may take 60 to 120 days, depending on total dredged quantity.

4.2.6 DISPOSAL SITES

Disposal of all the dredged material occurs on the adjacent designated beach disposal site to nourish a section of the beach just to the east of the breakwater. This area provides a recreational beach area for Fort Casey State Park and protects park infrastructure from erosion. The beach deposition area is approximately 600 feet long and centered in front of the restroom building on the east side of Fort Casey State Park.

4.2.7 IN-WATER WORK WINDOW

The in-water work window in Keystone Harbor is 16 July through 15 February. The USACE does not anticipate any other timing constraints.

4.2.8 CONSULTATION HISTORY

The USACE conducted informal consultation with USFWS and NMFS in 2006 (USFWS #1-3-06-I-0303; NMFS #2006/01974). The most recent consultation occurred for the 2011 maintenance dredging and concluded with letters of concurrence from the USFWS on 24 June 2011 (USFWS #13410-2011-I-0125) and from NMFS on 18 August 2011 (NMFS #011/01689).

The EFH consultations occurred concurrently with the ESA consultations; the conclusion is that ESA conservation measures are adequate to avoid, minimize, or otherwise offset potential adverse effects to the EFH of the species protected by the MSA.

4.2.9 ACTION CONSULTED UPON

The USACE is consulting on routine maintenance dredging within the channel prism and boat basin at an interval of approximately every 5 years, of a volume of up to 75,000 cy, via clamshell or hydraulic dredge with dredged material placed at the adjacent designated beach site immediately east, as described above.

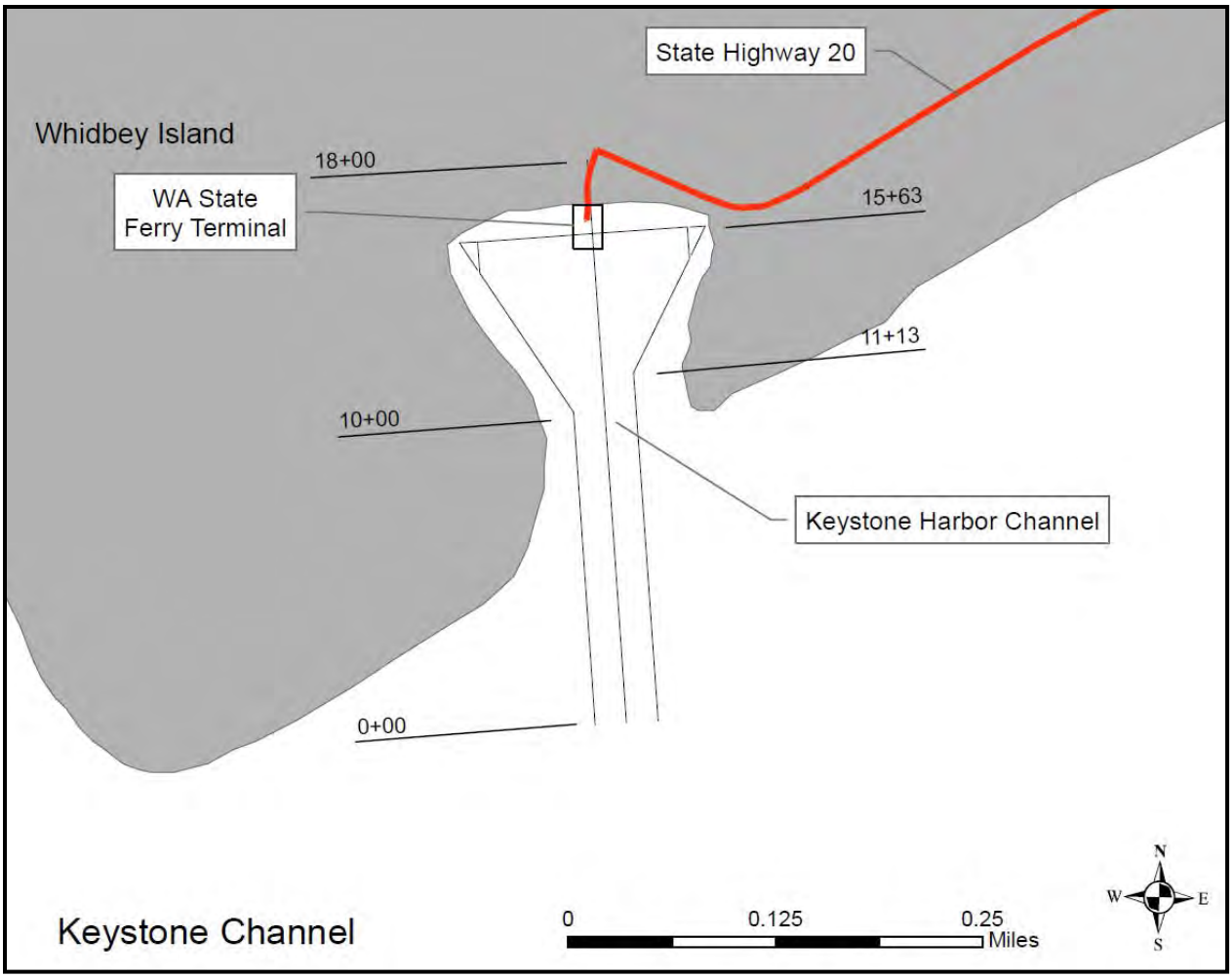

Figure 8. Keystone Harbor authorized Federal Navigation Channel and Washington State Ferry terminal.

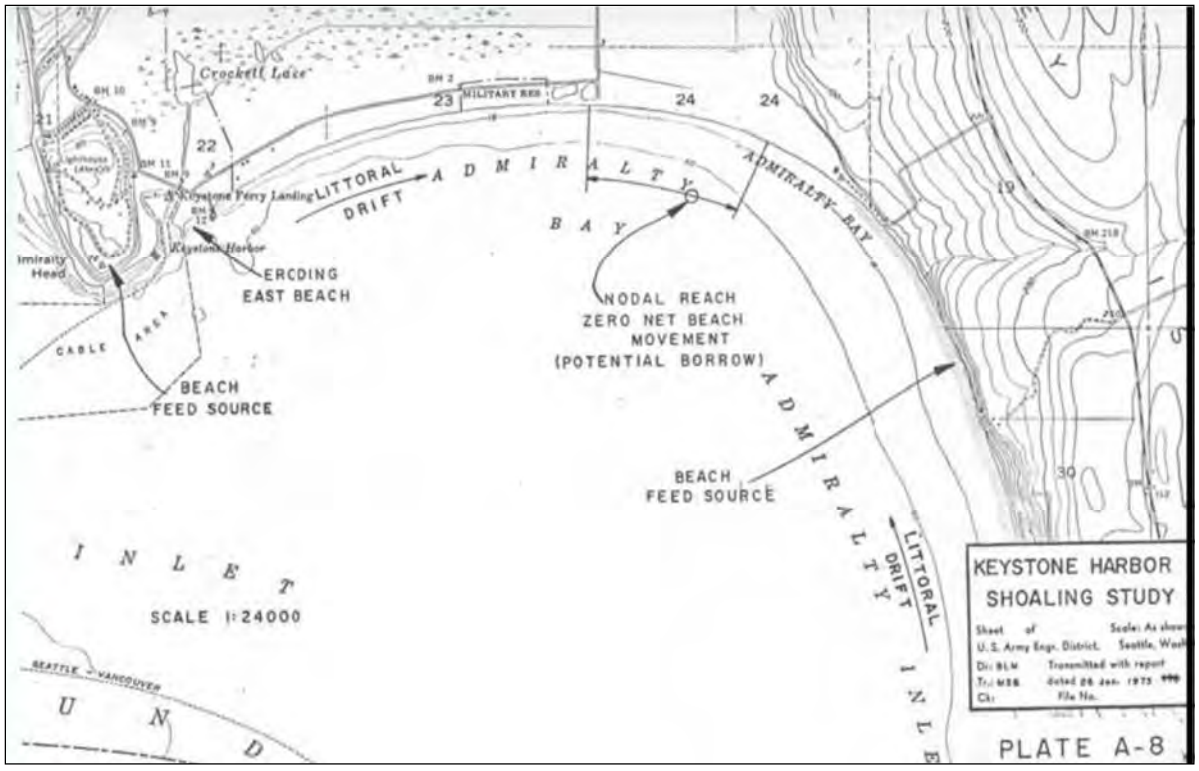

Figure 9. Littoral drift cells along the shoreline of the project area (USACE 1973).

4.3 Snohomish River Navigation Channel

4.3.1 PROJECT NAME

Everett Harbor and Snohomish River Project

4.3.2 AUTHORIZATION

The Everett Harbor and Snohomish River Navigation Channel were authorized by the Rivers and Harbors Act of June 25, 1910 (House Document 1108, 60th Congress, 2nd Session) and subsequently modified by more than a dozen Acts.

4.3.3 LOCATION

The Everett Harbor and Snohomish River Navigation channel is located around the north end of the City of Everett in Snohomish County, Washington. The maintained channel extends from between the Highway 2 Bridge and the Interstate 5 Bridge downstream to the mouth of the river at Port Gardner Bay (Figure 10 below and Figure 20 in Chapter 5).

4.3.4 PROJECT DESCRIPTION

Project Area and Action Area

The Snohomish River estuary starts in Possession Sound and continues to river mile (RM) 9, the extent of saltwater influence. It is nearly 4.5 miles wide at the edge of the river delta in Possession Sound. The shoreline along the lower Snohomish River is moderately developed with maritime

industry, commercial recreation, and undeveloped areas of intertidal and freshwater wetlands and associated uplands. The Snohomish River navigation channel is the downstream reach of the Snohomish River system. The Pilchuck, Skykomish, and Snoqualmie Rivers are the largest tributaries. The area of the navigation channel is approximately 162 acres of the approximately 600 acres of aquatic habitat in this reach. Creation of Jetty Island with dredged materials placed at the mouth of the estuary began in 1903 and now covers 15 acres with a 19-acre mudflat that formed within the protected embayment. A natural sand spit and area of saltmarsh formed off the northern tip and eastern side of the island. An eelgrass meadow has established off the western shore of Jetty Island. The proposed dredging project encompasses the lower 6.6 miles of the river channel and includes the entire navigation channel and the upstream and downstream settling basins within the channel. Beneficial use disposal occurs at Jetty Island as well as two upland disposal sites along the shoreline of the lower Snohomish River; these are the Port of Everett's Riverside Business Park and the City of Everett's Parcel "O" site. Material is placed at the DMMP-managed Port Gardner non-dispersive disposal site when material is not needed for beneficial use. The affected action area is the Snohomish River estuary (approximately 9 miles long to the upstream extent of tidal influence), and Jetty Island with its surrounding mudflats and saltmarsh. This area represents the maximum likely area for underwater sound attenuation of dredging equipment, the area that turbidity effects can be detected, and the area of potential disturbance to listed salmon and rockfish.

Purpose

The purpose of the proposed project is to maintain safe and reliable navigation within the lower Snohomish River by reducing the potential risks associated with shoaling in the navigation channel. Without annual maintenance dredging, shoaling would lead to a reduction of depths in the navigation channel limiting the capacity of vessel traffic to enter and leave the various water dependent facilities associated with the project. Maintenance dredging of the two settling basins reduces sedimentation rates in the navigation channel, limiting the quantity and frequency of dredging.

Navigation Features

The authorized project features include the following:

(1) A channel from Puget Sound up the Snohomish River, 1 mile long, 150 to 425 feet wide, and -15 feet MLLW;

(2) An upper channel extending to RM 6.3, 150 feet wide (and wider at the turns), -8 feet MLLW; and

(3) Two settling basins in the navigation channel:

a. the downstream basin at 700 feet wide, 1,200 feet long, -20 feet MLLW, with 500,000 cy capacity, and

b. the upstream basin at 150 feet wide and 1,740 feet long -40 feet MLLW, with 1,000,000 cy capacity.

Two feet of allowable overdepth may occur during dredging; routine maintenance dredging may include an additional two feet of advance maintenance. The authorized project also includes the

East waterway, but it will not be included within the scope of this BA. The East Waterway has not been dredged for many decades and the USACE does not anticipate dredging for the near future. In addition, there is a State clean up activity planned.

4.3.5 DREDGE AND DISPOSAL METHODS, QUANTITIES, FREQUENCY, AND DURATION

Maintenance dredging occurs with hydraulic pipeline dredge when placing material for beneficial use, or clamshell dredge when placing material in an aquatic disposal site. The USACE typically performs maintenance dredging and disposal operations annually, and alternates between the upstream settling basin (Sta. 337+06.83 to 354+46.83) and channels (355+78.54 to 381+78.54) and downstream settling basin (Sta. 78+00 to 90+00) and channels (0+00 to 78+00 and 90+00 to 337+06.83) so each area is dredged at least every other year (Figure 10). When dredging cannot be performed in any given year (which may be due to funding, weather, or other limitations), then both basins and channels would be dredged in the next maintenance event, again if funding allows. Based on dredging history at this project, the USACE may dredge up to 500,000 cy from each settling basin and 200,000 cy from the navigation channel for 1,200,000 cy as a maximum. Quantities have been estimated conservatively for environmental impacts analysis and would include the amount dredged for two feet of advance maintenance in any dredging episode in which the need is executed. Maintenance dredging occurs between 16 October and 14 February each year and work typically takes 60 to 90 days for each upstream and downstream episode.

4.3.6 DISPOSAL SITES

The disposal sites include the DMMP Port Gardner open-water disposal site, addressed in a separate Section 7 consultation, as well as the three beneficial use disposal sites: Jetty Island, Parcel “O”, and Riverside.

4.3.7 IN-WATER WORK WINDOW

The in-water work window at the mouth of the Snohomish River is 16 July through 14 February for the tidal area. Other timing constraints the USACE adheres to include a conservation measure of limiting dredging to 16 October through 14 February for avoidance of bull trout.

4.3.8 CONSULTATION HISTORY

Informal consultation occurred in 2003 and NMFS provided a letter dated 31 October 2003 (NMFS #2003/01258) with amendments dated 15 December 2003 and 22 July 2004; these letters remained in effect for work that occurred in 2006. USFWS provided a letter of concurrence dated 31 August 2005 (USWFS #1-3-05-IR-0557 and 1-3-05-IC-0558) for the 2006 work. Reinitiation occurred with NMFS in 2007 after Puget Sound steelhead were listed and NMFS provided a letter of concurrence with the determination of “may affect, not likely to adversely affect” Puget Sound steelhead (NMFS #2007/06114). Informal consultation with the Services occurred in 2009 with the USACE receiving a concurrence letter from NMFS on 23 November 2009 (NMFS #2009/05451) and from USFWS on 19 November 2009 (USFWS #13410-2010-I-0001). The last consultations were informal with both Services; consultation with NMFS concluded on 11 October 2011 (NMFS #2011/03310) and with USFWS on 23 August 2011 (USFWS #13410-2011-I-0383).

The EFH consultations occurred concurrently with the ESA consultations; the conclusion is that ESA conservation measures are adequate to avoid, minimize, or otherwise offset potential adverse effects to the EFH of the species protected by the MSA.

4.3.9 ACTION CONSULTED UPON

The USACE proposes annual maintenance dredging via clamshell or hydraulic up to 1,200,000 cy from the channel and settling basins, and placing dredged material placed at one of the DMMP multi-user open-water disposal sites, such as the Port Gardner non-dispersive site, and at one or more beneficial use sites, all as described above.

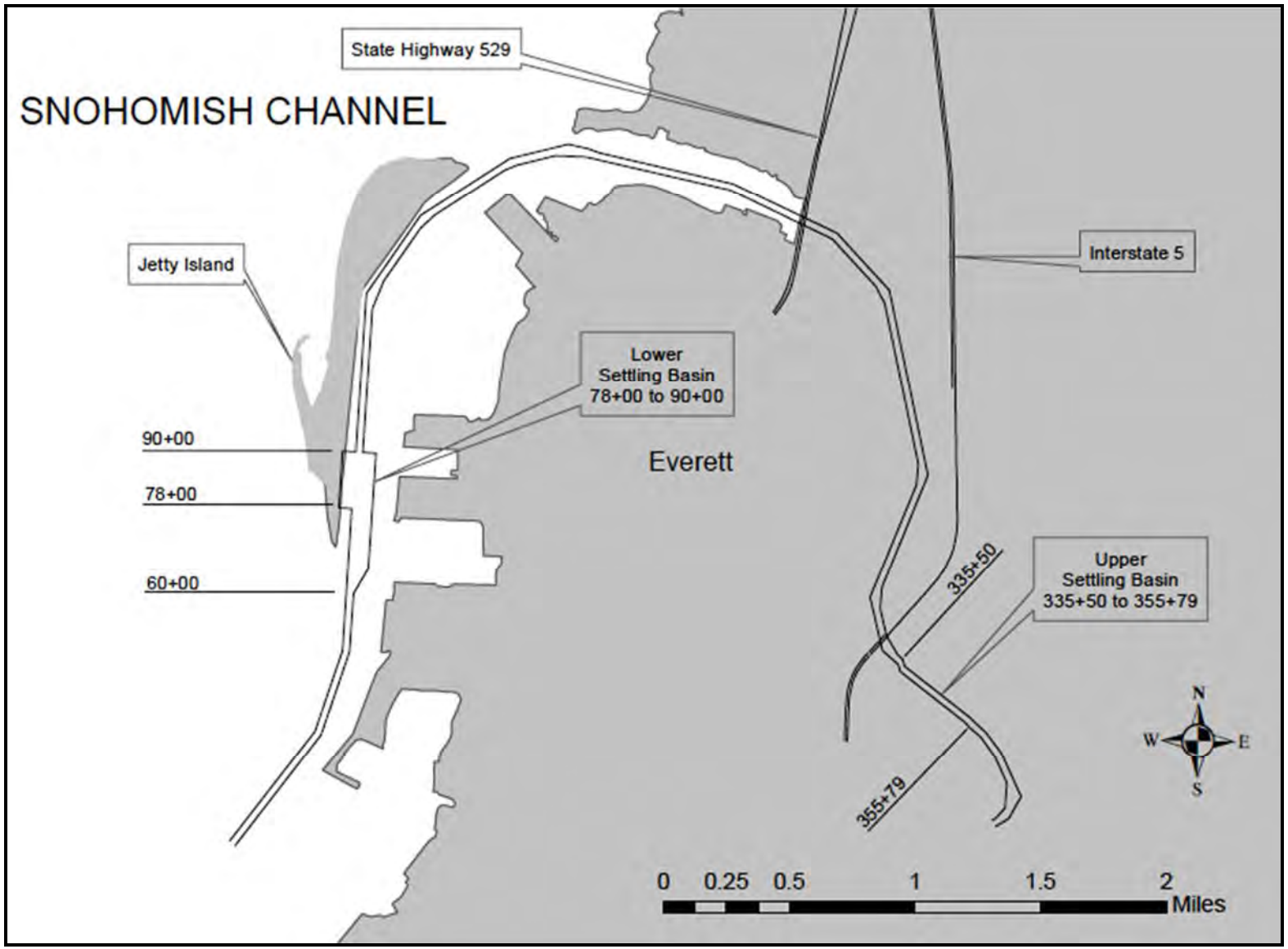

Figure 10. Everett Harbor and Snohomish River Federal Navigation Channel.

4.4 Duwamish Waterway

4.4.1 PROJECT NAME

Seattle Harbor Federal Navigation Project, Duwamish Waterway

4.4.2 AUTHORIZATION

The Seattle Harbor Federal Navigation Project and maintenance dredging is authorized by the Rivers and Harbors Act of 2 March 1919 (65th Congress, 3rd Session) and modified by the Rivers and Harbors Acts of 3 March 1925 (68th Congress, 2nd Session) and 3 July 1930 (71st Congress, 2nd Session).

4.4.3 LOCATION

The maintained Federal navigation channel is in the Duwamish Waterway located in the industrial area south of downtown Seattle and connects to the Port of Seattle and Elliott Bay in King County, Washington.

4.4.4 PROJECT DESCRIPTION

Project Area and Action Area

The Duwamish Waterway is upstream from the Port of Seattle container terminal facilities and in an area containing dense industrial, commercial, and residential development. The shoreline along the Duwamish Waterway is developed for industrial and commercial operations and the adjacent upland areas are heavily industrialized. This is a major shipping route for containerized and bulk cargo, consequently subject to high volumes of marine traffic. There is little aquatic vegetation in the upper Duwamish Waterway; most of the shoreline is armored with riprap. The aquatic area is a migration corridor for juvenile and adult salmonids with small pockets of rearing habitat along the shore. The Turning Basin can host adult salmon that pause here on their upstream migration. The action area affected by dredging is the routinely maintained reach of the Upper Duwamish Waterway and Turning Basin with indirect effects extending downstream no more than one mile. Project effects may extend a short distance upstream due to tidal action that influences the saltwater wedge and fine suspended sediment.

Purpose

The purpose of dredging the Duwamish Waterway is to maintain navigable depths for the commercial and recreational vessels that require access to points along the shore in this reach, providing substantial regional economic benefits. Annual or biennial maintenance dredging of the Turning Basin (which acts as a settling basin) removes sufficient material to keep sediment from moving downstream and necessitating maintenance dredging of the lower Duwamish Waterway. These downstream areas typically contain material unsuitable for open-water disposal; therefore, the purpose of maintaining the Turning Basin as a settling basin is to reduce the required dredge areas by concentrating sediments to a confined area.

Navigation Features

Although the total length of the Duwamish Waterway navigation channel is 5.3 miles, the length of channel that the USACE routinely maintains is at the upstream reach of the channel and is

approximately 3,300 feet long from station 242+00 to station 275+56 (Figure 11). The authorized dimension for the channel bottom width is 150 feet. The area typically dredged includes a settling basin that extends from the natural bend in the river at RM 5.5 (known as the Turning Basin). The authorized depth in the channel and Turning Basin is -15 feet MLLW with two feet allowable overdepth during dredging; routine maintenance dredging may include an additional two feet of advance maintenance. The authorized dimensions for the Turning Basin are 250 feet wide by 500 feet long located at station 270+00 to 275+56 (Figure 11); the capacity for sediment is approximately 50,000 cy. The total area of the turning basin and channel is approximately 8 acres.

Areas of the Duwamish Waterway that contain material determined unsuitable for aquatic disposal are excluded from this consultation. Additionally, the USACE is excluding from this consultation any dredging of capped Superfund sites even though the surface layer may contain sediments determined suitable for aquatic disposal. The authorized project also includes the East and West Waterways at the Port of Seattle, but they will not be included in this BA. There is no routine dredging of these waterways, as sediment accumulation is unpredictable and infrequent.

4.4.5 DREDGE AND DISPOSAL METHODS, QUANTITIES, FREQUENCY, AND DURATION

Typically, a clamshell dredges and loads the dredged materials onto bottom-dump barges for placement at an open-water site. The typical volume of material removed during maintenance dredging is approximately 100,000 cy when executed annually. The USACE proposes to remove up to 250,000 cy in any dredging event, which may occur every one to three years. Quantities have been estimated conservatively for environmental impacts analysis and would include the amount dredged for two feet of advance maintenance in any dredging episode in which the need is executed. Maintenance dredging in the Duwamish Waterway is required every one to three years to remove accumulations of shoaling river sediment. Scheduled dredging occurs between 1 October and 15 February each year dredging occurs and the work requires approximately 45 days to complete.

4.4.6 DISPOSAL SITES

The USACE typically places the dredged material at the DMMP-managed Elliott Bay open-water non-dispersive disposal site. Any material that does not meet the DMMP criteria for open-water disposal would be subject to a separate Section 7 consultation and deposited in an approved upland disposal site. Some suitable material may be available for beneficial use if an opportunity arose. The USACE would conduct independent supplemental consultation if there is any proposed disposal of dredged material from the Duwamish Waterway for beneficial use in a manner that triggers Section 7 obligations.

4.4.7 IN-WATER WORK WINDOW

The in-water work window for the Duwamish Waterway is 1 October through 15 February.

4.4.8 CONSULTATION HISTORY

The USACE received a Biological Opinion from NMFS on 21 September 2006 for maintenance of the Turning Basin in the Duwamish Waterway (NMFS #2005/06457). USFWS provided a letter of concurrence for this action on 12 January 2006 (USFWS #1-3-06-I-0081). The last consultation

was informal resulting in letters of concurrence from NMFS on 10 August 2011 (NMFS # 2011/02973) and the UFSWS on 19 August 2011 (USFWS # 13410-2011-I-0340).

4.4.9 ACTION CONSULTED UPON

Maintenance dredging of the channel prism and settling basin described above at an interval of approximately one to three years, of a volume of up to 250,000 cy, via clamshell dredge with dredged material placed at one of the DMMP multi-user open-water disposal sites, such as the Elliott Bay non-dispersive site.

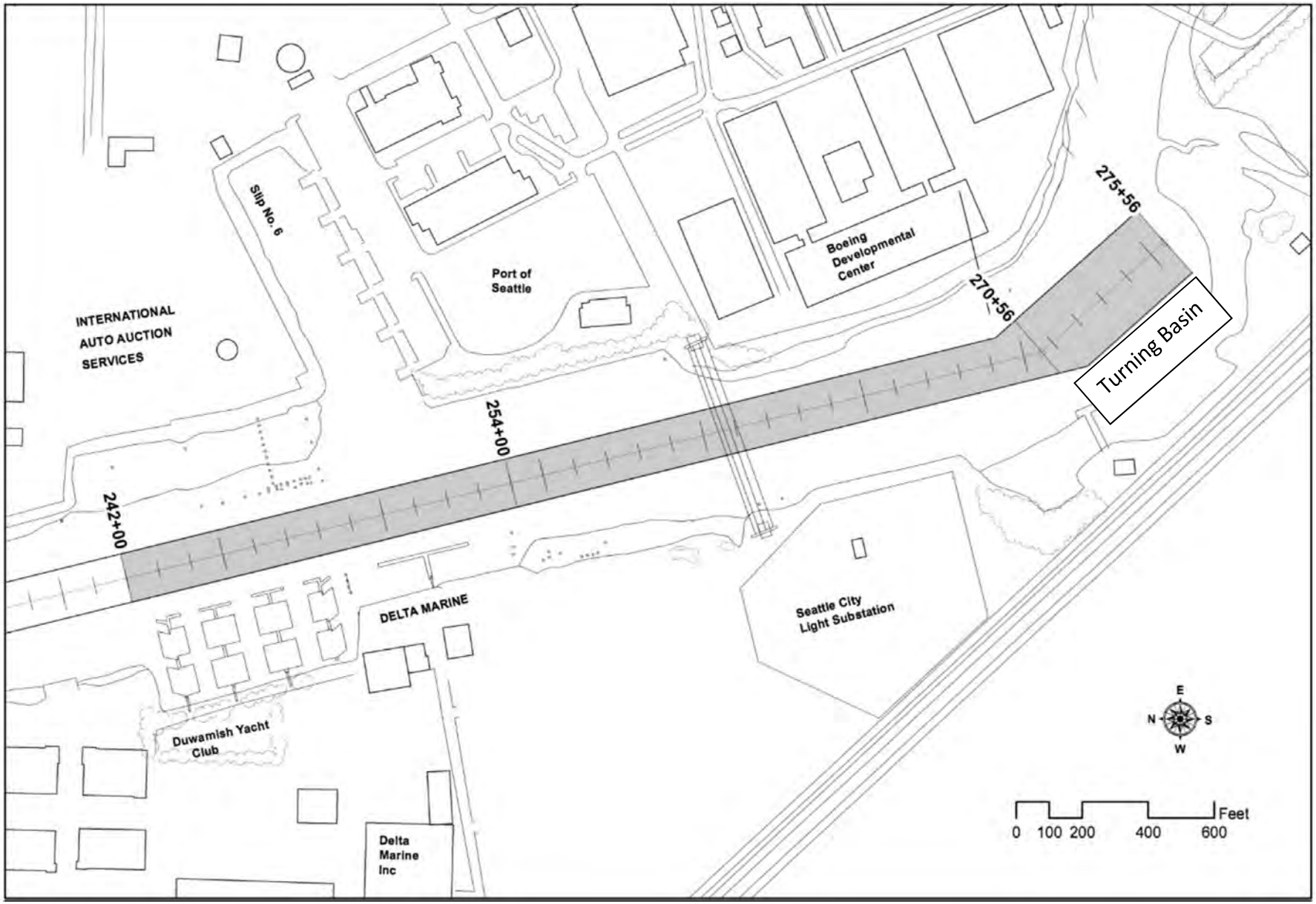

Figure 11. Upper Duwamish Waterway navigation channel and turning basin.

4.5 Port Townsend Navigation Channel

4.5.1 PROJECT NAME

Port Townsend Harbor

4.5.2 AUTHORIZATION

The Rivers and Harbors Act of 3 July 1958 (85th Congress, 1st Session) authorized the Port Townsend Harbor project and associated maintenance dredging by the Department of the Army.

4.5.3 LOCATION

Port Townsend Harbor is located at the north end of Puget Sound at the mouth of Port Townsend Bay adjacent to Admiralty Inlet, which is the connection between Puget Sound and the east end of the Strait of Juan de Fuca in Jefferson County, Washington.

4.5.4 PROJECT DESCRIPTION

Project Area and Action Area

The Port Townsend Harbor navigation channel is at the entrance to the public marina on the south shore of the town of Port Townsend (Figure 12). The 1 mile of shoreline eastward from Boat Haven marina is 25 percent residential and 75 percent commercial entities (Nightingale 2002). The marina itself is largely public usage with a small amount of privately owned area. Boat Haven Industrial Park occupies several acres that are immediately adjacent to the marina to the north and west. The primary uses in the industrial area are dry dock boat storage, boat building and repair, commercial fish processing, marine-related offices, and manufacturing (Port Townsend 2007). The shoreline to the west of the marina is open to public recreation.

Port Townsend Bay experiences a high degree of mixing between the Strait of Juan de Fuca and Puget Sound due to the sill that creates the mixing forces in Admiralty Inlet (Nightingale 2000). For this reason, Port Townsend bay typically has higher dissolved oxygen (DO) levels than the smaller bays in the area. Shallow nearshore marine habitats provide migration corridors for juvenile salmonids. The shoreline in the action area is more natural and less disturbed at the southeast end toward Glen Cove, then becomes highly industrialized and urban from Port Townsend Paper mill moving eastward across the waterfront to Point Wilson on the eastern edge. The Washington State Ferry Terminal is in the downtown waterfront area of Port Townsend. Many other piers and overwater structures stand along this reach of Port Townsend Bay, and the shoreline is a mix of some sand and some armoring with riprap. The affected action area includes the aquatic habitat for an approximately one-mile radius surrounding the entrance of the boat basin. The area of the navigation channel is approximately 2.7 acres.

Purpose

The Port of Port Townsend uses the federally authorized navigation channel to provide commercial and recreational vessels with access to the mooring basin. The U.S. Coast Guard (USCG) uses the harbor for mooring rescue, security, and support vessels. Without periodic maintenance dredging, shoaling would lead to an increasingly shallower channel, reducing the ability of vessels to enter and leave Port Townsend Harbor safely. The purpose of maintenance

dredging is to maintain the authorized width and depth of the channel to allow vessels to continue using Port Townsend Harbor.

Navigation Features

The authorizing document provides for a mooring basin of 14 acres, -12 feet MLLW in the inner part and -15 feet MLLW in the outer part, protected by a breakwater 1,550 feet long, including a 950-foot rock and earth fill section and a 600-foot rock and pile section. A 4-acre commercial vessel basin was added and the breakwater was lengthened to 2,285 feet in 1964. The USCG moors the 87-foot vessel *Osprey* in the outer basin. The inner basin includes a public boat ramp. Two feet of allowable overdepth may occur during dredging; routine maintenance dredging may include an additional two feet of advance maintenance.

4.5.5 DREDGE AND DISPOSAL METHODS, QUANTITIES, FREQUENCY, AND DURATION

A clamshell dredges and loads the dredged sediment onto barges for transport to the DMMP Port Townsend open-water disposal site. Maintenance dredging includes the entire mooring basin and the full length of the navigation channel. The entrance reach of the Federal navigation channel has three segments with a total length of 616 feet and a 40-foot width; the remainder of the channel is 1,300 feet long inside the marina along the breakwater. The USACE may also remove sediment from the USCG slip for the Cutter *Osprey*, comprising an area of approximately 2,100 square feet. The quantity dredged from the navigation channel and boat basin is up to 50,000 cy per episode. Quantities have been estimated conservatively for environmental impacts analysis and would include the amount dredged for two feet of advance maintenance in any dredging episode in which the need is executed. Dredging is required roughly every 8 to 10 years. Dredging this project with a 6 to 9 cy clamshell bucket will take approximately 45 days.

4.5.6 DISPOSAL SITES

The USACE typically transports the dredged material via bottom dump barge to the DMMP-managed Port Townsend open-water dispersive disposal site located to the northwest of the Quimper Peninsula in the Strait of Juan de Fuca.

4.5.7 IN-WATER WORK WINDOW

The in-water work window for Port Townsend Navigation Channel is 16 July through 15 February to protect salmon and bull trout in Marine Tidal Reference Area 10.

4.5.8 CONSULTATION HISTORY

The most recent consultation with the Services was informal. Consultation with NMFS was completed on 5 August 2008 (NMFS # 2008/04477) and with the USFWS on 7 August 2008 (USFWS #13410-2008-I-0466).

4.5.9 ACTION CONSULTED UPON

Maintenance dredging of the channel prism and USCG slip described above at an interval of approximately 10 years, of a volume of up to 50,000 cy, via clamshell dredge with dredged material placed at one of the DMMP multi-user open-water disposal sites, such as the Port Townsend dispersive site.

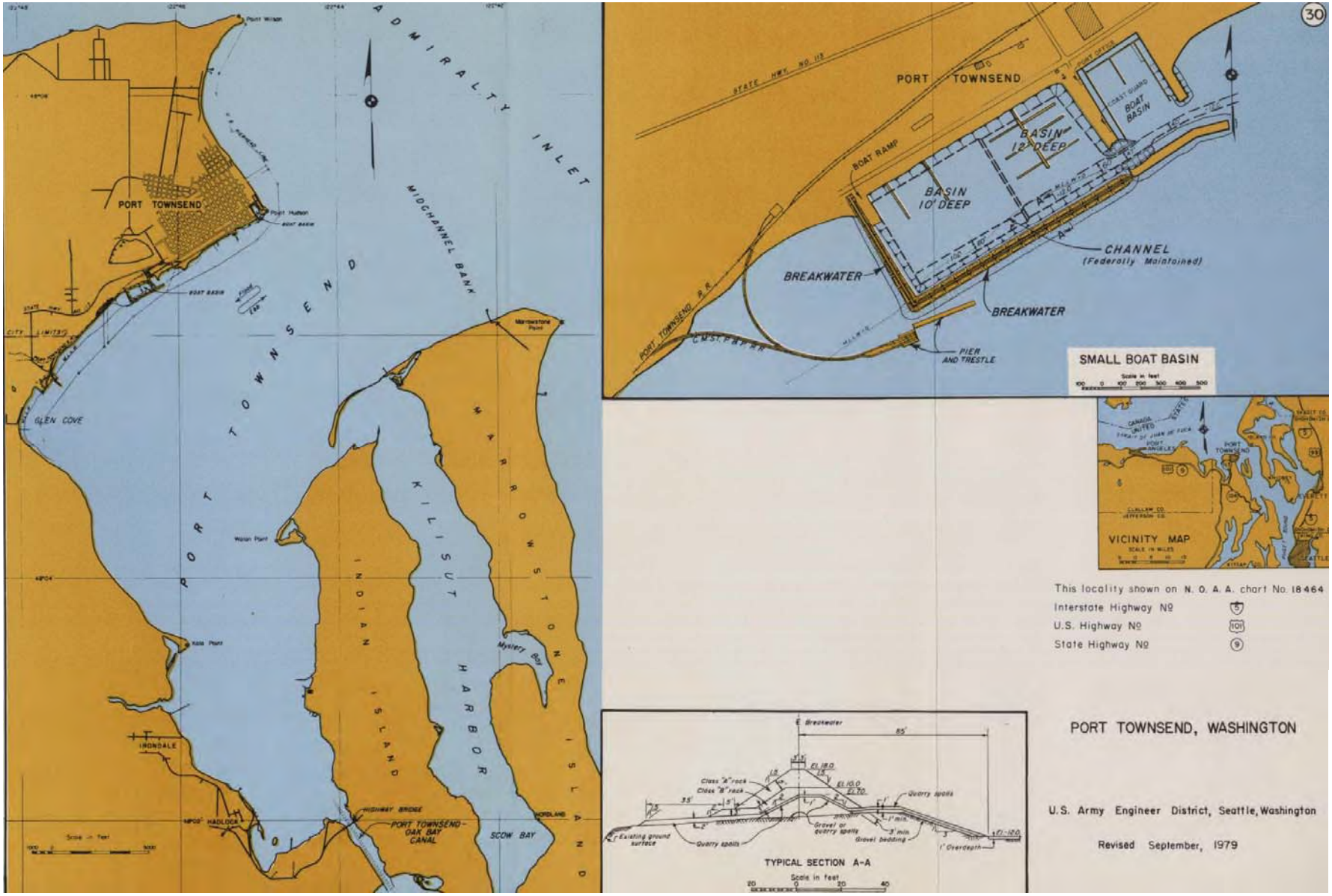

Figure 12. Port Townsend Federal Navigation Channel at the entrance to Boat Haven Marina.

4.6 Quillayute River

4.6.1 PROJECT NAME

Quillayute River Navigation Channel

4.6.2 AUTHORIZATION

The Quillayute River Navigation Channel project and maintenance dredging by the Department of the Army was authorized by the Rivers and Harbors Act of 3 July 1930 (House Document 290, 71st Congress, 2nd session) and modified by the Rivers and Harbors Acts of 2 March 1945 (79th Congress, 1st Session) and 3 September 1954 (83rd Congress, 2nd Session).

4.6.3 LOCATION

The Quillayute River Navigation Channel project is located on the northwest coast of the Olympic Peninsula in Clallam County, Washington. The channel and small boat basin are located in the town of La Push, about 50 miles southwest of Port Angeles and 15 miles west of Forks, Washington. The navigation channel provides access to the small boat basin that hosts the Quileute Tribe's marina, the only harbor of refuge in the area and only USCG station along the 120 miles of coastline between Neah Bay and Grays Harbor, Washington (Figure 13).

4.6.4 PROJECT DESCRIPTION

Project Area

The Quillayute River extends 5.6 river miles west from the confluence of the Bogachiel and Sol Duc Rivers, which drain a portion of the northwest slope of the Olympic Mountains in Clallam County, Washington. The Quillayute is joined by the Dickey River at Mora, flows a mile westward where an armored spit turns the river south, and flows another mile southward before entering the Pacific Ocean at La Push. The mouth of the river lies among rocky islands and sea stacks. The Quillayute River forms the north boundary of the Quileute Indian Reservation

The area of analysis includes all of the lower half-mile of the Quillayute estuary, the marina and waterfront area of La Push including disposal sites, the southern end of Quillayute Spit on the river and the ocean sides, and First Beach sediment placement area.

Purpose

The overall purpose of this work is to provide for safe navigation and moorage by returning the navigation channel and boat basin to its authorized depth of -10 feet MLLW plus two feet of allowable overdepth. This work is needed so that vessels may safely transit the channel for entry into and exit from the marina, and so that the USCG can keep their rescue boats stationed effectively in the current location. La Push is the only rescue station between Neah Bay and Grays Harbor and is, therefore, an important location for timely response to distressed mariners in nearby Pacific Ocean. The marina at La Push offers a livelihood for approximately 325 Tribal members and 50 non-Tribal citizens including USCG personnel. The primary commercial activity is fishing and fish processing. During the summer, a significant number of recreational and transient commercial fishing vessels use the basin for moorage and re-fueling.

Navigation Features

The project was constructed in 1932; Federal maintenance began in 1949 and has continued to the present. The purpose of the continuing maintenance of the various project features is to protect the navigational channel and the infrastructure and property of the community of La Push. The current project features were developed in 1962. Authorized features of the Federal navigation project include the following (Figure 14):

1. A small boat basin 1,070 feet long, 313 feet wide, and -10 feet MLLW, with a 1,500-foot timber training wall constructed to elevation +16 feet MLLW plus an authorized overdepth of two feet along the west side to reduce shoaling inside the boat basin, and a timber seawall at the downstream end to protect against ocean waves;
2. A rubble mound jetty 1,400 feet long at the east side of the river mouth at +15 feet MLLW;
3. A rubble mound dike 1,050 feet long, +8 feet MLLW, along the west side of the river between Quillayute Spit and James Island;
4. A navigation channel varying from 75 to 275 feet wide and -10 feet MLLW with an entrance channel southeast of James Island and extending 3,500 feet upstream ending with a stilling basin alongside the marina's training wall.
5. Maintenance of Quillayute Spit, 2,080 feet long and +20 feet MLLW, a naturally occurring spit that is artificially maintained with armoring to provide protection to the marina and town from ocean waves.

Two feet of allowable overdepth may occur during dredging; routine maintenance dredging may include an additional two feet of advance maintenance.

4.6.5 DREDGE AND DISPOSAL METHODS, QUANTITIES, FREQUENCY, AND DURATION

The components of the Federal project that are within the scope of this consultation are the navigation channel ranging from 75 to 275 feet wide and 3,500 feet long and the small boat basin that is 1,070 feet long and 313 feet wide (Figure 13). The channel and basin are maintained at -10 feet MLLW. The volume of sediment anticipated to be dredged in each episode is up to 100,000 cy. Dredging occurs with a hydraulic pipeline dredge. Dredged material is transported via hydraulic pipeline to one of the following beneficial use placements: Site B (formerly Sites 1 and 2A) on Quillayute Spit, Site A, and First Beach. The disposal method is direct outfall onto upper elevations of the beach and riprap armoring at what had been labeled as Sites 1 and 2A; the USACE has combined and lengthened these two sites to become Site B (see section 5.3.2). The contractor transports an excavator from Mora Road and offloads the equipment at the auxiliary parking area at the north end of Quillayute Spit. The excavator places the pipeline at the designated location in Site B disposal area. Disposal at Site A allows the material to decant with controlled clean run-off water to the river and eventual transport of the decanted sediments to First Beach to control erosion. If erosion control is unnecessary, sediment placed at Site A shall be available for beneficial use by the Quileute Tribe. The regular dredging cycle is every two years, but actual execution may be less frequent due to funding availability or low interest from dredging contractors. The maintenance dredging can take up to 60 days with some interruptions

due to weather; dredging has taken the entire fish work window of five months due to various circumstances presented by the dredging site and project that have occurred over the years.

Dredging will occur during a work window based on an agreement between the USACE and the Washington Department of Fish and Wildlife (WDFW), National Park Service, the Environmental Protection Agency (EPA), and the Quileute Tribal Natural Resource Managers. The proposed start date for dredging is 1 September for material dredged from the outer channel, with temporary placement of up to 15,000 cy of the material at Site A, an upland site immediately east of the Federal channel, for approximately two months and eventual placement onto First Beach on or after 1 November. Dredging of the inner channel and boat basin will commence 1 October with placement of up to 85,000 cy at Site B. Disposal of material at Site B may not begin until after 1 October of any year due to the work window that protects spawning surf smelt. This start date was initially agreed upon for the fall 2009 dredging. For subsequent years, the USACE considered the results of a surf smelt study conducted in 2009 that provided guidance on the impacts of beach disposal to the surf smelt population that spawns on Rialto Beach. Results from this study showed no surf smelt eggs present during the timing of proposed material placement on the beach. Furthermore, the beach profile analysis shows that massive amounts of beach material moves with each higher high tide and especially in storm events. The USACE infers from this data that the quantity of material disposed from dredging is a minor fraction of all material transported in this drift cell. Additional studies conducted by WDFW and local tribes have contributed some information regarding timing and location of surf smelt spawning activity. Based on two years of results reported by WDFW, spawning activity does not appear to be substantial enough to conclude the September 1 and October 1 start dates pose a risk to surf smelt at this time. Quantities have been estimated conservatively for environmental impacts analysis and would include the amount dredged for two feet of advance maintenance in any dredging episode in which the need is executed.

4.6.6 DISPOSAL SITES

All disposal sites at Quillayute are located in the nearshore zone or adjacent upland. The material dredged from the inner channel and the boat basin will be disposed on the ocean side of Quillayute Spit at new disposal Site B, replacing Sites 1 and 2A. The material that accumulates in the inner navigation channel and boat basin is deemed appropriate grain size distribution to help maintain the surf smelt spawning habitat, and to cover the riprap of the Quillayute Spit. USACE coastal engineers have determined that the coarse-grained material plays a critical role in protecting the spit and sea dike structures from wave damage and erosion. Historically, dredged material placed on the spit has been in two separate locations; sites 1 and 2A are located near the southern terminus of the spit. Each site was selected due to ongoing erosion issues threatening the structural integrity of the spit. As of 2016, the USACE is proposing to expand the length of the disposal area and rename it as Site B (see section 5.3 for a full description).

Site A is an upland disposal site at the west corner of town adjacent to the navigation channel. Material from the outer channel reach is disposed at Site A for decanting. This material may be placed after 1 November onto First Beach to protect the root of the south jetty that erodes during coastal storm events at the discretion of the USACE. Material not placed onto First Beach is typically available for the Quileute Tribe’s reuse in upland areas.

4.6.7 IN-WATER WORK WINDOW

The in-water work window for the Quillayute Navigation Channel and small boat basin begins 1 September with upland disposal and 1 October for disposal on Quillayute Spit. The work window is open through 28 February. Extending the work window into March has been considered when dredging could not be completed within the established work window; however, dredging in March has not been approved because it may interfere with the Tribe's access to the halibut fishery, and because the three hatcheries upstream in the system begin releasing juvenile Chinook salmon. Dredging beyond the end of the fish work window is outside the scope of this BA and would trigger reinitiation of consultation.

4.6.8 CONSULTATION HISTORY

The USACE conducted informal consultation in 2004 for a 5-year period and received concurrence letters from NMFS on 19 October 2004 (NMFS #2004/01099) and USFWS on 22 December 2004 (USFWS #1-3-05-I-0026). Consultation occurred again in 2009 for another 5-year period and the USACE received a concurrence letter from NMFS on 23 July 2009 (NMFS #2009/02967). Based on results of informal conversations between USACE and USFWS staff, the USACE determined dredging would have no effect to ESA-listed species that are under the jurisdiction of USFWS and wrote a "no effect" memo for the project record in 2009. An analysis of project effects in 2014 resulted in the USACE writing a "no effect" memo for all ESA-listed species. The USACE maintains the conclusion of no potential effects on any listed species or designated critical habitat.

4.6.9 PROPOSED ACTION

Maintenance dredging of the Federal navigation channel prism and small boat basin described above at an interval of approximately two years, of a volume of up to 100,000 cy, via hydraulic pipeline dredge with dredged material placed at the beneficial use Site B as described above, as well as transport and placement at First Beach following dewatering at Site A.

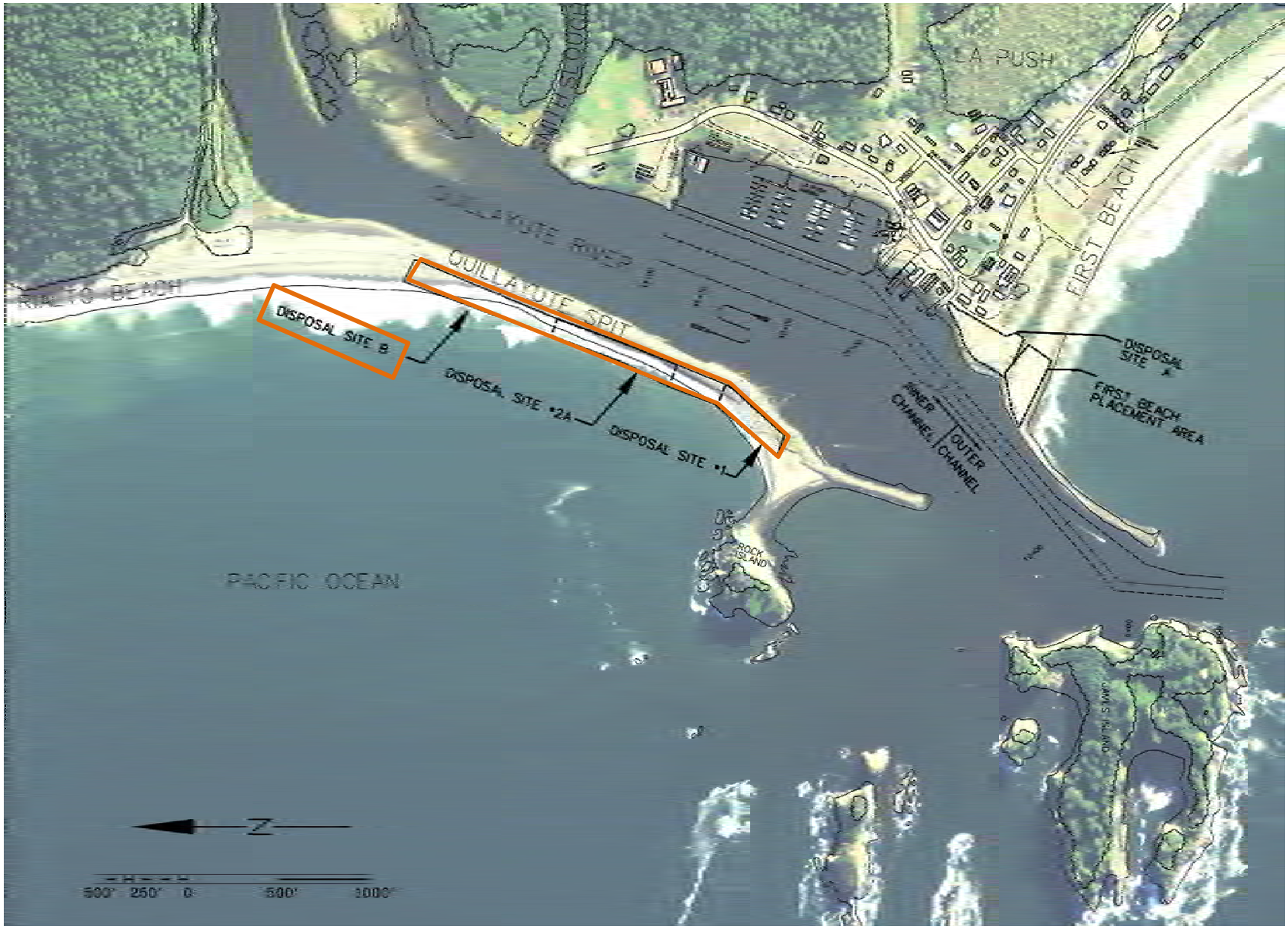

Figure 13. Quillayute River Navigation Channel routine maintenance dredging and disposal project area configuration as of 2016.

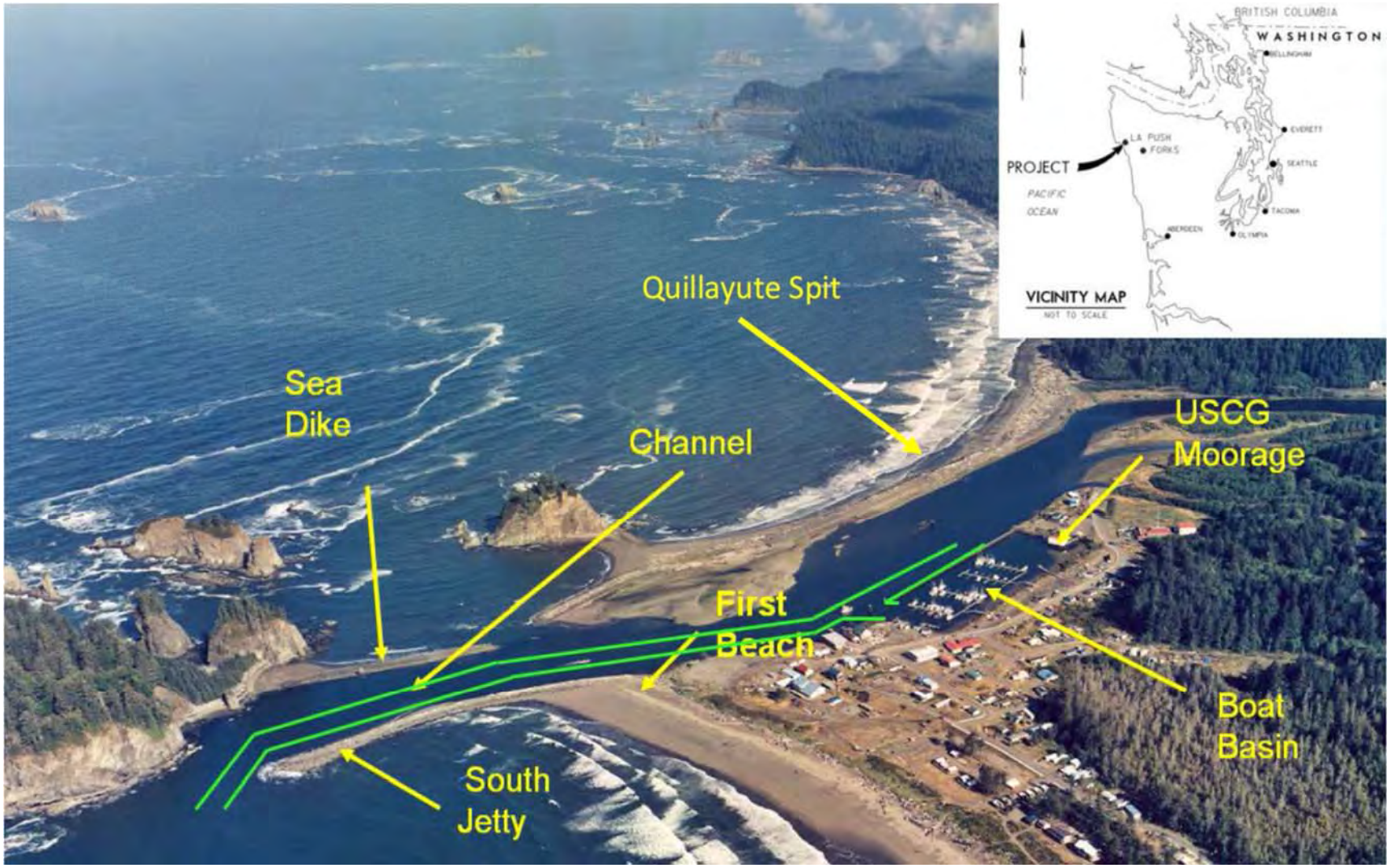

Figure 14. Federally authorized navigation features at the Quillayute River estuary, La Push, Washington.

4.7 Grays Harbor Navigation Channel

4.7.1 PROJECT NAME

Grays Harbor and Chehalis River Federal Navigation Project

4.7.2 AUTHORIZATION

Improvements at Grays Harbor and the bar entrance were first authorized in the Rivers and Harbors Act of 1896 (54th Congress, Session 1). The Grays Harbor and Chehalis River project was adopted 30 August 1935 (74th Congress, Session 1). The 1935 Rivers and Harbors Act combines former projects "Grays Harbor and Bar entrance" and "Grays Harbor, Inner Portion and Chehalis River," adopted by Acts of 3 June 1896, 2 March 1907, 25 June 1910, 8 August 1917, 21 January 1927, and 3 July 1930, and modified 2 March 1945, 30 June 1948, and 3 September 1954. More recently, dredging the navigation channel to −38 feet MLLW was authorized as the Navigation Improvement Project by Congress in Section 202 of the Water Resources Development Act of 1986 (Public Law 99-662). However, only three outer reaches were deepened to their authorized depths at that time; execution of deepening of the remainder of the reaches was initiated in 2016 after a Limited Reevaluation Report and Supplemental Environmental Impact Statement (LRR-SEIS) was completed in 2014.

4.7.3 LOCATION

Grays Harbor is located 50 miles west of the city of Olympia on the southwest coast of Washington, approximately 110 miles south of the entrance to the Strait of Juan de Fuca and 45 miles north of the mouth of the Columbia River. The cities of Aberdeen, Hoquiam, Ocean Shores, and Westport are located within Grays Harbor (Figure 15).

4.7.4 PROJECT DESCRIPTION

Project Area and Action Area

Grays Harbor is a large estuary and the Chehalis River flows into its eastern end where the city of Aberdeen sits on the north bank with the city of Hoquiam immediately to the northwest. The Hoquiam and Humptulips Rivers also flow into Grays Harbor. Two long peninsulas ending at Point Brown on the north and Point Chehalis on the south separate the estuary from the Pacific Ocean. The Federal navigation channel traverses Grays Harbor, providing shipping access between the Pacific Ocean and the lower reaches of the Chehalis River where the cities of Aberdeen, Hoquiam, and Cosmopolis are located. The 23.5-mile channel is divided into nine distinct reaches with two turning basins (Figure 16 and Figure 17).

The affected action area includes the maintained navigation channel in the lower mainstem Chehalis River and transecting Grays Harbor, an area extending laterally 1,500 feet from each edge of the navigation channel to allow for underwater noise attenuation (Clarke et al. 2002), and a one-mile radius into the Pacific Ocean off the entrance to Grays Harbor. Turbidity effects typically dissipate within 600 feet downcurrent from the dredging operation; this affected area is therefore much smaller than the potential underwater noise effects. The channel is approximately 940 acres and occupies about 1.3 percent of the approximately 74,000 acres of the Grays Harbor estuary, which is dominated by mudflats and shallow water habitats.

Purpose

The purpose of the project is to maintain congressionally authorized project depths to provide safe navigation and wide turning areas for large ships while they traverse Grays Harbor from the Pacific Ocean to the Port of Grays Harbor. This project maintains the ability of large ocean-going vessels to enter and leave the Port of Grays Harbor safely. Operations at the Port of Grays Harbor are important to the local economy directly and indirectly providing hundreds of local jobs. The local economy is historically tied to forest products shipped to domestic and international markets. More recently, the Port of Grays Harbor has improved rail access and terminal facilities for grain exports and other bulk cargo.

Navigation Features

The authorized project at Grays Harbor includes the following navigation features:

- Navigation channel from deep water including an entrance across the bar in Grays Harbor to Cow Point; the maintained length is 23.5 miles
- Cow Point and Elliott Slough Turning basins
- South jetty 13,374 feet long, elevation +16 feet MLLW
- North jetty 17,200 feet long, elevation +16 feet MLLW
- Point Chehalis revetment and groins
- The breakwater at Westhaven Cove Marina

Two feet of allowable overdepth may occur during dredging; routine maintenance dredging may include an additional two feet of advance maintenance.

4.7.5 DREDGE AND DISPOSAL METHODS, QUANTITIES, FREQUENCY, AND DURATION

Maintenance dredging has been conducted with mechanical (clamshell), hopper, and hydraulic pipeline dredges. A clamshell dredges the inner harbor (Outer Crossover Reach and eastward). A hopper dredges the outer harbor (Outer Crossover Reach and westward) because rough water conditions preclude the use of a clamshell dredge. A hopper dredge with pump-ashore capability may place material if needed in the Point Chehalis Revetment Extension Mitigation Site. Table 4 provides the average quantities, frequency, and duration for dredging each reach of the channel; it also provides the channel prism dimensions, including applicable allowable overdepth and advance maintenance depth dimensions. The average volume anticipated to be dredged annually is up to 3,700,000 cy, the maximum volume is 4,400,000 cy. Quantities have been estimated conservatively for environmental impacts analysis and would include the amount dredged for two feet of advance maintenance in any dredging episode in which the need is executed. The seven reaches dredged annually include Cow Point and the Cow Point Turning Basin, Hoquiam, North Channel, Inner and Outer Crossover, South Reach, and Entrance/Point Chehalis Reach.

Table 4. Details of Grays Harbor Navigation Channel maintenance dredging organized by reach.

Reach	Volume (cubic yards)	Sediment Type	Dredge Type	Channel Dimensions[1]	Disposal Area(s)	Work Closures	Work Scheduled
S. Aberdeen	~150,000 Semi decadal	silt / sand	clamshell	-32' MLLW 200-300' wide	South Jetty or Point Chehalis[2]	15 Feb to 15 July	16 July to 14 Feb
Elliott Slough Turning Basin	~60,000 biennially	silt / sand	clamshell	-32' MLLW 350-550' wide	South Jetty or Point Chehalis[2]	15 Feb to 15 July	16 July to 14 Feb
Aberdeen	~200,000 Semi decadal	silt / sand	clamshell	-32' MLLW 200-300' wide	South Jetty or Point Chehalis[2]	15 Feb to 15 July	16 July to 14 Feb
Cow Point	~800,000 annually	sandy silt	clamshell	-38' MLLW 350-550' wide	South Jetty or Point Chehalis[2]	15 Feb to 15 July	16 July to 14 Feb
Cow Point Turning Basin	~300,000 annually	sandy silt	clamshell	-38' MLLW 350-950' wide	South Jetty or Point Chehalis[2]	15 Feb to 15 July	16 July to 14 Feb
Hoquiam	~500,000 annually	sandy silt	clamshell	-38' MLLW 350' wide	South Jetty or Point Chehalis[2]	15 Feb to 15 July	16 July to 14 Feb
North Channel	~300,000 annually	silty sand	clamshell	-38' MLLW 350' wide	Point Chehalis	15 Feb to 31 July	1 August to 14 Feb
Inner Crossover	~300,000 annually	silty sand	clamshell	-38' MLLW 350-450' wide	Point Chehalis	15 Feb to 31 July	1 August to 14 Feb
Outer Crossover	~300,000 annually	silty sand	hopper or clamshell	-38' MLLW 350' wide	Point Chehalis	hopper: 1 June to 31 March clamshell: 15 February to 31 July	hopper: April and May clamshell: 1 August to 14 February
South Reach	~300,000 annually	sand	hopper	-38' MLLW 350-450' wide	Point Chehalis or Half Moon Bay	1 July to 31 March	April to June
Entrance/ Point Chehalis	~900,000 annually	sand	hopper	-40' to -46' MLLW 600-900' wide	South Jetty, or Half Moon Bay or Point Chehalis	1 June to 31 March	April and May
Bar Channel	~300,000 annually	sand	hopper	-46' MLLW 900' wide	South Beach or South Jetty or 3.9 mile ocean site	1 June to 31 March	April and May

[1] Depths are authorized depths and do not include 2' advance maintenance or 2' overdepth allowance, except at South Aberdeen reach with 0' advance maintenance and 1' overdepth allowance and Elliott Slough Turning Basin with 3' advance maintenance for half of the channel. Widths are at channel bottom and do not include extra width at channel bends.

[2] Adverse weather/wave relief site.

[3] Volumes are based on historic shoaling rates and most recent condition surveys. Actual volumes dredged may be less than those in the table. Quantities have been added to the channels that are being deepened in 2016 based on those reported in the June 2014 LRR-SEIS.

4.7.6 DISPOSAL SITES

Disposal occurs at two open-water placement sites, two nearshore aquatic sites, and one upland site. The Point Chehalis and South Jetty Open-Water Placement sites are multi-user aquatic sites and are the subject of independent consultation. The nearshore aquatic sites are the Half Moon Bay site and the South Beach site. The Point Chehalis Revetment Extension Mitigation site is an upland site.

The purpose of placement at the Half Moon Bay and Mitigation sites is to maintain a stable beach profile west of the Point Chehalis revetment extension constructed in 1999 and to ensure that the armor stone toe of the revetment extension is not exposed to wave action. The Mitigation site is located above the mean higher high water (MHHW) elevation (+9 feet MLLW at this location), but sand from the site erodes into Half Moon Bay during high tide and storm events. Following placement, the material erodes through natural processes and enters the nearshore zone and thus the littoral system. Material is placed in the South Beach nearshore aquatic site for beneficial use to return material to the nearby longshore drift system. The purpose of placement at this site is to slow beach erosion on the south side of the South Jetty resulting from the interruption of longshore sediment transport by the two jetties at the mouth of Grays Harbor. Section 5.4 describes the use of these sites in detail.

4.7.7 IN-WATER WORK WINDOW

The in-water work windows vary by reach and method of dredging and occur as follows:

<u>Inner Harbor Reaches (clamshell)</u>

- South Aberdeen, Cow Point, Cow Point Turning Basin, Elliott Slough Turning Basin, and Hoquiam window is 16 July through 14 February
- North Channel and all of Crossover window is 1 August to 14 February

<u>Outer Harbor Reaches (hopper)</u>

- Outer Crossover, Entrance, Point Chehalis, and Bar Channel window is 1 April to 31 May
- South Reach window is 1 April through 30 June

Outer Crossover Reach may be dredged by either clamshell or hopper dredge depending on the timing of execution of the dredging, the quantity of shoaling since the last maintenance event, and the availability of specific dredging equipment when needed. Whichever equipment is employed, it would adhere to the applicable work window as listed above.

4.7.8 CONSULTATION HISTORY

The USACE conducted ESA Section 7 consultations with the Services for the maintenance dredging program in 2006 (NMFS #NWR-2006-03926; USFWS #1-3-06-I-0469), and in 2011 (NMFS #NWR-2011-2093; USFWS #13410-2011-0274). The Services concurred with the USACE's determinations of "may affect, not likely to adversely affect" for all listed species and critical habitat covered by this consultation. The 2011 consultation covered maintenance dredging of the GHNIP from 2011 through 2026 (USACE 2011b); however, there have been project modifications since 2011. In 2012, the USACE proposed to make alternative use of clamshell dredging in the Outer Crossover Reach, an area previously hopper dredged, and the Services

concurred with the USACE determinations of "may affect, not likely to adversely affect" for designated critical habitat and all the listed species covered by the previous consultation (NMFS #2011/02093; USFWS #13410-2011-1-0274-R001). In 2013, the USACE reinitiated consultation on maintenance dredging for a minor realignment of the navigation channel that represents decreased quantities of dredging and disposal. The Services concurred with the USACE's determination of "may affect, not likely to adversely affect" for all of the species in the previous consultations as well as for the recently listed streaked horned lark (NMFS #WCR-2013-68; USFWS #13410-2011-I-0274-R002). In March 2014, the USACE consulted the Services on effects of the Navigation Improvement Project; the Services concurred with the USACE's determination of "may affect, not likely to adversely affect" for all listed species and critical habitat covered by this consultation (NMFS #WCR-2014-476; USFWS #01EWFW00-2014-1-0444). This consultation applies to the deepening construction as well as maintenance of these reaches at the deepened depths through 2026. Therefore, the deepened navigation channel is part of the baseline conditions analyzed in this consultation. Consultation in this document is intended to extend the post-deepening consultation coverage from 2026 through 2042.

4.7.9 ACTION CONSULTED UPON

Maintenance dredging of the 23.5-mile channel prism described above at an annual interval, of a volume of up to 4,400,000 cy, via clamshell and hopper dredge with dredged material placed at one of the multi-user or beneficial use sites described above.

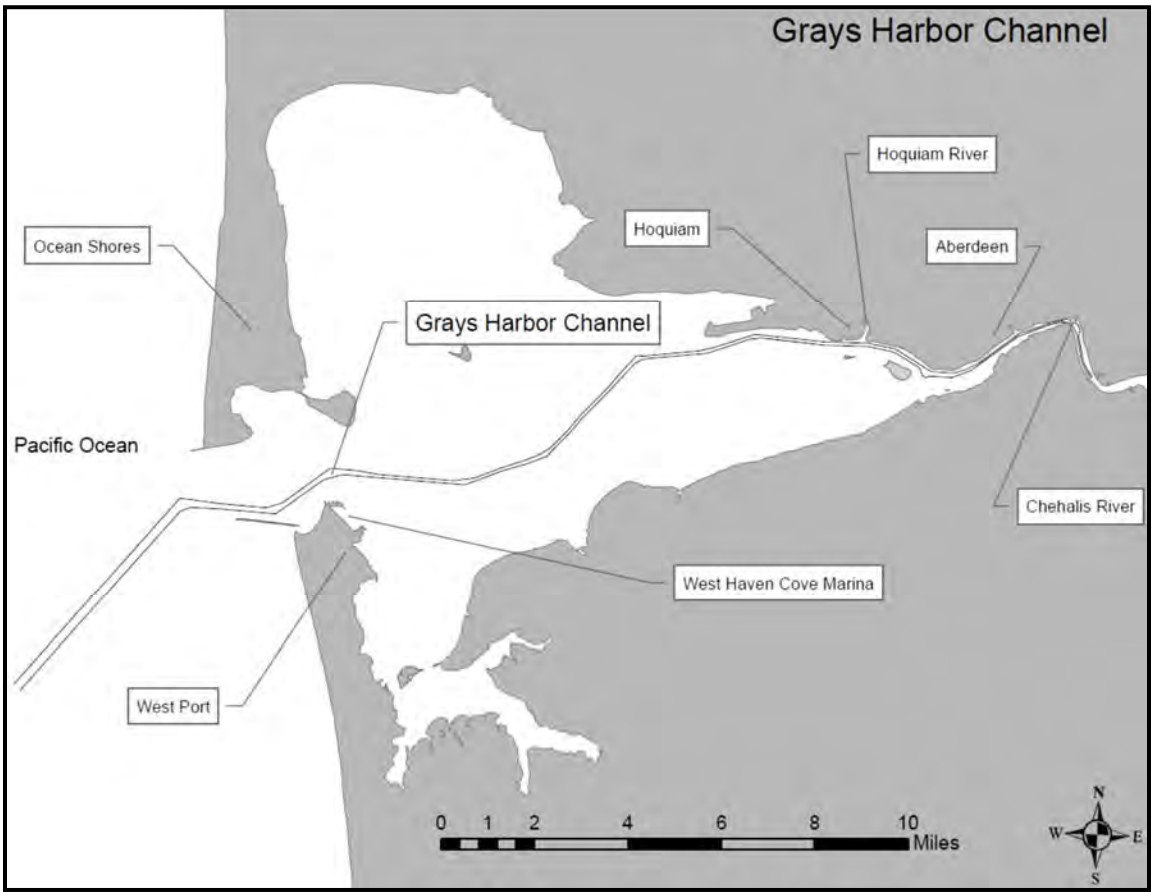

Figure 15. Grays Harbor Navigation Channel and surrounding cities.

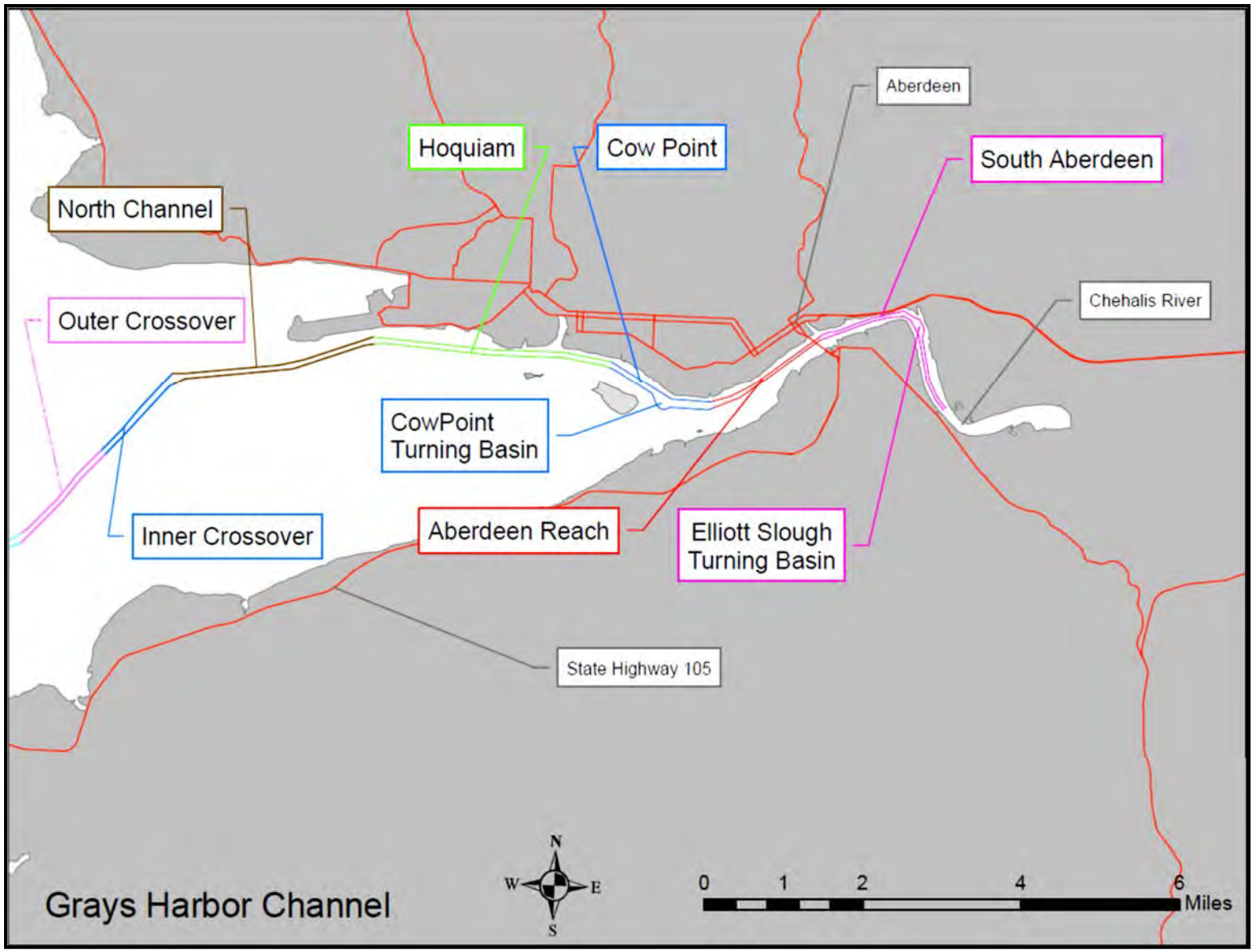

Figure 16. Inner harbor reaches of Grays Harbor Channel.

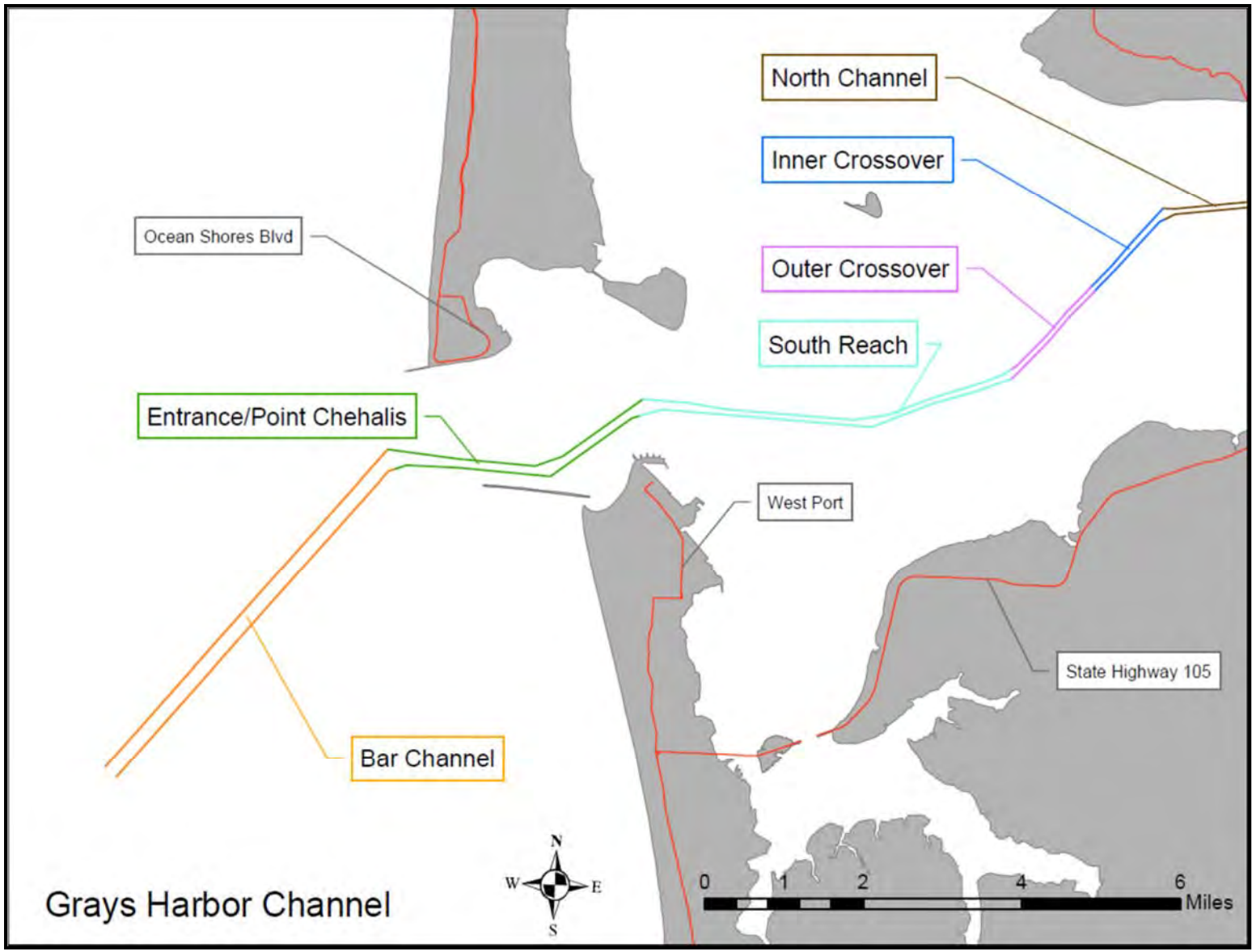

Figure 17. Outer harbor reaches of Grays Harbor Channel.

4.8 Westhaven Cove Small Boat Basin Entrance Channels

4.8.1 PROJECT NAME

Westhaven Cove Small Boat Basin

4.8.2 AUTHORIZATION

Breakwater facilities enclosing the Westhaven Cove Small Boat Basin were authorized by the Rivers and Harbors Act of 30 June 1948 (Pub. Law 80-858, 80th Congress, 2nd Session). Once the Port of Grays Harbor completed construction of the initial (northwest) entrance channel and the first component of berthing facilities within the boat basin in 1952, the United States assumed thereafter the obligation to maintain that 100-foot-wide entrance channel to a depth of -16 feet MLW. Under the authority of Section 107 of the Rivers and Harbors Act of 1960 (Pub. Law 86-695, 86th Congress, 2nd Session), as amended, in 1979 the Corps constructed a second (southeast) entrance channel, a central access channel within the boat basin, and a turning basin, along with additional improvements to the breakwater facilities. All channel segments and the turning basin footprint are maintained to an authorized depth of -16 feet MLLW.

4.8.3 LOCATION

Westhaven Cove is located near Point Chehalis on the east shore of Westport, Grays Harbor County, Washington. The harbor is home to Westport Marina and USCG Station Grays Harbor (Figure 18).

4.8.4 PROJECT DESCRIPTION

Project Area and Action Area

The project area of the navigation channel is approximately 9 acres. The action area is Westhaven Cove Marina and extending one mile into Grays Harbor adjacent to the entrance channels in all directions.

Purpose

The purpose for the project is to maintain authorized depths at the two entrance channels to the Westport Marina and USCG station for safe transit of vessels. Maintenance of safe navigation through the entrance channels, single access channel, and turning basin is important because the fishing fleet moored in this marina is critical to the local economy.

Navigation Features

Westhaven Cove includes the Northwest Entrance Channel, Southeast Entrance Channel, an access channel to marina slips, and a turning basin in the southeast corner of the marina at the USCG station. The entrance channels are 100 to 200 feet wide and 16 feet deep plus two feet allowable overdepth during dredging; routine maintenance dredging may include an additional two feet of advance maintenance.

4.8.5 DREDGE AND DISPOSAL METHODS, QUANTITIES, FREQUENCY, AND DURATION

Dredging may be conducted by either clamshell or hydraulic dredging method at this site. Hydraulic transport of material to the open-water Point Chehalis aquatic disposal site would be

conducted via either a floating or submerged pipeline. The USACE estimates a need for removing up to 75,000 cy of sediment from both entrance and access channels and turning basin over each 10-year dredging interval. For each dredging event, the work would take approximately 14 to 21 days.

4.8.6 DISPOSAL SITES

Material dredged from Westhaven Cove that is suitable for unconfined open-water disposal would be placed at either the Point Chehalis or the South Jetty dispersive open-water disposal sites.

4.8.7 IN-WATER WORK WINDOW

The in-water work window for the Westhaven Cove Small Boat Basin is 16 July through 31 January for Tidal Reference Area 15 at Westport.

4.8.8 CONSULTATION HISTORY

This project has no ESA consultation history.

4.8.9 ACTION CONSULTED UPON

Maintenance dredging of the channel prism described above at an interval of approximately 10 years, of a volume of up to 75,000 cy, via clamshell or hydraulic pipeline dredge with dredged material placed at one of the Grays Harbor aquatic multi-user sites described above.

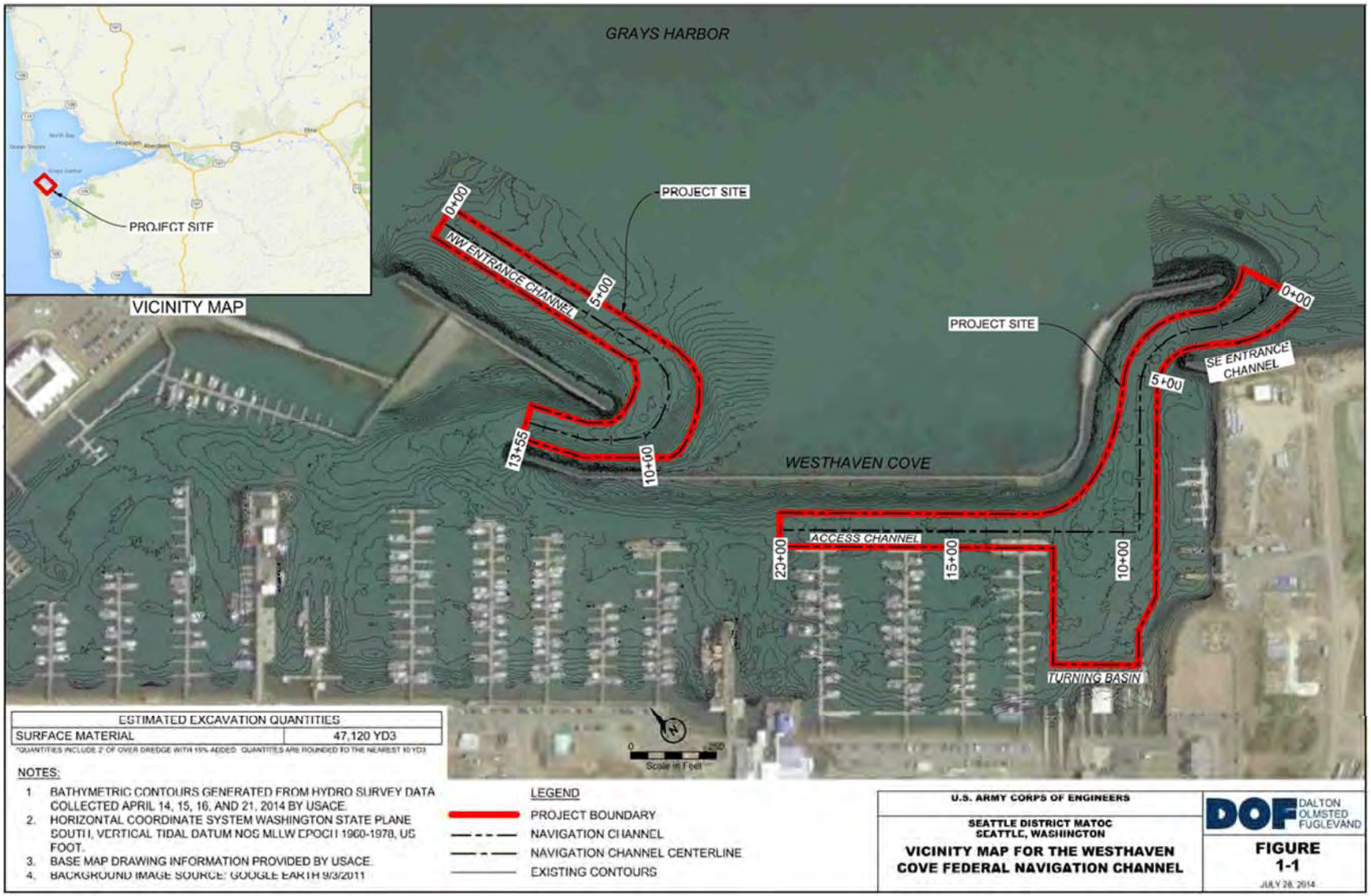

Figure 18. Navigation channels at Westhaven Cove Marina in Westport, Washington.

5 PROPOSED ACTION: BENEFICIAL USE DREDGED MATERIAL DISPOSAL SITES

There are 10 beneficial use disposal sites in Western Washington (Table 5, **Figure 19**). There are two upland and one nearshore disposal sites in the Snohomish River delta at Everett, one nearshore disposal site adjacent to Keystone Harbor, three upland and nearshore sites adjacent to the mouth of the Quillayute River, and one upland and two nearshore disposal sites at the entrance to Grays Harbor. Locations are covered in detail in the following sections.

Table 5. Beneficial use dredged material disposal site locations, disposal type, and disposal technique.

Location	Disposal Site	Disposal Site Type	Disposal Technique
Everett	Jetty Island	Upland and nearshore zone; beneficial use for beach nourishment	Hydraulic Pipeline, place onshore
Everett	Riverside	Upland beneficial use	Hydraulic Pipeline, place onshore
Everett	Site "O"	Upland beneficial use	Hydraulic Pipeline, place onshore
Keystone	Keystone Beach	Upland and nearshore zone; beneficial use for beach nourishment	Transport barge and front end loader; or hydraulic pipeline, place onshore
Quillayute	Site A	Upland beneficial use	Hydraulic Pipeline, place onshore
Quillayute	Site B (formerly sites 1 and 2A)	Upland and nearshore zone; beneficial use for beach nourishment	Hydraulic Pipeline, place onshore
Quillayute	First Beach	Upland and nearshore zone; beneficial use for beach nourishment	Material moved from Site A via bulldozer
Grays Harbor	Half Moon Bay	Nearshore placement; beneficial use for shoreline nourishment	Hopper Dredge
Grays Harbor	South Beach	Nearshore placement; beneficial use for shoreline nourishment	Hopper Dredge
Grays Harbor	Point Chehalis Revetment Extension Mitigation Site	Upland beneficial use	Pump ashore via Hopper Dredge

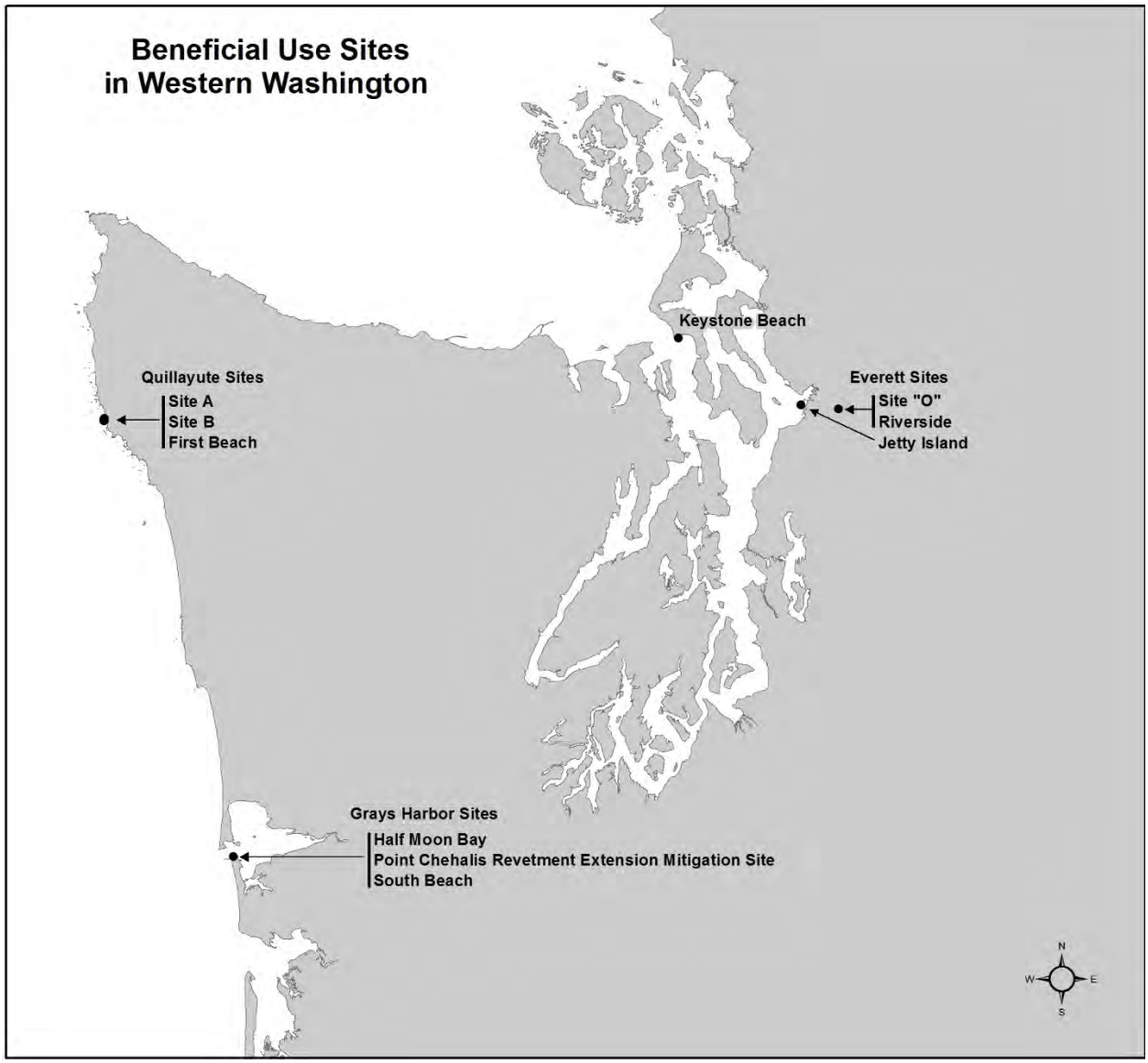

Figure 19. Beneficial use disposal sites used during maintenance dredging in Western Washington.

Some navigation channels contain material that is unsuitable for open-water disposal. This consultation only extends to suitable dredge material and any required dredging of unsuitable material will trigger a separate Section 7 consultation obligation.

Some disposal sites are situated so that placement of clean dredged material contributes to the environment (beneficial use of dredged material). Possible uses include placing material to enhance beaches, replace eroded shoreline, soften armored shoreline, etc. Some dredged material is sufficiently clean that it is useful in 1) containing (capping) contaminated material; 2) nourishment of beaches and drift cells; and 3) creation of shallow water habitat. Sediment used for capping of contaminated material is not a part of this proposed action and would be addressed in a separate consultation.

Table 6. Amount of material placed in each Western Washington beneficial use dredged disposal site from 2003 through 2015

Location	Disposal site	Volume in cy
Keystone Harbor	Keystone Beach nearshore zone and upland	119,251
Snohomish	Jetty Island nearshore zone and upland	423,317
Snohomish	Riverside upland	125,000
Snohomish	Site "O" upland	256,389
Quillayute	Site 1 nearshore zone and upland	88,672
Quillayute	Site 2A nearshore zone and upland	134,406
Quillayute	Site A upland	32,575
Quillayute	First Beach nearshore zone	5,000
Grays Harbor	Half Moon Bay nearshore zone	1,481,845
Grays Harbor	South Beach nearshore zone	2,049,484
Grays Harbor	Point Chehalis Revetment Extension Mitigation Site upland	135,705

Quillayute sites 1 and 2A will be combined into one large site, renamed site B, for future disposal actions.

5.1 Snohomish River Beneficial Use Disposal Sites

There are three beneficial use disposal sites at Port Gardner in the Snohomish River delta area adjacent to the City of Everett. These include Jetty Island, Riverside, and Site “O” (Figure 20). Table 6 lists the amount of material placed in each disposal site since 2003. Jetty Island is an example of beneficial use of dredge material. Jetty Island was artificially created by disposing material on the western side of a rock and wood revetment that protected the Everett shoreline. The sandy dredged material that constitutes Jetty Island is indistinguishable from the material that makes up the Snohomish River delta, thus Jetty Island provides increased natural habitat.

5.1.1 Jetty Island Beneficial Use Disposal Site

The location of Jetty Island appears in Figure 20. Jetty Island was created by placing dredged material on the west side of a wood jetty originally constructed to protect the Everett commercial waterfront from storm waves (Figure 21). Based on available records, the USACE constructed a wood pile jetty in 1901 (some of the wood jetty was later replaced with rock) seaward of the portion of the Port of Everett that was exposed to the open waters of Port Gardner. Dredged material removed from the adjacent navigation channel between the Port of Everett and the jetty was placed on the west side of the wood/rock jetty as a disposal site; this began in about 1903. Subsequently Jetty Island grew from these beginnings and eventually buried most of the jetty, except for the southern end, which is still exposed. Thus, Jetty Island came about because of disposal of maintenance-dredged material. Figure 21 is a picture of the Everett waterfront taken in 1902 showing the jetty.

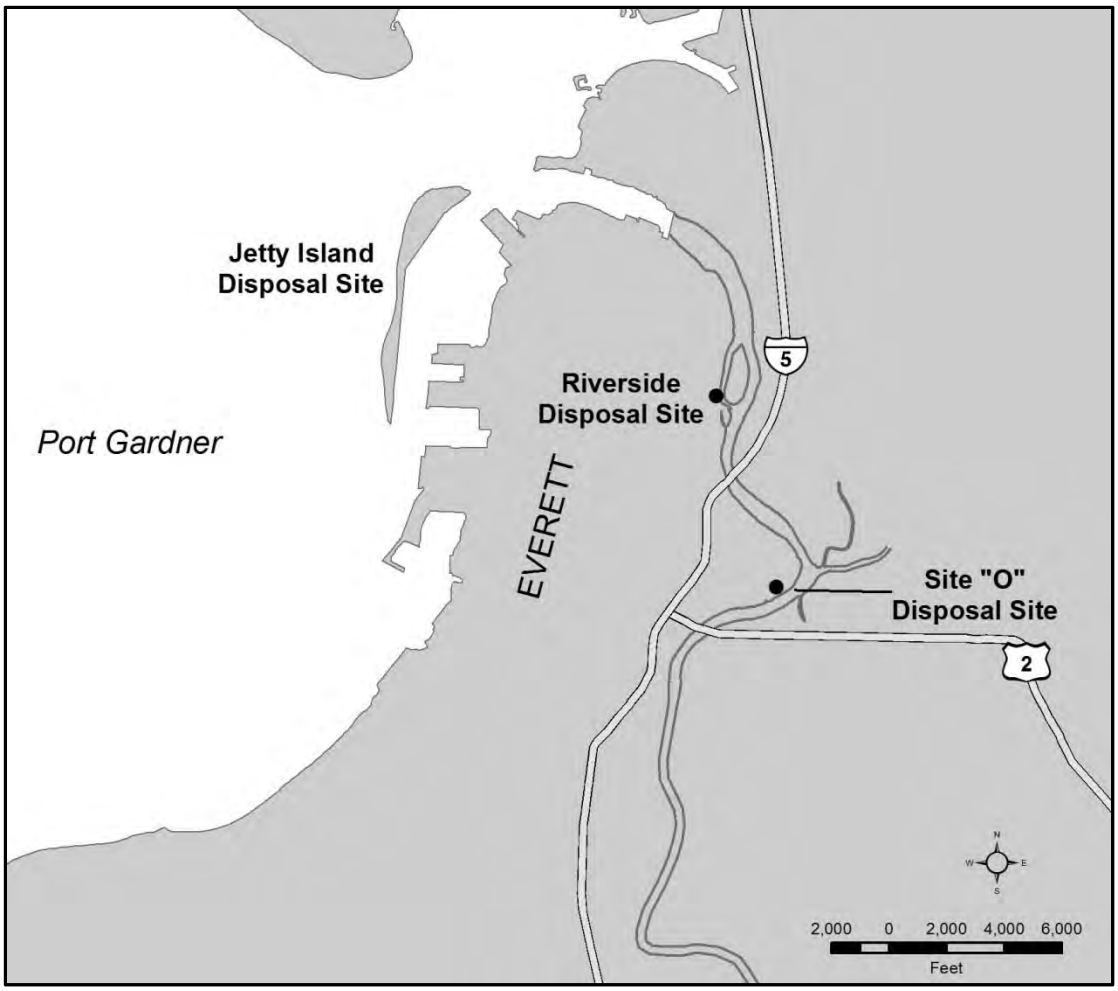

Figure 20. Port Gardner (Everett) beneficial use disposal site locations. The Jetty Island disposal site is generally the southern half of the island.

Placement of material on Jetty Island is considered beneficial use of dredged material. The primary purposes for placing material on Jetty Island are for stabilization of the jetty and for suppression of the nonnative, invasive Scot's broom (*Cytisus scoparius*). Additionally, the sediment is beneficial for salmon habitat. Nearshore habitat has been identified as a limiting factor for salmon recovery in this basin; therefore, material is occasionally placed at Jetty Island as beneficial use in the nearshore zone. Dredged material (typically sand) is placed on the island via a hydraulic pipeline dredge. The USACE and the Port of Everett placed approximately 323,000 cy of clean sediment along the western portion of the island in 1989 as a 1,500-foot long berm to balance erosion losses from the west side of the island and to create protected intertidal marsh and mudflat habitat as well as a lagoon to enhance species diversity and provide salmon habitat. Monitoring has shown the berm has created valuable mudflat habitat for benthic invertebrates that improved the food supply and habitat value of Jetty Island for juvenile salmon, forage fish, and shore birds (Pentec 2000). However, since there is no natural source of sediment to nourish the berm, continued nourishment of the berm will be necessary to prevent its gradual erosion and to maintain the habitats created by the berm and adjacent areas of Jetty Island.

Figure 21. Everett waterfront in 1902 showing the jetty before it was buried with dredge material creating Jetty Island, which protects the exposed waterfront.

The project area is Jetty Island, the shoreline out to -30 feet MLLW on the marine side, and the adjacent mouth of the Snohomish River. Placement of dredged materials occurs from the top of the existing beach at an approximate elevation of +15 downslope to +1 feet MLLW with a 10:1 slope tying into the existing grade of adjacent beach (Figure 22). Placement is unconfined in the nearshore zone and materials are allowed to settle out and naturally disperse. Up to about 1,250,000 cy could be placed in the disposal site over the next 25 years. Jetty Island disposal is typically conducted biennially, although the frequency could vary based on factors such as shoaling rates and available budget. Up to 40,000 cy is expected to be placed at Jetty Island per episode. The in-water work window as approved by NMFS is 16 October through 14 February to protect juvenile Chinook salmon and bull trout.

The pipeline placed across Jetty Island normally runs along a public path to minimize effects to vegetation. The pipeline route avoids the high salt marsh located several hundred feet to the north. Dredged material is placed only on uplands dominated by grasses, as well as the supratidal and upper intertidal zones, and the grasses are replanted following placement of the dredged material. However, the path is often flooded under several feet of water and requires placing the pipe farther north through the uplands dominated by Scot's broom. No impacts to aquatic vegetation or other habitats in the nearshore zone will result from placement of dredged material on Jetty Island.

Figure 22. Dredged material placement area on Jetty Island.

5.1.2 Riverside Disposal Site

The Riverside Disposal site is located on the left bank of the Snohomish River at about river mile 4.8 (Figure 20). Sediment hydraulically dredged from the upstream settling basin and adjacent portion of the channel would be placed directly onto the 8-acre southern portion of the Riverside Business Park. The material is subsequently collected and moved via truck by the Port for use at the Riverside site or other regional sites in need of fill material. Up to about 350,000 cy could be placed in the disposal site over the next 25 years. Disposal at the Riverside site is typically biennial, although the frequency can vary based on factors such as shoaling rates and available budget. Up to 40,000 cy is expected to be placed at the Riverside site per episode. A small work vessel tows a plastic pipeline to the site during high tide. A wire rope or strap attached to the pipe allows a dozer to pull the pipe up and over the containment berm, which has been constructed with on-site materials. The hydraulic pipeline extends from the dredge positioned in the upper settling basin, runs along the left bank river channel, over the salt marsh and riparian berm, and into the Riverside site. Dredged material composed of a slurry of sediment and water is pumped from the dredge to the site. Turbidity levels of discharged decant water are monitored and managed in accordance with the conditions of the CWA Section 401 water quality certification issued by the Washington Department of Ecology.

Dredgers take great care during placement of the pipeline to minimize impacts to intertidal salt marsh and riparian vegetation along the shoreline to the greatest extent feasible. The salt marsh plants will be in winter dormancy during the approximately three- to four-week period when the pipeline would be resting on the marsh and the pipeline does not move once in place. Berms of sand surrounding the basin separate the dredged material from the riparian edge of the river by containing the water/sediment slurry. The disposal site is devoid of vegetation except for upland grasses, slopes gradually downward to the north. The slurry slowly flows downgradient toward the outlet weirs. As the sediment settles out, the water continues flowing until the water flows through a system of weirs and returns to the river. The Port of Everett determines the ultimate fate of the material.

The project area for this disposal site is the 8-acre Riverside beneficial use disposal site and the adjacent river for one mile downstream of the disposal site.

5.1.3 Site “O” Disposal Site

This site is located on the upland shore adjacent to the Snohomish River (Figure 20) at approximately river mile four. Sediment hydraulically dredged from the upstream settling basin in the Snohomish River and adjacent portion of the channel is placed directly onto the southeastern corner 9-acre portion of Site “O” (formerly known as Kimberly Clark log yard) site. The sediment is subsequently “re-handled’ (collected and moved via truck) by the City or Port for use at other regional sites in need of fill material. Up to 650,000 cy could be placed in the disposal site over the next 25 years. The method of placement is similar to the sediment placement at Riverside Business Park site (please see the Riverside section above); although Site “O” has no salt marsh. Site “O” disposal is typically conducted biennially, although the frequency could vary based on factors such as shoaling rates and available budget. Up to 150,000 cy is expected to be placed at the Site ”O” per episode. The City or Port of Everett determines the fate of the material placed in Site “O”.

The project area is the 9-acre portion of the Parcel "O" disposal site and the adjacent river for one mile downstream of the disposal site.

5.2 Keystone Beach Beneficial Use Disposal Site

Disposal of dredged material occurs on the previously used Keystone Beach disposal site (Figure 23), located on the shoreline just east of the jetty protecting the east side of the entrance channel to Keystone Harbor. The disposal site is approximately 2.5 acres in the supratidal and upper intertidal zone. All dredged material beneficially re-nourishes the section of the beach to the east of Keystone Harbor (Figure 24). The project area for the Keystone Beach disposal site is the area of the 2.5-acre disposal site, the shoreline out to -30 feet MLLW and continuing down current for one mile. The dredged material is placed during low tide to replace lost intertidal material when no ESA-listed species are present.

The method used to deposit material on the beach depends on the dredge equipment. With hydraulic dredging, the material is pumped to the beach area. To minimize effects to water quality from the discharge from hydraulic dredge, berms created from local material preclude effluent from flowing directly into Puget Sound before the water fraction filters through the berm. Dredged material is graded mechanically to match the natural beach profile and remove any mounds and depressions that may cause injuries to the public. With mechanical dredging, the sediment is loaded onto flat-deck barges. Once filled, the barges are pushed near the beach (grounding is not permitted), and the dredged material offloaded using the clamshell bucket to move the material onto the high ground staging area where any water remaining in the material quickly seeps into the porous substrate. Material is subsequently transported with terrestrial equipment (e.g. front end loader) to the nearby beach disposal site where no berms or dewatering methods are required due to the prior decanting on the barge and on shore. The approved in-water construction window is 16 July through 15 February. Up to 165,000 cy could be placed in the disposal site over the next 25 years, with up to 50,000 cy expected to be placed per episode.

Figure 23. Keystone Harbor and the adjacent Keystone Beach beneficial use disposal site.

Figure 24. Dredged material disposal area for beach nourishment to protect park infrastructure at risk of damage from shoreline erosion.

5.3 Quillayute River Beneficial Use Disposal Sites

All disposal sites at Quillayute are located in the nearshore zone or adjacent upland (Figure 13 in Chapter 4). Dredging is by hydraulic dredge allowing direct placement of material onto beneficial use disposal sites. Dredged material is used beneficially to maintain the spit that separates the lower portion of the Quillayute River from the Pacific Ocean. The Quillayute Spit runs parallel along the west bank of the lower Quillayute River, maintains the river in its current channel, and prevents Pacific Ocean waves from flooding the La Push boat basin and village. The beneficial placement of dredged material helps maintain the spit by replenishing the eroded sand adjacent to the structure. The dredged material placed onto the spit maintains the sediment balance within the system, maintaining spawning habitat for surf smelt and an additional benefit of providing protection to the navigation structures by reducing the erosive effects from ocean waves undermining the structures.

No ESA-listed species or designated critical habitat occur in the disposal sites. There are no potential effects from disposal on any listed species or designated critical habitat. These disposal sites are included in this BA for information only and provide a record of deposited dredged material.

The established work windows for the disposal sites at the Quillayute River are 1 September through 28 February for Site A, 1 October through 28 February for new disposal Site B (formerly Sites 1 and 2A), and material cannot be placed on First Beach until after 1 November continuing through 28 February.

5.3.1 Former Disposal Sites 1 and 2A

Former Site 1 is located on the western side of Quillayute spit and is used in conjunction with former Site 2A for placement of material on the spit (Figure 13). This location is used to keep riverborne material within the nearshore environment and to enhance the integrity of Quillayute Spit. The two existing sites are approximately 300 feet apart and near the southern terminus of the spit. Site 1 is 1.2 areas and 2A is 1.61 acres. Dredged material placement is typically via hydraulic pipeline dredge with the outlet just over the crest of the jetty armoring and above MHHW (+8.45 feet MLLW at this location) to minimize suspended sediment in the water. Material that enters the water directly, primarily during higher tides, moves along by longshore currents and deposits in the intertidal zone further down current to the north. The names of these two sites are now obsolete as the USACE is proposing to combine and lengthen the disposal areas to become disposal Site B.

5.3.2 Disposal Site B

Wave action continues to damage various areas along the entire Quillayute spit, eroding material from the toe of the riprap. The USACE is proposing to merge Sites 1 and 2A, and increase the overall footprint to stretch from the northern end to the southern end of the riprapped spit. The new disposal site is designated Site B.

Site B will be approximately 3,000 feet long, 75 feet wide, with an area of approximately 6 acres. Up to 75,000 cy per dredge episode placed in various locations within Site B and up to 975,000 cy over the next 25 years assuming dredging occurs every two years. The focus for

each placement event will be limited to those areas identified in need of nourishment. The method of placement will continue to be that described for former Sites 1 and 2A.

Site B will keep riverborne material within the nearshore environment. The fate of the material will enhance the shoreline in the drift cell down current of the disposal site and buttress the protective spit. The area of analysis includes the 6-acre Site B, the marine shoreline out to -30 feet MLLW and continuing down current (northward) of the disposal site for 1 mile.

5.3.3 Disposal Site A

Site A is a 1.75-acre site on the Quileute Tribe's reservation at the southwest corner of the town of La Push (Figure 25). The portion of the area used for material placement has capacity for approximately 15,000 cy per placement episode. Up to 180,000 cy could be placed in the disposal site over the next 25 years. Dredged material is typically placed via hydraulic pipeline dredge. The contractor uses a dozer and/or excavator to create a suitably sized basin and then uses the onsite material to surround the basin with a berm. The basin inside the berm will be of sufficient size to allow turbid water to settle, before allowing the water to return to the Quillayute River through an outfall weir that directs the clean water onto riprap to prevent shoreline erosion. Turbidity levels of discharged decant water are monitored and managed in accordance with the conditions of the CWA Section 401 water quality certification issued by the Washington Department of Ecology. The material has been used by the Quileute Tribe for construction purposes in the past, but in recent years has been used at First Beach to protect the jetty root as described in the following section. Material at Site A may be placed after 1 November onto First Beach to protect the root of the south jetty that erodes during coastal storm events at the discretion of the USACE. Material that is not placed onto First Beach may be available for tribal reuse in upland areas.

The area of analysis for the Site A disposal site is the area of the 1.75-acre disposal site and the Quillayute River down current for one mile.

5.3.4 First Beach Disposal Site

Up to 15,000 cy of dredged material placed per episode in upland Site A is pushed onto the sloped bank at First Beach (Figure 25) with a dozer. The area of the First Beach site is 1.51 acres. Once fully decanted, the dredged material is transported over the top of the bank at First Beach down to where it intersects the shoreline, not to extend below MLLW. A dozer grades the material to a slope varying between 5:1 and 20:1 depending on height of the bank and quantity of available material. This placement is usually done during the month of November. Once in place, the material moves with natural erosive forces (wave action and longshore currents) to assume its final contours and sediment gradations. The material placed consists of sand with a small fraction of gravel and cobble from the outer river channel. The purpose of delaying the material placement until early November is twofold: 1) it will avoid surf smelt spawning and emergence, and 2) it will allow the material to dry for approximately one to two months. Placing dry material on the beach will prevent elevated levels of turbidity in the waters surrounding First Beach. In 2012, 5,000 cy was placed at this site. Up to 180,000 cy could be placed in this site over the next 25 years. The purpose for placement is to protect the south jetty at First Beach.

The area of analysis for the First Beach disposal site is the 1.51-acre disposal site and into the adjacent ocean waters out to -30 feet MLLW and continuing down current for one mile.

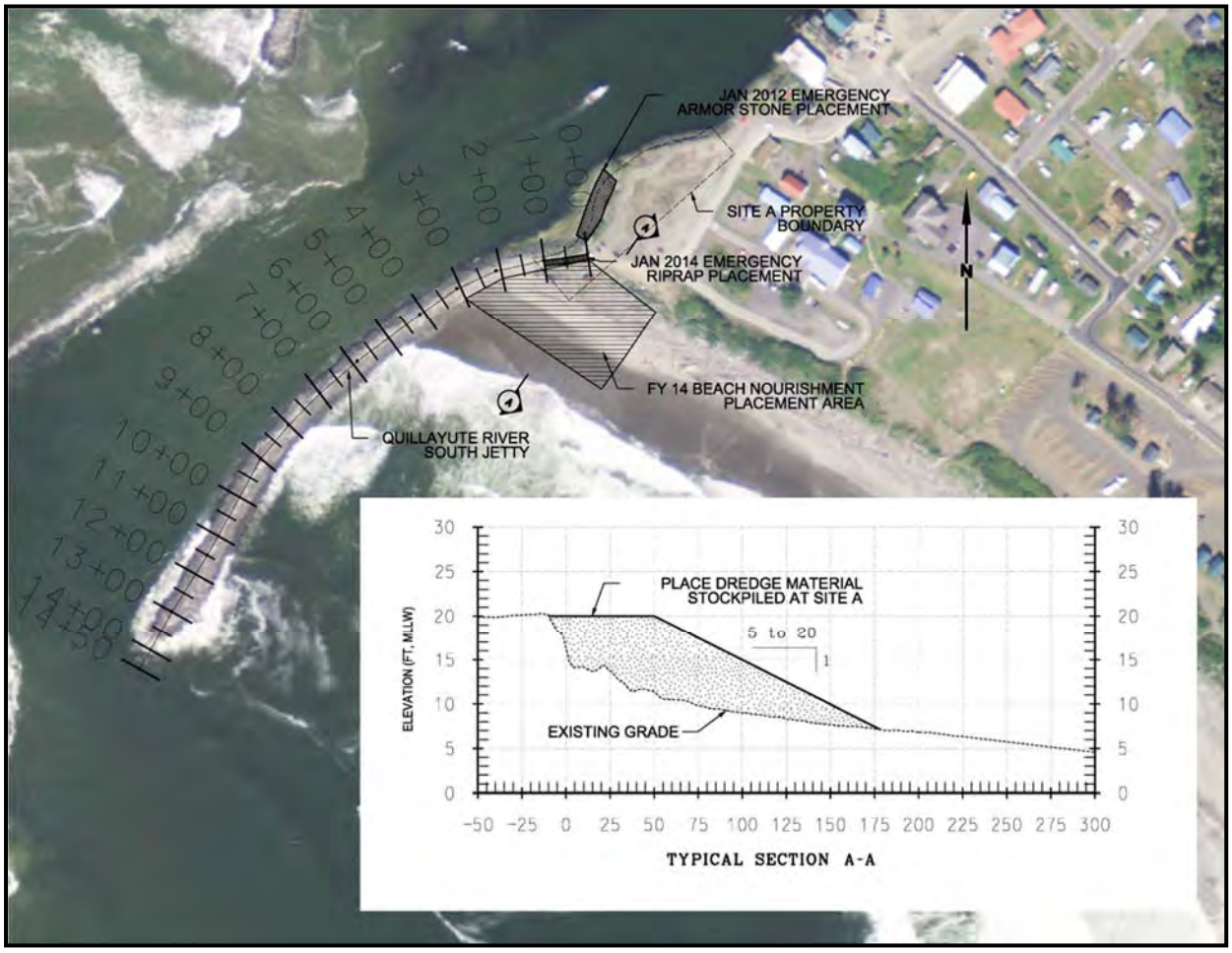

Figure 25. Location, footprint, and grading profile of material placed at First Beach.

5.4 Grays Harbor Beneficial Use Disposal Sites

The USACE places material at three beneficial use disposal sites in Grays Harbor. Two of these sites are subtidal nearshore zone (Half Moon Bay and South Beach) and one is upland at the Point Chehalis Revetment Extension Mitigation Site (Mitigation Site). Material placed in these sites is outer harbor material derived from marine sources (Figure 26). Disposal at these locations was discussed in the completed consultation document through 2026 (USACE 2011b) and a supplemental biological assessment with letters of concurrence for deepening and post-deepening maintenance in 2014. Consultation in this document is intended to extend the post-deepening consultation coverage from 2026 through 2042.

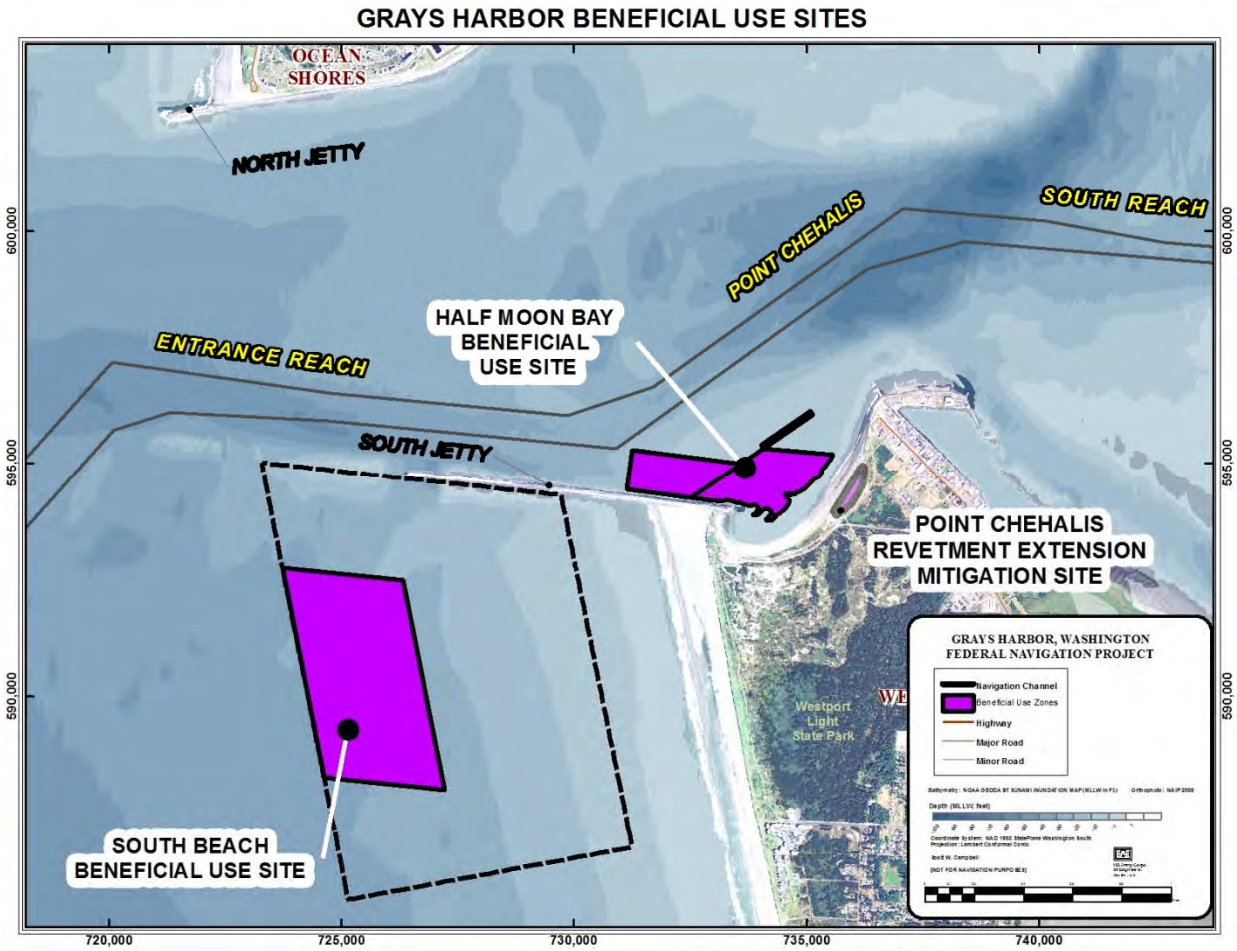

Figure 26. Grays Harbor Beneficial Use Sites.

Dredged material placed in the Half Moon Bay beneficial use site enhances the nearshore area of Half Moon Bay. South Beach beneficial use site is located in the Pacific Ocean adjacent to the South Jetty and just offshore of the beach in that area. Material placed in the South Beach site enters the littoral transport system and helps maintain the local beaches. The Mitigation Site is an upland site, located adjacent to the Half Moon Bay Beach. It is intended to maintain a stable beach profile and to ensure that the armor stone of the revetment extension is not exposed to wave action.

The determination of which disposal site will be used during the course of maintenance dredging is based on several factors, including the following:

- weather and wave conditions at the time of disposal;
- presence of commercial crab pots in a disposal site and/or access lane; and
- dredge capability to place material upland.

Dredged material placed in the beneficial use disposal sites is typically dredged and transported via hopper dredge, but could on occasion be dredged and transported via bottom dump barge where tugs move the bottom dump barges to and from the aquatic beneficial disposal sites.

The in-water work windows for aquatic disposal in Grays Harbor are shown in Table 4 in section 4.7.5. Work windows are primarily designated to protect juvenile salmonids, which occupy the shallow shoreline areas.

5.4.1 South Beach Site

The purpose of disposal at this site is to slow erosion on the south side of the South Jetty. This site is used only for deposition of material transported via hopper dredge. Ocean sea state conditions are sufficiently rough that only a hopper dredge can safely transport material to this site. The sandy dredged material is placed as close to shore as possible, generally between -35 feet and -40 feet MLLW. This location extends the residence time of dredged material in the nearshore littoral system while avoiding depositing material on productive crabbing areas. It replaces material that has been eroded by longshore currents. The area of this disposal site totals 1,223 acres. Material placed at this site adds to and benefits the longshore drift system. Up to 5,221,000 cy could be placed in the disposal site over the next 25 years with up to 600,000 cy expected to be placed per episode. The fate of the material is to become an integral part of the nearshore zone and local drift cell.

The project area for the South Beach nearshore disposal site is the 1,223 acres of the disposal site and into the adjacent ocean waters out to -50 feet MLLW from the beach continuing down current for one mile as well as the transit path between the dredging location and South Beach.

5.4.2 Half Moon Bay Site

Material is placed into the Half Moon Bay nearshore site and the Point Chehalis Revetment Extension Mitigation Site principally to comply with the mitigation obligations of keeping the Revetment Extension buried to ensure the armor stone is not exposed and maintaining a stable beach profile on the eastern shoreline of Half Moon Bay. The Half Moon Bay nearshore nourishment site is used for placement as bathymetric conditions permit (i.e., when the bay is deep enough for bottom-dump barges or hopper dredges to navigate). Typically, the USACE uses its shallowest draft hopper dredge (MV *Yaquina*) to place material via pumping a slurry through a pipeline from the dredge at the Half Moon Bay site. Dredged material is placed so that material will be transported, via natural processes, to the adjacent subtidal and intertidal areas to assist in maintaining a stable beach profile. The sandy dredged material from outer Grays Harbor is placed in Half Moon Bay as close to shore as possible so the material will enter the Half Moon Bay shoreline environment. The area of this disposal site totals 93 acres. Material placed at this site benefits the Half Moon Bay beach. Up to 100,000 yards could be placed yearly, as necessary, in this disposal site over the next 25 years. Material can be transported to this site by either hopper dredge or bottom dump barge, but hopper dredge is the typical transport vehicle. The fate of the material is for it to become part of the local nearshore littoral area and longshore drift cell.

The project area for the Half Moon Bay disposal site is the 93-acre disposal site and out to -30 feet MLLW continuing down current for 1 mile, which in this case is both directions because the currents change direction with ebb and flood; the project area includes the transit path between the dredging location and Half Moon Bay.

5.4.3 Point Chehalis Revetment Extension Mitigation Site

The upland Point Chehalis Revetment Extension mitigation site is recharged when feasible with material from a hopper dredge with hydraulic pump-ashore capability. The hopper dredge transits to a mooring dolphin within Half Moon Bay and hydraulically pumps dredged material via a floating or submerged pipeline into the mitigation site. The slurry of sand and water discharges to the area in front of the buried revetment. A sand berm/perimeter dike separates the discharge area from Half Moon Bay. The slurry of water and sand temporarily ponds in the placement site, and water is conveyed via effluent pipe into Grays Harbor at the exposed rock revetment near Groin A. Turbidity levels of discharged decant water are monitored and managed in accordance with the conditions of the CWA Section 401 water quality certification issued by the Washington Department of Ecology. The sandy dredged material quickly dewaters and a dozer grades the sand uniformly over the placement area. Marine-derived sandy dredged material is placed in the Mitigation Site located above +9 feet MLLW and is expected to subsequently erode through natural processes onto the intertidal beach area; portions of the material move farther into the nearshore zone and thus the littoral system. This site is intended to maintain a stable beach profile and to ensure that the armor stone of the revetment extension is not exposed to wave action; excess stockpiled material may be available for use as needed to repair damage caused by storm erosion at nearby locations.

Another means of pumping dredged material into the Mitigation Site would involve a booster pump anchored in Half Moon Bay. In this case, a pipeline from a hopper dredge or a barge would be attached to the booster pump for the final “push” onto the adjacent upland Mitigation Site.

The project area is the 4.6-acre Mitigation Site and out to -30 feet MLLW continuing down current for 1 mile, which in this case is both directions because the currents change direction with ebb and flood. Up to 374,000 cy could be placed in the Mitigation Site over the next 25 years. For a booster pump anchored in Half Moon Bay, the project area is a one-mile radius around an anchored booster pump and extending along the pipe to the shore in Half Moon Bay and an area of 100 feet on each side of the pile that crosses the shore to the Mitigation Site.

6 CONSERVATION MEASURES

Section 7(a)(1) of the ESA directs Federal agencies to use their authorities to further assist the purposes of the ESA by carrying out conservation programs for the benefit of the threatened and endangered species. During the formulation of the combined-projects approach to the maintenance-dredging program, a list of conservation measures was developed and incorporated into the program to reduce environmental impacts of dredging to ESA-listed species. These measures appear below:

1. The USACE will use a clamshell (mechanical) dredge whenever possible to minimize the possibility of entraining or otherwise harming ESA-listed species.
2. The clamshell dredging operation will be conducted in a manner that minimizes spillage of excess sediments from the dredge bucket and transport barge to minimize effects to water quality.
3. The USACE will conduct dredging operations during the prescribed work window. If this cannot be done due to extenuating circumstances, then the USACE will notify the Services and re-consult if necessary.
4. Maintenance dredging will be conducted based on the results of site-specific hydrographic condition surveys conducted for the year of dredging.
5. The USACE will obtain suitability determinations of the sediment following DMMP protocols for sediment disposal and beneficial use (beneficial use could trigger consultation with the Services if the disposal location is not included in this document). Material determined unsuitable for open-water disposal will be disposed at an approved upland site.
6. Barges used to transport the dredged material to the disposal or transfer sites will not be filled beyond their capacity so that they will completely contain the dredged material.
7. The USACE will require barge operators to maintain the seals on the bottom dump barges to minimize loss of sediment during transport.
8. The USACE will coordinate with the local Indian Tribes that have usual and accustomed fishing rights in each project area.
9. The USACE will coordinate with WRIA groups, per the Salmon Habitat Recovery Plan and other local restoration/stewardship groups, to identify individual and long-term opportunities for beneficial use of dredged material. If beneficial use opportunities are identified, and funds are available, then the USACE will consult with the Services on the beneficial use opportunities.
10. If killer whales approach active tugs towing barges, the tug will continue under power and at a safe speed to maintain safe control of the tug and barge(s). The USACE acknowledges the 2011 expansion of the required vessel separation zone around killer whales (76 FR 20870). Contract terms will define whether a hired vessel is considered

Federal or not, but in general, a tug with tow is considered limited in its maneuverability.

11. Bottom dump barges will not dump when killer whales are nearby; this is to eliminate the possibility of the material hitting a killer whale as it descends through the water column.
12. Hopper dredge dragheads and hydraulic pipeline dredge cutterheads shall not exceed three feet above the substrate with pumps running more than three times per eight hours of dredging.
13. Once the material has been removed, the material will not be dumped back into the water, except into a disposal or beneficial use site.

7 ENVIRONMENTAL BASELINE

The environmental baseline is the past and present impacts of all Federal, State, or private actions and other human activities in an action area, the anticipated impacts of all proposed Federal projects in an action area that have already undergone formal or early Section 7 consultation, and the impact of State or private actions that are contemporaneous with the consultation in process [50 CFR §402.02]. This section is an analysis of the effects of past and continuing human and natural factors leading to the status of the species, its habitat (including designated critical habitat) and ecosystem, within the action area. The environmental baseline is a "snapshot" of a species' health and that of its environment at the time a federal action is proposed. It includes the effects of dredging and disposal actions that have previously been consulted on and for which no new information or new circumstances apply. It does not include the future effects of the action under review in the consultation. Further future Federal actions that are not a direct effect of the action under consideration (and not included in the environmental baseline or treated as indirect effects) are not considered in this biological assessment.

The environmental baseline represents the set of environmental conditions, captured as of the consultation benchmark date, to which the direct and indirect effects of the proposed action would be added. For an ongoing Federal action previously subject to consultation[1], or otherwise compliant with ESA requirements at the time of the last Federal action, the environmental baseline comprises three components. The first environmental baseline component consists of those environmental effects resulting from past resource commitments, as of the benchmark date of the consultation. This component of the environmental baseline comprises the collective effects of past and continuing human activities "leading to the current status of the species, habitat (including designated critical habitat), and ecosystem, within the action area." This is the "snapshot" of species' health referenced in the Consultation Handbook. The second component of the environmental baseline pertaining to this ongoing agency action is composed of the unavoidable effects of the maintenance dredging and disposal actions on the species, their habitat and the ecosystem, throughout the period of analysis over which the effects of the proposed agency action are being evaluated, i.e., through 2042. The third component consists of the authorized species/habitat effects that have already been the subject of Section 7 consultation. These three environmental baseline components are discussed in more detail below.

Maintenance dredging has two major aspects: one is removal of accumulated sediment from navigation channels and harbors, and the second is disposal of the sediment once it is removed. The sections below describe the environmental baseline for maintenance dredge sites. This is followed by the general environmental baseline for beneficial use disposal sites.

For the purpose of this analysis, previously undertaken and completed resource commitments include construction of the features of the covered navigation projects themselves. These

[1] Not all of the dredging locations have been subject to Section 7 consultation, either because no action has been taken at a particular location since before the enactment of ESA, or because no action has been taken since listing of any species which might be affected by dredging at a particular location.

navigation project resource commitments predate the relevant listings/designations. The presence of these navigation project elements constitutes an "existing human activity" that, over the course of time prior to the inception of the proposed action, has generated effects on listed species and designated /proposed critical habitat. The effects generated by the existence of the navigation projects and their components are thus part of the environmental baseline. The environmental baseline also encompasses the collective effects of all operations and maintenance activities conducted prior to the date of this BA. These effects include, for instance, geomorphic changes stemming from construction and prior maintenance.

The second component of the environmental baseline extends to prospective effects inherent in the passive existence of the features of the navigation projects, distinct from the effects of any affirmative navigation project operations. The static existence of the structural features of these navigation projects has altered – and will continue to alter – tidal circulation patterns in action areas, and has modified their geomorphology, which has resulted in changes in physical conditions.

Because the environmental baseline of a continuing agency action like the existing navigation projects consists of more than a mere "snapshot" and must have a prospective component, it is critical to identify the dividing line that distinguishes future effects encompassed within the environmental baseline from the future effects of the proposed action. The dividing line between effects falling within the environmental baseline versus those proximately caused by the proposed action is found by identifying agency activities that involve the exercise of agency discretion.

The effects of non-discretionary activities fall outside the scope of direct and indirect effects proximately caused by agency action (50 CFR 402.03). The USACE cannot be considered the legal cause of effects of an action – or a condition or status – regarding which the agency lacks discretion. Because of this absence of causation, the effects of non-discretionary activities are outside the scope of effects of the proposed action. Because they are outside the scope of the impacts of the proposed action, the effects of those non-discretionary activities are encompassed within the environmental baseline. The continued existence and functional performance of the structural navigation project features, once they have been constructed, are non-discretionary.

Once a USACE civil works project has been implemented through construction, execution of the general congressional authorization of that project has been initiated. This inception of execution of the legislatively authorized purpose renders the continued accomplishment of the basic legislative purpose of that project non-discretionary. Once the navigation channel and other structural features have been constructed, absent subsequent congressional action, the USACE lacks discretion to remove those features, either through affirmative dismantling action or by allowing the structure to fall into functional disrepair through inaction or neglect.

Thus, as of the date of construction, the effects generated by the physical presence of the navigation project facilities are non-discretionary because the USACE retains no ability to adjust or eliminate those effects. These non-discretionary effects extend into the future, as well,

because by their very presence the features of the navigation projects will continue to cause impacts on the environment. In the context of an evaluation of ongoing operation and maintenance, "existence" is more than merely a static or finite concept that terminates as of commencement of the consulted-upon action. The existence of the navigation project structures continues to persist into the action period, and the effects of those structures' existence remains an element of the environmental baseline for analytical purposes throughout the action period.

The "existence" of each navigation project feature must necessarily also encompass the basic level of physical maintenance required to keep that structure intact and passively functional to meet its legislatively authorized purpose of providing a safe, reliable, and cost-effective navigation route consisting of prescribed dimensions. The responsibility to maintain civil works structures so that they continue to serve their congressionally authorized purposes is inherent in the authority to construct them in the first place. The responsibility to maintain each navigation project in a functionally intact condition is therefore nondiscretionary. Only a distinct congressional enactment expressly de-authorizing one or more elements of the navigation projects could terminate this responsibility and afford the USACE latitude to cease to maintain that structure. If, for analytical purposes, the navigation project was assumed to not be maintained in an intact state, and assumed to be allowed to degrade into a state of non-functionality during the action period, the concept of continued "existence" of a structure that predates listing would lose all relevant meaning.

The environmental baseline therefore includes the effects of the continued presence of the navigation project's elements, maintained to the extent necessary to remain structurally intact and functional to meet the legislative purpose of facilitating navigation. Because this body of effects is encompassed within the environmental baseline, non-discretionary maintenance processes necessary to keep the facilities structurally and functionally intact fall outside the scope of agency action subject to consultation. Individual maintenance processes that involve discretionary choices, on the other hand, fall outside the environmental baseline and are subject, as appropriate, to Section 7 consultation; these activities – to the extent they are not already addressed in previously concluded Section 7 consultations – are addressed in this BA as components of the proposed action.

The third component of effects constituting the environmental baseline in this supplemental consultation is those effects of maintenance dredging over the action period that have previously been addressed in consultations with the Services.

The Services' determination as to whether jeopardy or adverse modification will likely result once the proposed action is implemented will take into account the combined effects of: (1) the action, and (2) the impacts under the environmental baseline. The measure of effects of the proposed action, "to be added to the underlying baseline conditions," is the extent to which the proposed action "causes some deterioration" in the species' conditions, or causes "some new risk of harm" as compared with the effects under the environmental baseline. It is therefore the measure of the difference between the direct and indirect effects proximately caused by the proposed action, and the effects encompassed within the environmental baseline, that

determines whether the proposed action will likely have an adverse effect on listed species and/or designated critical habitat – and, if so, the degree of that likely adverse effect.

The analyses in this document focus on the effects associated with maintenance of navigation features and the placement of material generated by maintenance dredging in beneficial use disposal sites, to include future maintenance dredging attributable exclusively to subsequent annual maintenance dredging for the 25-year program horizon. Depending on the results of any sampling and analysis, changes in the program, and changes in ESA-listed species and/or designated critical habitat, this BA may be supplemented in the future.

The following sections describe the environmental baseline that was considered when developing the environmental consequences, as well as the effects terminology, action areas, and general effects assumptions and mechanisms.

7.1 Environmental Baseline for Maintenance Dredging Projects

Most of the authorized navigation projects are located in river deltas and/or estuaries where sediment is transported into the navigation channels by adjacent rivers, wave action, and currents. Authorized navigation channels are usually associated with port facilities, which are typically associated with human population centers. Historically, cities and towns were established near rivers because rivers and estuaries provided the best means of travel and for transport of materials from one location to another in the early development of Western Washington. Embayments associated with river mouths provide sheltered water for large commercial vessel moorage. As port facilities were developed and expanded and vessels became larger with increased draft, it became necessary to deepen navigation channels and areas adjacent to wharfs to accommodate larger vessels. Major ports in Western Washington were constructed in embayments on unconsolidated substrate with compositions that varied based to a large degree on the material brought to the area from adjacent rivers. Thus, maintaining navigation channels and associated facilities removes material that is typically composed of unconsolidated sediments ranging in size from clay particles to small rocks, with the predominant material being sand with various fractions of finer material, including organic material.

The cycle time between maintenance dredging events is related to the amount of sediment carried into navigation channels from adjacent rivers, by wave action and by currents. The cycle time in Western Washington ranges from once per year to once in 10 years.

River deltas and adjacent marine embayments are subject to dynamic forces. Floods cause river channels to migrate, and suspended sediment settles out of the water column in embayments. As a result, the physical environment is subject to changes measured in time scales of months to years. Rivers that flow by or through cities were channelized, their banks were armored, and adjacent embayment shorelines were armored, all to prevent erosion. One result of this manipulation was that flood events increased in frequency. This was primarily due to channelization of lower river reaches, simplification of drainage systems (fewer small creeks), filling of wetlands, removal of forest cover, and development of large areas of impervious surfaces. Channel and shoreline armor simplified nearshore habitat and the armor was less desirable to fish that associate with nearshore habitat.

The present situation is dominated by armored shorelines, channelized river deltas, simplified drainage patterns, straightened river and tributary channels, dikes and levees, increased flood frequency, and increased suspended sediment load in rivers and associated embayments. Water movement (currents) through areas that have been dredged is undoubtedly changed to some degree as a result of channel creation. Navigation channels may allow salt water to intrude farther upstream than likely occurred prior to navigation channel construction. All of these physical changes have resulted in degraded habitat for ESA-listed species, especially those that depended on habitat that was subsequently modified. The proposed continued maintenance of these channels would perpetuate these conditions throughout the consultation period. These existing and prospective conditions all fall within the environmental baseline.

7.1.1 Physical Environment of the Combined Maintenance Dredging Projects

7.1.1.1 Tides and Currents

Tides and currents in constructed navigation channels are likely changed over the pre-navigation environment in that navigation channels are straight and deep compared to natural channels. Channel construction can result in slightly increased water velocity within the constructed channel and penetration of salt water farther upstream compared to pre-channel construction conditions. Nevertheless, the tides and currents in the areas surrounding the navigation channels are typical of tides and currents in Western Washington river deltas and estuaries (embayments).

7.1.1.2 Water Quality

Potential point and non-point sources of contaminants can be found in most project areas in Western Washington and are associated with past and present land uses adjacent to the project areas. For example, industrial development has included paper mills, timber and wood products industries, marine vessel moorage and repair, fish processing, and petroleum refineries. Agriculture uses fertilizers and pesticides. These activities have caused water quality degradation. However, since the passage of the Clean Water Act there has been a general reduction in water pollution and improvements in water quality in most water bodies in Western Washington.

Turbidity. Baseline turbidity in navigation channels is caused by material eroding from the terrestrial environment. The proximate causes are spring snowmelt and storm events, both of which cause increased water flow across terrestrial landscapes causing increased turbidity in navigation channels.

Dissolved Oxygen. DO in constructed navigation channels is typical of adjacent areas of lower rivers and estuaries. The USACE has conducted water quality sampling as required by the Washington State Department of Ecology (Ecology) and has not observed oxygen depressions in maintained navigation channels that are detrimental to aquatic life.

Temperature. The water temperature in most constructed navigation channels is adequate for all aquatic life and is typical of surrounding areas. However, water temperature is a concern in a few constructed navigation channels, especially in late summer and early fall when river flow is at or near its lowest. An example is the Duwamish River where immigrating salmon remain in the cool salt water near the bottom of the navigation channel as far upstream as possible before moving into the warmer freshwater as they continue on to the spawning grounds. During the

remainder of the year, water temperatures are generally adequate for aquatic life. The lack of riparian trees and urban development are causes of elevated water temperatures. Riparian trees provide shade, when the trees are not present, solar heating contributes to increases in water temperature. Urban development includes paved surfaces where the sun heats the surface and transfers heat to any water that passes over the paved surfaces.

Sediment and Water Quality. The water quality in constructed navigation channels is generally good. There are very few exceedances of maximum water quality standards and exceedances are typically for elevated fecal coliform levels, which are not associated with contaminants such as polychlorinated biphenyls, dioxins/furans, and heavy metals.

The sediments in most constructed navigation channels do not contribute contaminants to the water because most of the sediment is not contaminated and contaminants bind to sediment particles. However, some navigation channels have contaminated sediments because of past industrial activities. An example is the Duwamish River where a significant fraction of the substrate in the river has been designated a Superfund Site.

Most navigation channel sediments are low-ranked, meaning few or no sources of chemicals appear to contribute to channel sediments, at least in those areas that undergo active maintenance dredging. This conclusion is based on data that show no or low levels of chemicals of concern and no significant toxic responses in biological tests at most locations.

7.1.1.3 Physical Environment

Substrate. Substrate is typically composed of unconsolidated material ranging in size from clay particles to small rocks, with the predominant material being sand with various fractions of finer material, including organic material. The substrate is composed to a large degree of the material brought to the area from adjacent rivers, and by waves and currents. The substrate in navigation channels is subject to dynamic forces that occur in estuaries and river deltas. Floods bring sediment that settles out of the water column into navigation channels, which can cause changes in the physical environment of navigation channels. One major result of urbanization has been an increase in the frequency of flood events due mainly to channelization of lower river reaches, simplification of drainage systems (fewer small creeks) filling of wetlands, removal of forest cover, and creation of impervious surfaces.

The substrate in navigation channel footprints is subject to disturbance due to high water events, tidal currents, and wave action. Navigation channels were originally constructed for economic reasons and not environmental reasons; thus, navigation channels were authorized and are located in areas where commercial and recreational interests operate.

Bathymetry. The construction of navigation channels changed bathymetry and increased water depths in constructed channels compared to preconstruction conditions. The constructed channels are generally straight compared to natural channels. The result was a much more uniform bathymetry in constructed navigation channels compared to natural channels. Navigation channel depths range from -8 feet to -51 feet MLLW (regardless of authorized depth).

Physical Habitat. The lower reaches of rivers and terrestrial areas adjacent to rivers and estuaries have been altered by diking, filling, urbanization, conversion to farmland, and other

anthropogenic activities over the past 100 and more years. These activities caused the loss of riparian, wetland, and nearshore habitats and lowered the elevation of the substrate in authorized navigation channels. This process did not completely eliminate native habitat such as side channels and mudflats; varying amounts of that physical habitat still exist.

Although the quantity and distribution of physical habitat types has been altered, the project areas contain large areas representing a wide variety of habitats, including deep channel (-50 feet MLLW, primarily of anthropogenic origin), shallow channel, intertidal/subtidal mudflat, eelgrass beds, intertidal/subtidal sand flats, sand islands, fringing marshes, and riparian vegetation.

7.1.2 Biological Environment of the Combined Maintenance Dredging Projects

The biology of the navigation channel project areas is typical of estuarine and river delta habitat in Western Washington. All of the navigation channel depths are within the depth ranges of the organisms that occur throughout estuarine and river delta habitat. Organisms found in navigation channels are similar to organisms located in adjacent shallow areas (pers. comm., D. Kendall, USACE biologist, 2013).

7.1.2.1 Infauna

Infaunal organisms, primarily invertebrates, dominate navigation channel substrates. Some fishes can burrow into the substrate, but do not live there (e.g. sand lance and Pacific midshipman). The composition of the substrate, the stability of the substrate, and the available food supply determine the abundance of the infaunal organisms.

Three primary variables determine community composition in Puget Sound. These include depth, sediment composition (amount of fines), and salinity (Lie and Evans 1973, Lie 1974, Kendall 1983, Kendall 1992, WESTON 1995, Striplin Environmental Associates 1996, Seiderer and Newell 1999, Desprez 2000). In authorized navigation channels, sediment composition and salinity, but not depth, are expected to influence infaunal community composition. Any differences in sediment composition from one location to another are likely the cause of differences in infaunal composition between navigation channels, although those changes are probably minor given that the sediment is unconsolidated. There might be changes in which species dominates in a particular navigation channel, but there would likely few if any changes in overall species composition. Salinity fluctuations cause most infaunal animals to “close up” during unfavorable salinity conditions (Kendall 1983). Infaunal organisms are tough and have adapted to changes in their environment, especially tidally influenced and seasonal salinity changes. Interstitial salinity is generally higher than the overlying water when the tide goes out, thus providing a safe haven for infaunal animals living in areas subject to tidally influenced salinity fluctuations (Kendall 1983). Since organisms from adjacent shallow water areas colonize newly dredged areas, the USACE expects the overall species composition to be similar across navigation channels and areas adjacent to navigation channels.

7.1.2.2 Epibenthic Fauna

Epibenthic fauna is composed of those organisms that live on or just above the substrate, in this case of navigation channel substrate, which is subjected to stress from maintenance dredging. Other disturbance factors include frequent disturbance and stress from tidally influenced and

seasonal salinity fluctuations, large-scale sediment movements during floods, and sediment accumulation and movement under typical flow conditions. Several hundred species of invertebrates and fishes live on, or are associated with the substrate in the marine waters of Western Washington; these include crabs, shrimp, shrimp-like small invertebrates, mollusks (clams and octopi), and many species of fish (e.g. rockfish and flatfish species). Flatfish settle onto the substrate and live there, as do many invertebrates (e.g. English sole, Dover sole, Dungeness crab, and spot prawns). Flatfish, rockfish, and other species occasionally move up into the pelagic region of the water column to forage.

The fish species composition of the subtidal waters is composed of species that occur at all times of the year and other species that occur sporadically (Donnelly and Burr 1995). Examples of resident species include flatfish and surf perch. Examples of sporadic species include surf smelt and sand lance. The differences in species composition depend more on season than location. Species composition is similar across areas (Donnelly and Burr 1995, Donnelly et al. 1984, Donnelly et al. 1988a, Donnelly et al. 1988b), but changes as a function of depth.

Studies by the USACE's Dredged Material Management Office indicate that demersal fish are coupled to the infauna and benthic invertebrates via their food source, which is primarily infauna and epibenthic invertebrates (Clarke and Kendall 1987; Kendall, pers. comm 2013).

7.1.2.3 Pelagic Fauna

Numerous species of fishes and invertebrates occupy the pelagic region of the water column above navigation channels. These species include salmonids, herring, sharks, surf perches, smelts, pteropods, and larval life stages of various fishes (e.g. rockfishes) and invertebrates (e.g. crab zoea). These species typically forage across large areas and are not associated with one location.

7.1.2.4 Primary Producers

Navigation channels are created for specific uses and vessel sizes and are not made deeper or wider than necessary. Navigation channels typically do not have attached vegetation due to water depth, current velocities, and vessels operating within a few feet of navigation channel bottoms, which discourages attached vegetation from becoming established and/or growing. Any vegetation that occurred in the footprint of a navigation channel prior to construction was removed during initial construction and if vegetation were to become established then maintenance dredging would remove it each time maintenance occurs.

Estuaries and navigation channels are dynamic and constantly flushed, bringing in new pelagic phytoplankton populations. Phytoplankton have rapid replication rates and population abundance can double in a day. Phytoplankton generally mature to reproductive life stages within three days and remain viable for days to weeks (Little 2000).

There are likely hundreds of phytoplanktonic species found in the waters of navigation channels that photosynthesize including single cell algae and diatoms. These organisms are small, typically less than 5 millimeters, and subject to the currents and wind.

7.1.2.5 Zooplankton

Crustaceans are the dominant contributor to zooplankton composition based on numerical frequency of occurrence and total standing biomass (Kinney et al. 1981). Zooplankton live in the water column above navigation channels. They are capable of short distance movement, but are often moved longer distances by local currents and wind generated waves.

7.1.2.6 Forage Fish

Forage fish are a critical link in the trophic structure of maintenance-dredging project areas, serving as prey for a variety of listed species. The number of forage fish found in an area varies. Three species of forage fish consistently inhabit Puget Sound, while seven species occur in Grays Harbor (Simenstad 1981).

Stomach content analysis of forage fish captured during 2004 sampling indicated that forage fish in Half Moon Bay consume pelagic organisms, with very little predation on benthic organisms (SAIC 2005). Herring, sand lance, and surf smelt all feed on plankton. This prey preference limits the indirect effects of maintenance dredging on these species.

7.1.2.7 Birds

Birds, including marbled murrelets, western snowy plover, and streaked horned lark can occur in some navigation channel areas. River deltas and estuaries are productive areas that attract birds to forage. Some species remain all year and others use local river deltas and/or estuaries as stopover and forage habitat during annual migrations.

7.1.2.8 Commercial and Recreational Vessels

Western Washington has a large number of commercial and recreational vessels as evidenced by the number of marinas. Navigation channels provide waterways for movement of commercial freight, commercial fishing vessels, and recreational vessels to and from marinas, waterfront commercial facilities, and different water bodies (e.g. vessel traffic between the Port of Grays Harbor and the nearby Pacific Ocean).

7.2 Environmental Baseline for Beneficial Use Disposal Sites

The USACE manages the beneficial use disposal sites. Consultation on beneficial use disposal sites has been via inclusion in the BAs and subsequent consultations for specific USACE maintenance dredging projects in the Snohomish River, the Quillayute River, and Grays Harbor. Baseline information on most of the beneficial use disposal sites is contained in individual BAs (USACE 2011b, 2011c, 2011d, 2013). This BA consolidates all relevant information on the USACE's disposal sites in the sections below.

Of the 10 disposal sites described in this document (Table 5), six disposal sites are located in an aquatic environment and four are in an upland environment.

7.2.1 Grays Harbor Disposal Sites at Half Moon Bay and South Beach

Two disposal sites in Grays Harbor, Half Moon Bay and South Beach, are located in nearshore zone habitat. Placement is subtidal and sediment dispersion moves into the intertidal zone.

7.2.1.1 Tides and Currents

Tides and currents at beneficial use aquatic disposal sites are typical of tides and currents in Western Washington. The disposal site locations were established to take advantage of tides and currents to disperse dredged material and minimize accumulation in disposal sites. The dredged material placed at these sites' littoral area and the local drift cells moves by tidal currents along the shoreline until it moves into deeper water due to converging drift cells or its movement is interrupted by a headland.

7.2.1.2 Sediment and Water Quality

Turbidity. Turbidity levels in Grays Harbor and the adjacent Pacific Ocean nearshore area naturally vary from high levels found in the inner harbor during high flow conditions found in the Chehalis River to low levels during low flow times. Storm events always increase turbidity levels because rains wash sediment into streams and rivers elevating turbidity levels. For example, a study by Bash et al. (2001) found that turbidity levels range from 0.5 Nephelometric Turbidity Units (NTUs) to 179 NTUs in four rivers in Western Washington (Skagit, Sammamish, North Fork Stillaguamish, and Stillaguamish). Turbidity in the nearby Pacific Ocean is low at most times.

Dissolved Oxygen. DO levels in navigation channels are generally good and maintenance dredging has not caused oxygen depressions based on water quality sampling conducted by the USACE during dredging events.

Contaminants. Potential point and non-point sources of contaminants occur in Grays Harbor and are associated with past and present land uses adjacent to the project areas. For example, industrial development has included paper mills, timber and wood products industries, marine vessel moorage and repair, and fish processing. Examples include heavy metals (copper) and persistent bioaccumulative toxics (PCBs, Dioxin/furans, etc.) Agriculture uses fertilizers and pesticides that wash off the land into adjacent water bodies resulting in some water quality degradation. However, since the passage of the Clean Water Act there has been a general reduction in water pollution and improvements in water quality in most water bodies in Western Washington.

The Chehalis River and other rivers that enter Grays Harbor are subject to runoff from adjacent terrestrial landscapes that can move contaminants from terrestrial areas to the aquatic environment. The DMMP evaluates all sediment material to be dredged prior to dredging. Any material found to be unsuitable for aquatic disposal would be subject to a separate consultation with the Services.

7.2.1.3 Substrate

The physical environment of the two disposal sites is typical to the physical environment where each disposal site is located. Changes in the physical environment of the disposal sites are short lived as dredged material disperses leaving their physical environments unchanged from predisposal conditions.

The amount of sediment discharged by rivers that drain into estuaries is a major factor in the frequency (or cycle time) of disposal in any given disposal site. Authorized disposal sites are located in close proximity to the navigation channel and often have similar physical

characteristics to those found in the maintenance-dredging project sites. The substrate is typically composed of unconsolidated material ranging in grain size from clay particles to small rocks, but is predominately sand with various fractions of finer material, including some organic material. The substrate is composed to a large degree of the material brought to the area from adjacent rivers and subject to dynamic forces in estuaries. Sediment from rivers that settles out of the water column onto disposal sites can cause changes in the physical environment of disposal sites such as changes in water depth and topography, independent of dredge disposal.

Urbanization in the Grays Harbor area has likely resulted in an increase in the frequency of flood events due to channelization of reaches, simplification of drainage systems (fewer small creeks), filling of wetlands, removal of forest cover, and creation of impervious surfaces. All of these factors have resulted in increased frequency of flood events and sediment runoff from the upland. The substrate in disposal site footprints is subjected to these disturbances. The amount of disturbance is due to the volume of high-water events and the strength of tidal currents, which are affected by water depth.

Bathymetry of the beneficial use disposal sites is of similar depths as other areas of Western Washington. Water depths range to about 45 feet. The two aquatic disposal sites are located in energetic areas to take advantage of currents to move material into the adjacent littoral areas.

7.2.1.4 Infauna

The substrate of the two aquatic beneficial use disposal sites located in Grays Harbor and the adjacent Pacific Ocean are composed primarily of sand. These sites are Dispersive sites are purposely located in areas where the material will maintain a sediment budget in the adjacent littoral area and beaches.

Several species characteristic of sandy substrate are opportunistic organisms, often small, tube dwelling, surface-deposit feeders that exhibit patchy distribution patterns in space and time (Albright and Bouthillette 1982).

7.2.1.5 Epibenthic Fauna

The baseline condition for epifauna in disposal sites is likely modified only slightly from pre-disposal conditions and is subjected to frequent disturbance and stress from disposal and natural forces including frequent turbidity associated with floods and storm events.

There are several hundred species of invertebrates and fishes that live on, or are associated with, a demersal life style in the marine waters of Western Washington including crabs, shrimp, shrimp-like small invertebrates, sea anemones, sessile tube dwelling polychaetes (serpulids, terebellids), mollusks (clams and octopi), and many species of fish (e.g. rockfish, sturgeon, ratfish, dogfish sharks and flatfish). Once flatfish (e.g. English sole, Dover sole) settle onto the substrate, they spend most of their lives there, as do most of the invertebrates, (e.g. Dungeness crab, spot prawns). Some species of flatfish occasionally move up into the pelagic region of the water column to forage.

The fish species composition of the subtidal waters is composed of species that occur during all times of the year and other species that occur seasonally or sporadically (Donnelly and Burr 1995). Examples of resident species include flatfish and surf perches. Examples of sporadic

species include herring and sand lance. The differences in species composition depend more on season than location, while fish species composition is similar across areas within a depth stratum (Donnelly et al. 1984, Donnelly et al. 1988a, Donnelly et al. 1988b, Donnelly and Burr 1995). Each depth stratum has its own characteristic species composition. Some species inhabit more than one depth stratum; others use only in one depth stratum.

SAIC (2005) analyzed the stomach contents of fish captured as part of a related beach seining effort (R2 Resource Consultants 2006) in Grays Harbor. Species collected for stomach content analysis included Chinook salmon, surf smelt, sand lance, American shad, shiner perch, English sole, speckled sanddab, and sand sole. With the exception of the flatfish, there was little overlap between the stomach contents of fish captured in Half Moon Bay and benthic organisms found there. Only English sole appeared to be feeding on benthic polychaetes derived from mid to lower tidal elevations in Half Moon Bay. Studies conducted prior at multiuser disposal sites show a correlation between stomach contents of benthic fishes (predominantly flatfish) and available benthic invertebrates (Clarke and Kendall 1987; Kendall and Clarke 1988; Kendall, pers. comm., 2013).

7.2.1.6 Pelagic Fauna

Numerous species of fishes and some invertebrates occupy the pelagic waters above disposal sites. These species include salmonids, herring, surf perches, smelts, pteropods, and larval life stages of various invertebrates (e.g. crab zoea). These species typically forage across large areas and are not associated with one location.

7.2.1.7 Primary Producers

The growth of eelgrass, benthic algae, and phytoplankton is controlled by light, especially day length, and can be suppressed by light attenuation resulting from elevated suspended sediment levels brought on by storm and flood events. Disruption of water clarity may be a limiting growth factor for eelgrass. Eelgrass can survive increased turbidity for short periods, but prolonged increases in light attenuation result in loss of or damage to eelgrass beds.

Estuaries are dynamic and constantly flushed bringing in new pelagic phytoplankton populations, and phytoplankton have rapid replication rates. Attached aquatic vegetation is typically associated with either shallow water or with hard substrate of 60 feet depth or less and likewise phytoplankton generally grows best in similar water depths. Population abundance of phytoplankton can double in a day, and they mature to reproductive life stages within three days and remain viable for days to weeks (Little 2000). The intertidal beach disposal sites do not have attached vegetation. The nearshore aquatic disposal sites were chosen specifically in areas where dredged material would disperse and move inshore and not in locations where macroalgae and/or rooted (eelgrass) vegetation were present or would become established. Additionally, deposition of dredged material would discourage establishment of attached vegetation.

7.2.1.8 Zooplankton

The dominant members of pelagic zooplankton communities in disposal sites are invertebrates such as crab zoea and larval fishes. In Grays Harbor, crustaceans are the dominant contributor to zooplankton composition based on numerical frequency of occurrence and total standing

biomass (Kinney et al. 1981). Most of the crustaceans in the zooplankton community are capable of active movement.

7.2.1.9 Forage Fish

Forage fish are a critical link in the trophic structure of disposal sites, serving as prey for a variety of species, including ESA-listed species and are found in the area of disposal sites. Stomach content analysis of forage fish captured during 2004 sampling in Half Moon Bay, Grays Harbor, indicated that forage fish consume primarily pelagic organisms, with very little predation on benthic organisms (SAIC 2005). Herring, sand lance, and surf smelt all prey on pelagic plankton, primarily zooplankton.

7.2.1.10 Birds

Birds, including marbled murrelets, snowy plover, and streaked horned lark can occur on the water above beneficial use aquatic disposal sites. Estuaries and nearshore areas are productive areas that attract birds to forage. Some species remain all year and others use estuaries and ocean beaches as stopover and forage habitat during annual migrations.

7.2.2 Point Chehalis Revetment Extension Mitigation Upland Site

This disposal site is located in an area adjacent to Half Moon Bay beach. The site has native and non-native brushy vegetation. The area is subject to human and pet use (primarily dogs) and thus there are few if any terrestrial animals present. Birds are present but again presence of humans and their pets keep bird abundance at a minimum.

7.2.3 Jetty Island Disposal Site

Jetty Island is an artificial island located in the Snohomish River delta and adjacent to the Snohomish River main channel as it flows south by the Everett commercial waterfront. Jetty Island is a park used by people for picnics and recreation, but is not intended for long-term camping. An extensive eelgrass bed lies just off the western side of the island. Jetty Island slowly erodes and replenishes the local longshore drift cells and the adjacent eelgrass bed. In the late 1980s, a salt water lagoon was created by placing dredged material in such a way as to form a spit that protects a small intertidal area. The spit protecting the lagoon is subject to erosion and is replenished as needed. Animal life includes birds that frequent the island and juvenile salmonids that use the lagoon. People with dogs likely minimize bird use of the island.

7.2.4 Riverside Disposal Sites

This site is adjacent to the riparian area and a salt marsh along the Snohomish River. The site itself has minimal vegetation. Animal life includes birds and the occasional terrestrial animals that frequent the area. A pipeline that carries dredged material crosses the salt marsh during the winter when the salt marsh plants are dormant. Floating the pipeline into place and then pulling the pipeline across the bench with equipment parked in the upland minimizes disruption to the marsh surface and does not disrupt the ability of the salt marsh vegetation to sprout in the spring.

7.2.5 Site "O" Disposal Sites

This site is across the river from the vegetated riparian area and a salt marsh along the Snohomish River. The site has minimal vegetation. Animal life includes birds and the occasional terrestrial animals that frequent the area. People with dogs likely minimize bird use of the site. A pipeline that carries dredged material crosses the riverbank during the winter when the riparian plants are dormant. Floating the pipeline into place and then pulling the pipeline across the bench with equipment parked in the upland minimizes disruption to the riverbank and does not disrupt the ability of the riparian vegetation to sprout in the spring.

7.2.6 Keystone Beach Disposal Site

This disposal site is located on the beach adjacent to the east side of Keystone Harbor. The purpose is to place dredged material on an eroding beach to maintain the shoreline. The material is typically dredged from Keystone Harbor with a clamshell dredge and placed on a flat top barge. The barge is towed to a location just offshore of the staging area and the material is offloaded via the clamshell bucket from the barge. Effort is made to not ground the barge as this might damage the barge and may harm biological resources on the beach. After offloading to the shore, the material is rehandled to the beach placement area using front-end loaders. The other technique that could be used is a hydraulic dredge and pump the material onto the upland into a containment area with berms composed of native material that allows the slurry to filter and the water fraction to return to Puget Sound with minimal suspended sediment.

The area is subject to human and pet use (primarily dogs) and thus there are few if any terrestrial animals present. Birds are present but presence of humans and their pets keep bird abundance at a minimum.

7.2.7 Quillayute Disposal Sites

There are three disposal sites in the lower Quillayute River area; these include Site B (formerly Sites 1 and Site 2A), Site A, and First Beach. Site A is strictly an upland site; the other sites are located in the nearshore zone and include beach habitat. Material may be moved at the discretion of the USACE after 1 November from Site A onto First Beach to protect the root of the south jetty that erodes during coastal storm events. Material that is not placed onto First Beach may be made available for tribal reuse in upland areas. Placement at Site B feeds the littoral drift and adds material to the Quillayute Spit that tends to erode.

The coastal beach zone in the lower Quillayute River area consists of cobble, gravel, and sand. Large drift logs dominate the beach within the storm tide zone. The jetties, dike, and rocky habitat have attached micro- and macroalgae. The beach grass/scrub zone is a narrow zone typically above the line of driftwood. The plants that dominate this area are dunegrass, yarrow, English plantain, tansy ragwort, and oxeye daisy. The scrub zone is thought to be an older successional zone on accreting sandy areas. Common plants are twinberry, salal, Sitka willow, and red alder.

The nearshore estuarine areas are mostly diked or revetted shoreline. At low tide, mixed sand and gravel bars become exposed. Both maritime forest and broadleaf mixed forest can be found near the project area at the mouth of the river. The maritime forest is adjacent to local wetlands

and the river floodplain, and is comprised of Sitka spruce (*Picea sitchensis*) and red alder with occasional patches of sedge and willow. The broadleaf mixed forest community is dominated by red alder groves with some Sitka spruce, ash, and hemlock. The understory primarily contains salmonberry, buttercups, and piggyback, including some non-native plants.

Surf smelt are known to spawn on Rialto Beach (Fradkin 2001, ICF 2010); other fish around the shore and estuary include saddleback gunnels, pacific herring, starry flounder, sculpins, rockfish, perch, sticklebacks, sand lance, anchovy, and shad (Chitwood 1981).

Several bird species occur in the area including gulls, spotted sandpipers, whimbrels, cormorants, mergansers, scoters, pigeon guillemots, common murrelets, and peregrine falcons. Several other bird species roost in the area including brown pelicans. Bald eagles are frequently seen in the project area. Marbled murrelets occur in relatively low density offshore from the project area (Pearson et al. 2014); nesting habitat has been documented in the National Park forested area; however, this is more than a mile away from any project activity (WDFW 2016).

7.3 Environmental Baseline for Designated and Proposed Critical Habitat

There are 25 ESA-listed species described as DPSs or Evolutionarily Significant Units (ESUs) (Table 1) in the action area. Of these, 14 have designated critical habitat, another four have proposed critical habitat, and seven do not have designated or proposed critical habitat (Table 7 and Table 8). Three of the 18 species with designated or proposed critical habitat do not have critical habitat in the action area. Several of the ESUs and their primary constituent elements (PCEs) are combined into one PCE list because the PCEs are identical for all listed ESUs of a single species, an example are the three Chinook salmon ESUs (Willamette, lower Columbia River, and Puget Sound). In addition, some of the PCEs are not relevant to this BA. The following discusses the status of the baseline conditions for each relevant PCE of each ESA-listed species or ESU.

Table 7. The occurrence of Endangered Species Act listed species found in each maintenance dredge and beneficial use disposal site. A "√" in a box indicates presence.

	Bull trout	Lower Columbia Chinook	Upper Willamette Chinook	Puget Sound Chinook	Puget Sound steelhead	Columbia River chum	Hood Canal chum	Bocaccio rockfish	Yelloweye rockfish	Canary rockfish	Eulachon	Green sturgeon	Killer whale	Humpback whale	Blue whale	Fin whale	Sei whale	Sperm whale	Leatherback sea turtle	Loggerhead sea turtle	Green sea turtle	Olive Ridley sea turtle	Marbled murrelet	Western snowy plover	Streaked horned lark
Dredging																									
Swinomish Navigation Channel	√			√	√			√	√	√			√										√		
Keystone Harbor	√			√	√			√	√	√			√										√		
Snohomish River Navigation Channel	√			√	√																				
Upper Duwamish Waterway	√			√	√																				
Port Townsend Navigation Channel	√			√	√		√	√	√	√			√										√		
Quillayute River																									
Grays Harbor Navigation Channel	√	√	√			√					√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
Westhaven Cove Entrance Channels	√	√	√			√					√	√	√										√		
Disposal																									
Jetty Island	√			√	√			√	√	√			√										√		
Site "O"	√			√	√																				
Riverside	√			√	√																				
Keystone Beach	√			√	√																				
Site A																									
Site B																									
First Beach																									
Half Moon Bay	√	√	√			√					√	√	√										√	√	√
South Beach	√	√	√			√					√	√	√										√	√	√
Point Chehalis Revetment Extension Mitigation Site																									

Table 8. The designated or proposed critical habitat for ESA-listed species found in each maintenance dredge and beneficial use disposal site: "D" designated and in the project area

	Bull trout	Lower Columbia Chinook	Upper Willamette Chinook	Puget Sound Chinook	Puget Sound steelhead	Columbia River chum	Hood Canal chum	Bocaccio rockfish	Yelloweye rockfish	Canary rockfish	Eulachon	Green sturgeon	Killer whale	Humpback whale	Blue whale	Fin whale	Sei whale	Sperm whale	Leatherback sea turtle	Loggerhead sea turtle	Green sea turtle	Olive Ridley sea turtle	Marbled murrelet	Western snowy plover	Streaked horned lark
Dredging																									
Swinomish Navigation Channel	D			D	D																				
Keystone Harbor	D			D	D			D	D	D			D												
Snohomish River Navigation Channel	D			D	D																				
Upper Duwamish Waterway	D			D	D																				
Blair Waterway	D			D	D								D												
Port Townsend Navigation Channel	D			D	D		D	D	D	D			D												
Neah Bay Marina Entrance Channel	D			D	D		D						D												
Quillayute River																									
Grays Harbor Navigation Channel	D											D							D					D	D
Westhaven Entrance Channels	D											D													
Disposal																									
Jetty Island	D			D	D			D	D	D															
Site "O"	D			D	D																				
Riverside	D			D	D																				
Keystone Beach	D			D	D																				
Site A																									
Site B																									
First Beach																									
Half Moon Bay	D											D													
South Beach												D													
Point Chehalis Revetment Extension Mitigation Site																									

7.3.1 Bull trout

(1) Springs, seeps, groundwater sources, and subsurface water connectivity (hyporheic flows) to contribute to water quality and quantity and provide thermal refugia.

Baseline. This PCE relates to freshwater habitat upstream of navigation projects and outside of the project areas. Therefore, this PCE will not be considered in this document and consultation.

(2) Migration habitats with minimal physical, biological, or water quality impediments between spawning, rearing, overwintering, and freshwater and marine foraging habitats, including but not limited to permanent, partial, intermittent, or seasonal barriers.

Baseline. The baseline for this PCE has been altered via deepening of those areas that were designated as navigation channels. Upland development has contributed to altered water flows (altered hydrographs) and has been a source of contaminated material that can accumulate in navigation channel sediment. The loss of riparian vegetation and construction of upland impervious surface has altered the water temperature regime of navigation channels. In this respect, the baseline has been altered and degraded. During maintenance dredging, there can be minimal and localized changes in water quality due to turbidity, but these disturbances are small, localized, and short-term (typically hours) and result in short-term degradation. The other parameters of this PCE have not been degraded and will be maintained.

(3) An abundant food base, including terrestrial organisms of riparian origin, aquatic macroinvertebrates, and forage fish.

Baseline. The baseline for aquatic macroinvertebrate populations was altered by initial construction of navigation channels, and general development-driven alteration of delta and estuarine habitat, and is altered each time maintenance dredging occurs. The macroinvertebrate population recovers quickly through migration from adjacent undisturbed habitat and recolonization as the macroinvertebrates are generally short-lived and adapted to a dynamic environment. Therefore, the baseline for macroinvertebrates is temporally degraded during each maintenance dredge cycle. The loss of riparian vegetation through terrestrial development has likely reduced the abundance of terrestrial organisms (insects), degrading this parameter. The forage fish baseline conditions have not been altered by construction or maintenance of navigation channels and no changes are anticipated.

(4) Complex river, stream, lake, reservoir, and marine shoreline aquatic environments, and processes that establish and maintain these aquatic environments, with features such as large wood, side channels, pools, undercut banks and unembedded substrates, to provide a variety of depths, gradients, velocities, and structure.

Baseline. The marine and river delta shoreline has been altered for development. Construction of navigation channels generally reduced sinuosity and created uniform substrate conditions. Maintenance of navigation channels involves removal of large wood, which can be a navigation hazard, but is habitat for bull trout. Development of shoreline terrestrial areas has reduced shoreline complexity resulting in degraded baseline conditions for this PCE.

(5) Water temperatures ranging from 2 to 15 °C (36 to 59 °F), with adequate thermal refugia available for temperatures that exceed the upper end of this range. Specific temperatures within

this range will depend on bull trout life-history stage and form; geography; elevation; diurnal and seasonal variation; shading, such as that provided by riparian habitat; streamflow; and local groundwater influence.

Baseline. One parameter of this PCE, shading, might be degraded in the maintenance dredging project areas. Land based development has eliminated much of the natural shoreline vegetation, especially large trees, which has likely caused increased thermal heating. Thus, this shading has been degraded.

(6) In spawning and rearing areas, substrate of sufficient amount, size, and composition to ensure success of egg and embryo overwinter survival, fry emergence, and young-of-the-year and juvenile survival. A minimal amount of fine sediment, ranging in size from silt to coarse sand, embedded in larger substrates, is characteristic of these conditions. The size and amounts of fine sediment suitable to bull trout will likely vary from system to system.

Baseline. This PCE relates to upstream habitat and does not occur in the project areas surrounding navigation channel construction, maintenance, or disposal.

(7) A natural hydrograph, including peak, high, low, and base flows within historic and seasonal ranges or, if flows are controlled, minimal flow departure from a natural hydrograph.

Baseline. The natural hydrograph has been altered in many of the areas where navigation channels have been established due primarily to development of the terrestrial environment and in some areas upstream dams that control the hydrograph. Therefore, this baseline condition is degraded.

(8) Sufficient water quality and quantity such that normal reproduction, growth, and survival are not inhibited.

Baseline. Water quality is altered due to contaminants from terrestrial sources and when maintenance dredging occurs, suspended sediment enters the water column for a short time. Water quantity is altered (specifically the timing of flood waters) due to development in the terrestrial environment. Therefore, this PCE is degraded.

(9) Sufficiently low levels of occurrence of non-native predatory (e.g., lake trout, walleye, northern pike, smallmouth bass); interbreeding (e.g., brook trout); or competing (e.g., brown trout) species that, if present, are adequately temporally and spatially isolated from bull trout.

Baseline. Nonnative predatory species do not occur in the project areas under consideration in this consultation.

FR (200):63898-64070

7.3.2 Puget Sound, lower Columbia River, and Willamette River Chinook salmon

(1) Freshwater spawning sites with water quantity and quality conditions and substrate supporting spawning, incubation and larval development.

Baseline. This PCE is not applicable to navigation channel construction or maintenance and is not in the action areas.

(2) Freshwater rearing sites with:

(i) Water quantity and floodplain connectivity to form and maintain physical habitat conditions and support juvenile growth and mobility;

(ii) Water quality and forage supporting juvenile development; and

(iii) Natural cover such as shade, submerged and overhanging large wood, log jams and beaver dams, aquatic vegetation, large rocks and boulders, side channels, and undercut banks.

Baseline. This PCE is not found in the action areas and will not be subject to discussion in this document.

(3) Freshwater migration corridors free of obstruction and excessive predation with water quantity and quality conditions and natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, side channels, and undercut banks supporting juvenile and adult mobility and survival.

Baseline. This PCE is not found in the action areas and will not be subject to discussion in this document.

(4) Estuarine areas free of obstruction and excessive predation with:

(i) Water quality, water quantity, and salinity conditions supporting juvenile and adult physiological transitions between fresh- and saltwater;

(ii) Natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, side channels; and

(iii) Juvenile and adult forage, including aquatic invertebrates and fishes, supporting growth and maturation.

Baseline. Navigation channel construction and maintenance has degraded some aspects of this PCE. Turbidity increases for short periods during dredge events. Submerged and overhanging large wood has been removed from navigation channels. Adjacent terrestrial development has reduced the amount of riparian vegetation, especially trees, reducing the sources of large wood. Therefore, baseline conditions are degraded in the short-term via suspended sediment and long-term through reduced large wood recruitment.

(5) Nearshore marine areas free of obstruction and excessive predation with:

(i) Water quality and quantity conditions and forage, including aquatic invertebrates and fishes, supporting growth and maturation; and

(ii) Natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, and side channels.

Baseline. Maintenance dredging of navigation channels degrades water quality for short periods via the introduction of suspended sediment. Large wood is removed from navigation channels and terrestrial development has reduced riparian vegetation. Therefore, the conditions regarding water quality (only during dredge events) and large wood have become degraded.

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

Baseline. Navigation channels do not occur in offshore marine areas. As a result, the only aspect of this PCE that can be degraded is the water column during transport and disposal of dredged material. Some dredged material can become suspended as dredged material falls through the water column during descent to a disposal site. Designated critical habitat does not occur at beneficial use disposal sites.

Bioaccumulation of certain persistent bioaccumulative toxins (PBTs) such as polychlorinated biphenyls (PCBs), polychlorinated 2,3,7,8 substituted dioxins and furans (PCDD/F), and polychlorinated diphenyl ethers (PBDEs) are of general concern for marine fish and mammals in Puget Sound over a broad area. In the prior (2010) BA, covering the PSDDA dredged material disposal sites, the USACE presented an appendix analyzing the potential effects of the dredging program on increasing bioaccumulation of these chemicals on Puget Sound Chinook salmon and Southern Resident killer whales. In this BA, this appendix (Appendix G) is updated to consider new scientific evidence and to evaluate recent programmatic developments. This is in accordance with how the DMMP updates its program to assure the use of the best available science via the Sediment Management Annual Review process, which has maintained the program in the forefront of sediment management programs nationwide.

FR 70(170):52630-52858

7.3.3 Puget Sound steelhead

1. Freshwater spawning sites with water quantity and quality conditions and substrate supporting spawning, incubation and larval development.

2. 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.

3. Freshwater migration corridors free of obstruction with water quantity and quality conditions and natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, side channels, and undercut banks supporting juvenile and adult mobility and survival.

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

5. Nearshore marine areas free of obstruction with water quality and quantity conditions and forage, including aquatic invertebrates and fishes, supporting growth and maturation; and natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, and side channels.

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

Baseline. The proposed steelhead critical habitat PCEs are the same as the Chinook salmon critical habitat PCEs (see section 7.3.2).

FR 78(9):2726-2729

7.3.4 Hood Canal summer run and Columbia River chum salmon

(1) Freshwater spawning sites with water quantity and quality conditions and substrate supporting spawning, incubation and larval development;

(2) Freshwater rearing sites with:

(i) Water quantity and floodplain connectivity to form and maintain physical habitat conditions and support juvenile growth and mobility;

(ii) Water quality and forage supporting juvenile development; and

(iii) Natural cover such as shade, submerged and overhanging large wood, log jams and beaver dams, aquatic vegetation, large rocks and boulders, side channels, and undercut banks.

(3) Freshwater migration corridors free of obstruction and excessive predation with water quantity and quality conditions and natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, side channels, and undercut banks supporting juvenile and adult mobility and survival;

(4) Estuarine areas free of obstruction and excessive predation with:

(i) Water quality, water quantity, and salinity conditions supporting juvenile and adult physiological transitions between fresh- and saltwater;

(ii) Natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, side channels; and

(iii) Juvenile and adult forage, including aquatic invertebrates and fishes, supporting growth and maturation.

(5) Nearshore marine areas free of obstruction and excessive predation with:

(i) Water quality and quantity conditions and forage, including aquatic invertebrates and fishes, supporting growth and maturation; and

(ii) Natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, and side channels.

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

Baseline. The chum salmon critical habitat PCEs have the same attributes as the Chinook salmon critical habitat PCEs (see section 7.3.2).

FR 70(170):52630-52858

7.3.5 Snowy plover

Sandy beaches, dune systems immediately inland of an active beach face, salt flats, mud flats, seasonally exposed gravel bars, artificial salt ponds and adjoining levees, and dredge spoil sites, with the following:

(1) Areas that are below heavily vegetated areas or developed areas and above the daily high tides;

(2) Shoreline habitat areas for feeding, with no or very sparse vegetation, that are between the annual low tide or low-water flow and annual high tide or high water flow, subject to inundation but not constantly under water, that support small invertebrates, such as crabs, worms, flies, beetles, spiders, sand hoppers, clams, and ostracods, that are essential food sources;

(3) Surf- or water-deposited organic debris, such as seaweed (including kelp and eelgrass) or driftwood located on open substrates that supports and attracts small invertebrates described in PCE 2 for food, and provides cover or shelter from predators and weather, and assists in avoidance of detection (crypsis) for nests, chicks, and incubating adults; and

(4) Minimal disturbance from the presence of humans, pets, vehicles, or human-attracted predators, which provide relatively undisturbed areas for individual and population growth and for normal behavior.

Baseline. Critical habitat does not occur at the Half Moon Bay and South Beach disposal sites in Grays Harbor nor in the Federal navigation channel. The only records of western snowy plovers nesting in the Grays Harbor area since 1983 are at Damon Point (Wahl et al. 2005). Damon Point, located approximately 9,000 feet north of Entrance Reach and the South Jetty placement site, is a known breeding site (77 FR 36727). Construction of the jetties (a feature of the Grays Harbor Navigation Project) altered sediment transport conditions at the mouth of the harbor and thereby resulted in the creation of Damon Point. Historically, western snowy plovers also nested in the area of South Beach and what is now Westhaven State Park (77 FR 36728). However, vehicle access to the beach was historically allowed in this area and it is heavily used by people and pets, factors that greatly limit nesting opportunities. The exposed supratidal and intertidal zones in Grays Harbor may provide foraging habitat, particularly the large expanses of exposed mudflats found in Bowerman Basin and in North Bay. Western snowy plovers are not known to over-winter in Grays Harbor, but occasionally appear at Leadbetter Point in Pacific County, to the south of Grays Harbor (Wahl et al. 2005; 70 FR 56970). The 2011 USFWS concurrence letter on Grays Harbor dredging stated, “Based on distance of the dredging and disposal sites from the nesting area and the fact that habitat conditions at Damon Point have remained suitable for western snowy plovers since the species was listed we do not expect that changes in sediment transport and deposition resulting from the proposed maintenance dredging and disposal activities will have measurable effects on western snowy plover nesting habitat”.

7.3.6 Marbled murrelet

These PCEs are from the 1996 final rule.

(1) Individual trees with potential nest platforms and

(2) Forest lands of at least one-half site-potential tree height regardless of contiguity within 0.8 kilometers (km; 0.5 miles) of individual trees with potential nesting platforms and that are used or potentially used by the marbled murrelet for nesting or roosting.

Baseline. Marbled murrelet critical habitat only occurs in old growth forests, not in lower reaches of rivers, estuaries, or marine areas.

FR 76(193):61599-61621

FR 77(118):36728-36869

7.3.7 Streaked horned lark

Areas having a minimum of 16 percent bare ground that have sparse, low-stature vegetation composed primarily of grasses and forbs less than 13 in (33 cm) in height found in:

(1) Large (300-acre), flat (0–5 percent slope) areas within a landscape context that provides visual access to open areas such as open water or fields, or

(2) Areas smaller than described in (1), but that provide visual access to open areas such as open water or fields.

Baseline. Critical habitat does not occur at the Half Moon Bay and South Beach disposal sites in Grays Harbor nor in the Federal navigation channel. However, Damon Point, located approximately 9,000 feet north of Entrance Reach and the South Jetty placement site, is the closest mapped critical habitat. The site has both the open landscape context and sparse, low-growing vegetation that are essential to the species. Streaked horned larks currently nest and winter on Damon Point and have been documented nesting along the beach just west of the treatment plant.

FR 78(192):61506-61589

7.3.8 Eulachon

Baseline. Critical habitat for eulachon is not designated for any of the project areas described in this BA. Based on the rarity of eulachon in Puget Sound and Grays Harbor, the potential for interaction with the beneficial use disposal operations is considered remote.

FR 76(203):65324-65352

7.3.9 North American green sturgeon

(1) For freshwater riverine systems:

Baseline. This PCE does not apply to green sturgeon critical habitat in Western Washington.

(2) For estuarine habitats:

(i) Food resources: abundant prey items within estuarine habitats and substrates for juvenile, subadult, and adult life stages.

Baseline. Channel construction and maintenance dredging has degraded baseline conditions in navigation channels because the infaunal and epibenthic fauna will be disturbed during dredging operations. The macroinvertebrate population recovers quickly through migration from adjacent undisturbed habitat and recolonization, as the macroinvertebrates are generally short-lived and adapted to a dynamic environment. Therefore, the baseline for macroinvertebrates is temporally degraded during each maintenance dredge cycle. The forage fish baseline conditions have not been altered by construction or maintenance of navigation channels.

(ii) Water flow: within bays and estuaries adjacent to the Sacramento River (i.e., the Sacramento-San Joaquin Delta and the Suisun, San Pablo, and San Francisco bays), sufficient flow into the bay and estuary to allow adults to successfully orient to the incoming flow and migrate upstream to spawning grounds.

Baseline. This PCE does not apply to green sturgeon critical habitat in Western Washington.

(iii) Water quality: water quality, including temperature, salinity, oxygen content, and other chemical characteristics, necessary for normal behavior, growth, and viability of all life stages.

Baseline. The water quality baseline condition is degraded during maintenance dredging and disposal operations because substrate food decreases for a short period in localized areas. Concerning the other parameters, the baseline conditions are maintained.

(iv) Migratory corridor: a migratory pathway necessary for the safe and timely passage of Southern DPS fish within estuarine habitats and between estuarine and riverine or marine habitats.

Baseline. Maintenance of navigation channels maintains this parameter.

(v) Depth: a diversity of depths necessary for shelter, foraging, and migration of juvenile, subadult, and adult life stages.

Baseline. The construction of a navigation channel generally results in local deepening, which is desirable for green sturgeon. Therefore, the baseline condition for this feature is not degraded and might be enhanced.

(vi) Sediment quality. Sediment quality (e.g., chemical characteristics) necessary for normal behavior, growth, and viability of all life stages.

Baseline. Construction and maintenance of navigation channels has not degraded this feature because construction and maintenance removes material and does not add anything to the substrate. In some cases, construction and maintenance improves the baseline by removing unsuitable material. Material placed in aquatic beneficial use disposal sites must meet DMMP criteria and be suitable for open-water disposal, which maintains or improves existing conditions at the disposal sites.

(3) For nearshore coastal marine areas:

(i) Migratory corridor: a migratory pathway necessary for the safe and timely passage of Southern DPS fish within marine and between estuarine and marine habitats.

Baseline. Navigation channels and disposal sites maintain this feature. Navigation channels can be used as migratory pathways by green sturgeon and the disposal sites where green sturgeon occur are dispersive where substrate conditions are not changed because of disposal.

(ii) Water quality: nearshore marine waters with adequate DO levels and acceptably low levels of contaminants (e.g., pesticides, organochlorines, elevated levels of heavy metals) that may disrupt the normal behavior, growth, and viability of subadult and adult green sturgeon.

Baseline. Water quality is maintained except for suspended sediment, which can be elevated for a short period. Therefore, there can be a temporary increase in suspended sediment, but otherwise these parameters are maintained.

(iii) Food resources: abundant prey items for subadults and adults, which may include benthic invertebrates and fishes.

Baseline. Maintenance dredging will temporally degrade baseline conditions in navigation channels because the infaunal and epibenthic fauna will be disturbed during the dredging operation. During the interval between dredging events, this parameter will be maintained.

FR (195):52300-52351

7.3.10 Southern Resident killer whale

(1) Water quality to support growth and development;

Baseline. The water quality baseline condition may be degraded during maintenance dredging operations. Some dredged material enters the water column as suspended sediment in levels higher than background for short periods and in localized areas. Placement of dredged material in disposal sites can result in temporary elevated suspended sediment levels as it settles.

There is a link between sediment and water quality and under the DMMP, disposal site-related effects, including toxicity and bioaccumulation, are limited to “minor adverse” effects, as determined through testing for chemistry, toxicity, and bedded bioaccumulation tests (for PBTs), and at times site-specific evaluations such as risk assessment are used as tools for making this determination. Sediments with higher than minor levels of adverse effect are typically disposed at approved upland sites.

(2) Prey species of sufficient quantity, quality, and availability to support individual growth, reproduction, and development, as well as overall population growth;

Baseline. Maintenance dredging will not degrade this PCE because navigation channels and their maintenance do not impede immigration or reduce feeding opportunities for returning adult Chinook or chum salmon. Juvenile Chinook or chum salmon typically emigrate along the shoreline in lower reaches of rivers and estuaries away from areas where navigation channels are located. Therefore, the baseline conditions are maintained regarding this PCE.

Southern Resident killer whales feed primarily on adult Chinook salmon. As the presence of salmon in the disposal areas would be rare, it is unlikely that there would be significant increase in the transfer of contaminants to the whales. Adult Chinook salmon typically feed on pelagic organisms such as herring and sand lance. This forage base would not be significantly affected by disposal activities because herring are generally plankton feeders, and sand lance are uncommon

in disposal sites. Spawning areas for both species are in intertidal and shallow subtidal areas that might be enhanced by disposal of sandy material offshore of areas where spawning could occur.

(3) Passage conditions to allow for migration, resting, and foraging.

Navigation channels and disposal sites maintain this feature. Navigation channels can be used as migratory pathways by killer whales and conditions at disposal sites regarding this PCE are maintained. However, should a killer whale coincidentally be present *en route* to or in the disposal area during a discharge event, it could experience a short period of non-lethal discomfort due to suspended sediments in the water column. The water column turbidity elevation is localized and of short duration (approximately 12 minutes in mid-water areas studied by Truitt (1986). Killer whales would likely move away from the area affected by the discharge and recover quickly from any discomfort.

Another factor for migration, resting, and foraging is underwater noise pollution that interferes with all cetaceans that use echolocation. Three studies that measured the killer whale audiogram show the range is approximately 500Hz up to 105kHz with varying sensitivities; the range of highest sensitivity is 18 to 42kHz, which includes their most common clicking noise at 20kHz (Hall and Johnson 1971, Bain et al. 1993, Szymanski et al. 1999). Very little data is available for the important parameter of received noise levels for killer whale tolerances and reactions. Erbe (2002) measured boat noise source levels at 145 to 169 dB re 1 µPA at 1m, and found this noise level elicited a behavioral response at 200m, and masked killer whale vocalizations at 14km distance. This study also found orca vocalizations to fall in the range of 105 to 124 dB re 1 µPA.

FR 71(229):69054-69070

7.3.11 Humpback whale

Critical habitat for humpback whale is not designated for any of the project areas described in this BA.

7.3.12 Leatherback sea turtle

The PCE essential for conservation of leatherback turtles is the occurrence of prey species, primarily scyphomedusae of the order Semaeostomeae (Chrysaora, Aurelia, Phacellophora, and Cyanea), of sufficient condition, distribution, diversity, abundance and density necessary to support individual as well as population growth, reproduction, and development of leatherbacks.

Baseline. Critical habitat does not occur within Grays Harbor, but does occur along the Washington Coast. This overlaps with the bar and entrance/Point Chehalis reaches at the entrance of the Federal navigation channel. Construction of navigation channels and subsequent maintenance did not and does not change baseline conditions for this PCE. The sessile life history stage of scyphomedusae typically occurs on hard substrate. The USACE is not aware of any sessile life history stages in navigation channels or beneficial use disposal sites. The pelagic life history stage is the food source for leatherback sea turtle. Dredging has does not change the abundance of scyphomedusae.

FR 77(17):4170-4201

7.3.13 Green sea turtle

Critical habitat for green sea turtles does not occur in Washington.

FR 63(170):46693-46701

7.3.14 Bocaccio, canary, and yelloweye rockfish

These rockfish species are only designated under the ESA in Puget Sound, not on the outer Strait of Juan de Fuca or the Washington Coast; the same occurs for designated critical Habitat.

Essential features for juvenile canary rockfish and bocaccio. Juvenile settlement habitats located in the nearshore with substrates such as sand, rock and/or cobble compositions that also support kelp are essential for conservation because these features enable forage opportunities and refuge from predators and enable behavioral and physiological changes needed for juveniles to occupy deeper adult habitats. Several attributes of these sites determine the quality of the area and are useful in considering the conservation value of the associated feature and in determining whether the feature may require special management considerations or protection. These features are relevant to evaluating the effects of a proposed action in a Section 7 consultation if the specific area containing the site is designated as critical habitat. These attributes include quantity, quality, and availability of prey species to support individual growth, survival, reproduction, and feeding opportunities; and water quality and sufficient levels of DO to support growth, survival, reproduction, and feeding opportunities. Nearshore areas are contiguous with the shoreline from the line of extreme high water out to a depth no greater than 30 meters (m; 98 feet) relative to MLLW.

Baseline. Navigation channels in Puget Sound are located in areas where the substrate is typically depositional and typically sandy with some fraction of fines. Navigation channels are devoid of kelp, rocks, and other features that would provide refuge from predators. Shoreline terrestrial habitat is degraded because of terrestrial development that has reduced the input of terrestrial materials including rocks, large wood and sediment that enters the intertidal areas adjacent to navigation channels.

Prey species for larval pelagic rockfish are typically located in the upper water column and move with water currents, tides, and wind independent of the existence of navigation channels. Some of the sediment material transported from upland and upstream sources into navigation channels may contain organic and chemical components that in the presence of oxygenated water may reduce DO levels in the aquatic area where dredges are operating and in disposal sites. Measurements of DO taken during dredging and disposal indicate that DO levels may become slightly depressed, but not to levels that are detrimental to aquatic life. Therefore, the baseline DO is minimally affected and generally maintained.

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

in considering the conservation value of the associated feature and whether the feature may require special management considerations or protection. These attributes are relevant in the evaluation of the effects of a proposed action in a Section 7 consultation if the specific area containing the site is designated as critical habitat. These attributes include the following:

(1) Quantity, quality, and availability of prey species to support individual growth, survival, reproduction, and feeding opportunities,

(2) Water quality and sufficient levels of DO to support growth, survival, reproduction, and feeding opportunities, and

(3) The type and amount of structure and rugosity that supports feeding opportunities and predator avoidance.

Baseline. Proposed critical habitat for the demersal life history stage of bocaccio, canary, and yelloweye rockfish in Puget Sound is located in water depths of 30m or greater. All of the navigation channels in Puget Sound and the Strait of Juan de Fuca that occur in Puget Sound are in water less than 20m deep. Therefore, this subject will not be discussed further in this BA (FR [151]: 47635-47669).

7.3.15 Summary

The substrate conditions as well as channel geometry have been made uniform through navigation channel construction resulting in a reduction in habitat complexity. Contaminated materials at levels below DMMP criteria for open-water disposal can be found in many of the navigation channels, but the emphasis is low levels; and this material comes from upland sources independent of maintenance dredging and disposal and accumulates in lower reaches of waterways (navigation channels).

8 EFFECTS OF THE MAINTENANCE DREDGING PROGRAM ON THE ENVIRONMENT

Effects associated with the action program are related to the incremental effect, over and above the baseline effects, of maintaining navigation features. The estimated volumes to be removed to return navigation features to authorized depths are based on historically dredged amounts. Actual volumes in each construction year would be determined based on bathymetric surveys of navigation channels just prior to maintenance dredging. Effects due to maintenance dredging, over and above any baseline effects are analyzed in this document.

Resources could be directly and indirectly affected during operation and maintenance activities. Operation-related effects could result in temporary, short-term, or long-term negative and/or beneficial outcomes for resources. These effects are discussed in detail in the sections that follow.

Although maintenance dredging and disposal are necessarily related, maintenance dredging and disposal have somewhat different effects on the environment. Dredging removes material and, depending on the dredge method, can entrain infauna and benthic organisms (hopper and hydraulic pipeline dredges). Maintenance dredging transports dredged material to offsite locations; therefore, disposal of dredged material can move organisms from one location (dredge site) into another (disposal site), and it can potentially bury demersal and infaunal organisms. Beneficial use at upland disposal sites typically involves maintenance of structures or shoreline.

This section assesses the environmental consequences of implementing the proposed maintenance-dredging program for this BA. The resources that could be affected by implementation of the proposed program are the ESA-listed species found in each project area, and the resources upon which the ESA-listed species depend. The environmental consequences associated with maintenance dredging follow this introduction.

8.1 Maintenance Dredging Projects

As previously stated, maintenance dredging is conducted in authorized and constructed navigation projects. In all cases, maintenance dredging is designed to maintain authorized project dimensions. Maintenance dredging removes accumulated sediment from authorized navigation projects and does not change authorized dimensions. Repeated maintenance dredging is often necessary to maintain a navigation project. Natural erosion and sediment transport causes navigation projects to fill with sediment on different time scales that range from annual to over 10 years. The outcome of maintenance dredging is to cause a navigation project to remain fixed in space through time, allowing vessel operators predictability in the location of navigable waters. A navigation project (channel) is typically a minor proportion of an associated river delta and/or associated estuary.

8.1.1 Effects to the Physical Environment

Maintenance dredging can change the physical environment in the project areas, which in turn can have effects on the biological environment. The physical effects are discussed first.

8.1.1.1 Tides and Currents

Maintenance dredging of navigation channels likely has little if any detectable effect on tidal levels because the tide will come and go independent of the minor changes in bathymetric changes in river deltas/estuaries caused by navigation channel construction and subsequent maintenance.

8.1.1.2 Water and Sediment Quality

Turbidity. There will likely be a minor increase in turbidity during maintenance dredging. Clamshell dredges produce more turbidity than hydraulic dredges and hopper dredges because the dredge buckets create turbidity when the bucket encounters the substrate and is retracted up through the water column. With hopper and hydraulic dredging, turbidity occurs at the bottom of the channel during dredging. Turbidity is also generated during the disposal phase. Hopper and clamshell dredging release material directly over the disposal site causing a vertical plume. Hydraulic dredges produce a slurry at their outfall that may result in releases to water column. Turbidity is monitored and steps are taken to keep turbidity within levels mandated by Clean Water Act Section 401 water quality certifications issued by Ecology. The USACE expects that turbidity will be kept within the levels mandated by Ecology's water quality certifications.

Dissolved Oxygen. Some dredged material may contain sediment with biological and/or chemical oxygen demand that could lower ambient DO levels. If material with depressed DO levels is placed in a dispersive disposal site then the material will be diluted through dispersion and biological oxygen demand and chemical oxygen demand will be reduced in any given location. Maintenance dredging only removes material that has accumulated since a previous maintenance dredge event. This has the effect of not allowing the accumulated sediment to become hard packed and resistant to being "churned up" by infaunal and benthic organisms and thus the likelihood of finding much anaerobic sediment during maintenance dredging is small. Anaerobic sediment will likely be a minor fraction, if any, of the material dredged during maintenance dredging. Thus, the USACE anticipates that there will likely be little or no reduction in ambient DO during maintenance dredging.

Non-compliant Material. All material is tested using DMMP procedures before the sediment is dredged. Only dredged material that meets open-water disposal standards is allowed to be discharged into the aquatic environment or nearshore zone. Any material dredged that does not meet DMMP standards is taken to upland disposal sites that have been approved to receive non-compliant material and dredging of these sediments would be the subject of a separate Section 7 consultation with the Services, if Section 7 obligations are triggered.

8.1.1.3 Physical Conditions

Substrate. Sediment loads from rivers that drain into estuaries is a major factor in the frequency (or cycle time) of maintenance dredging. Another source of sediment in coastal estuaries is from the adjacent Pacific Ocean. The sediment is unconsolidated and easily removed with mechanical, hydraulic pipeline, or hopper dredges.

Bathymetry. The bathymetry of the navigation channels is not expected to change appreciably as maintenance dredging is conducted. Maintenance dredging will remove sediment and return navigation channels to authorized (baseline) dimensions.

Physical Conditions. Only substrate of navigation channels previously constructed will be disturbed by the proposed action. The continuation of the USACE's maintenance dredging program will not result in any new or previously unanalyzed environmental effects to physical conditions in navigation channels.

8.1.2 Effects to the Biological Environment

Maintenance dredging effects to the biological environment are a result of changes to the physical environment discussed above. The following sections discuss these effects.

8.1.2.1 Infauna

Infauna will be disrupted during maintenance dredging; however, aquatic organisms in Western Washington are adapted to the dynamic nature of estuarine and lower river environments. Dredging involves removal of sediment within which infaunal organisms live. After maintenance dredging, the exposed substrate is likely devoid of all but the deepest burrowing organisms. Most species that live at the water depths of navigation channels in Western Washington are adapted to a dynamic environment because of the more or less constant input of sediment from adjacent rivers and estuaries, salinity changes during each tidal cycle, and storm generated wave action. Interestingly, disrupted infaunal communities typically recover in six to 18 months (Desprez 2000) with colonization coming from adjacent areas. In addition, the area of each navigation channel is a minor portion of adjacent similar habitat. The USACE does not expect the loss of infauna for a short period (6 to 18 months) in a small area to have detectable effects on local species that prey on infauna. Studies have indicated that infaunal communities that are in a state of flux, compared to climax communities, provide better and increased food supplies for juvenile fishes, which is a desirable outcome for juvenile salmonids (Rhoads et al. 1978, Trueblood et al. 1994, Kropp and Diaz 1995).

8.1.2.2 Epibenthic Fauna

Epibenthic organisms may undergo mortality due to entrainment during maintenance dredging. However, the effect will be minor in relation to the entire benthic community available in the local area. Most benthic organisms are unlikely to be adversely affected by maintenance dredging using a clamshell bucket because most of them are sufficiently mobile to avoid the active dredge and forage elsewhere because the clamshell bucket does not entrain mobile organisms. The habitat is changed because of dredging, but the dredge area is small compared with the entire aquatic area of a river delta and/or associated embayment. Epibenthic organisms will quickly return to the newly dredged area, likely within days, through migration.

8.1.2.3 Pelagic Fauna

Pelagic fauna typically forage across large areas and are not associated with one location. Maintenance dredging is unlikely to have a detectable effect on pelagic organisms, their habitat, or local species that forage on pelagic organisms.

8.1.2.4 Primary Producers

Primary producers include eelgrass (rooted plant), macroalgae, and plankton that photosynthesize. Rooted plants and macroalgae are not found in navigation channels because of maintenance dredging and because navigation channels are only slightly deeper than the vessels that use them. Vessel use tends to discourage growth of vegetation due to turbulence during vessel passage above shallow substrate.

Photosynthesizing plankton do occur in the water column in navigation channels, but are unlikely to be affected because they are typically located in the photic zone and move with the currents, thus passing through maintenance dredging areas. It is highly unlikely that maintenance dredging would have a detectable effect on phytoplankton and local species that depend on them as a food source.

8.1.2.5 Zooplankton

Most zooplankton are at the mercy of currents whatever the source of the currents and are only minimally influenced, if at all, by maintenance dredging activities. Zooplankton are subject to mortality from active propellers as vessels travel through navigation channels (Killgore et al. 2001, Kilgore et al. 2005, Bickel 2011). However, the USACE does not expect maintenance dredging to have any detectable effect on local zooplankton abundance because the area affected by an active dredge is a small proportion of the available adjacent area, zooplankton will move in and out of the area on currents, and zooplankton reproduction is relatively rapid (multiple within-season generations).

8.1.2.6 Forage Fish

Most forage fish do not occur in the benthic areas of the water column of navigation channels and thus are not affected by maintenance dredging. Those that might be found in the benthic areas of navigation channels are not associated with one location, are highly mobile, and can avoid dredging operations, especially clamshell dredges. The USACE does not anticipate any detectable effect of maintenance dredging on local forage fish.

8.1.2.7 Birds

Birds will occur in the areas where maintenance dredging occurs. However, birds can easily avoid the dredge machinery and move to nearby areas to forage. Thus, The USACE does not anticipate any detectable effect of maintenance dredging on birds that occur in the project area of an operating dredge.

8.2 Disposal Sites

Dredged material generated from the actions consulted upon is disposed of in three types of locations: nearshore aquatic placement, which occurs in the subtidal range of the nearshore zone; intertidal beach placement, which typically involves the supratidal and intertidal ranges of the nearshore zone; and upland disposal (see Table 3). The nearshore zone disposal sites in Western Washington have been authorized by the appropriate agency(s). Nearshore aquatic placement allows sediment to remain in its source system and benefits the subtidal and intertidal habitats where it is placed and circulates. Material placed on the supratidal and intertidal zones

of beaches erodes and moves with littoral drift cells into the adjacent nearshore areas. Material placed at upland sites does not enter the aquatic environment except in rare cases of extreme wave action at the Point Chehalis Revetment Extension Mitigation Site. Material deposited upland will have minor, discountable effects to the terrestrial environment where the dredged material is deposited, but there will be no direct effect on the aquatic environment.

In the following sections, nearshore aquatic placement and intertidal beach placement are grouped into "Nearshore Zone Beneficial Disposal Sites"; while intertidal beach placement may target the supratidal zone above MHHW for initial placement, it is distinct from "Upland Disposal Sites" in which the material is not necessarily intended to enter the littoral system.

8.2.1 Effects to the Physical Environment

8.2.1.1 Tides and Currents

Nearshore Zone Beneficial Disposal sites. Disposing of dredged material will have no discernible effects on tides and currents in these disposal sites because there will be little or no material buildup in these sites that would cause changes in bathymetry that could cause changes in currents. Without buildup of dredged material, there is no structure to interfere with tides and currents.

Upland Disposal Sites. Upland disposal sites will not have any effect on tides and currents because dredged material is placed out of reach of tides and currents.

8.2.1.2 Water and Sediment Quality

Turbidity in Nearshore Zone Disposal Sites. There will be a minor increase in turbidity during, and for a short time after disposal, especially near the substrate of the nearshore aquatic sites. The USACE expects that disposal will produce only a minor amount of turbidity and the dredged material will disperse, and perhaps cause increased turbidity in the lower reaches of the water column for a short time. However, the material will be dispersed over a large area and will likely be undetectable or in a thin layer. Some turbidity will occur at the intertidal beach disposal sites because some of the material is expected to move into the adjacent water bodies and into local longshore drift cells after supratidal placement. As material erodes from beach placement, natural turbidity is expected to match background, baseline levels. Any material that enters the longshore drift cells or lower reaches of rivers will mimic natural sediment movement.

DO in Nearshore Zone Disposal Sites. Some dredged material may have anaerobic sediment that could lower ambient DO levels. Material with anaerobic sediment placed in aquatic disposal sites will be exposed to oxygenated water and the biological oxygen demand will be quickly eliminated as the material disperses. The USACE anticipates that any subsequent reduction in ambient DO will not be sufficient to cause detrimental effects on the demersal and infaunal communities in disposal sites or nearby areas because the material will be dispersed over a large area reducing the effects to any given location. Material placed at the intertidal beach placement sites will have no effect to DO levels as the sediment disperses with the tidal wave action.

Upland disposal sites will have no effects to water or sediment quality or DO levels.

8.2.1.3 Physical Conditions

Substrate in Nearshore Zone Disposal Sites. Dredged material placed in these disposal sites will have little or no effect on benthic habitat because the disposal sites are specifically located in areas where currents and tides will cause the dredged material to move inshore or alongshore and not accumulate on the disposal site substrate. Dredged material dispersed over a wide area will likely have undetectable effects to the substrate.

Substrate in Upland Disposal Sites. Upland disposal sites are primarily used to place material for beneficial re-use purposes. Material placed in upland disposal sites will not cause any detrimental effects to aquatic physical habitat and will not harm any terrestrial wildlife.

Bathymetry in Nearshore Zone Disposal Sites. There will be no significant or long-term changes in bathymetry of nearshore aquatic and intertidal beach disposal sites because the sites are specifically chosen to allow movement of dredged material inshore or alongshore for natural distribution of sediment.

Physical Conditions in Nearshore Zone Disposal Sites. The USACE does not anticipate any persistent changes in physical conditions compared to baseline conditions at these sites because the dredged material will be dispersed. An example is Jetty Island where the island is maintained by placing dredged material on it and the physical conditions were changed from aquatic to terrestrial. Jetty Island did not exist until the USACE placed dredged material on the west side of the wood jetty, and later created the intertidal lagoon. The effects of the continued existence of Jetty Island fall within the environmental baseline and are not effects of the proposed action. The USACE is of the opinion that Jetty Island and its associated lagoon created and now maintains better physical aquatic conditions compared to the initial wood jetty.

Physical Conditions in Upland Disposal Sites. Dredged material in upland disposal sites will not cause negative effects in terrestrial conditions as compared with the environmental baseline.

8.2.2 Effects to the Biological Environment

Disposal of dredged material at the upland disposal sites has minor, discountable effects to terrestrial flora and fauna. The following sections describe effects of dredged material placement at the nearshore aquatic and intertidal beach beneficial use disposal sites.

8.2.2.1 Infauna

Effects to infauna at all disposal sites have been minimal. Dredged material placed in intertidal beach sites is moved without causing changes to infauna because these organisms are adapted to changes in sediment input and any dredged material remaining on-site would be too thin (generally less than 10 cm) to cause mortality or changes in species composition. Therefore, the USACE does not anticipate long-term changes to the infaunal community caused by disposal.

8.2.2.2 Epibenthic Fauna

Deposition of dredged material in intertidal beach disposal sites could cause mortality of epibenthic organisms, primarily small, less mobile crustaceans, because they might not be able to move sufficient distances fast enough to avoid being buried. If, after reaching the substrate, the material is sufficiently thin, the crustaceans will burrow to the surface and resume their life

style. Larger benthic organisms are mobile, can detect the descending dredged material, and move out of the way. Once any suspended material has settled and dispersed, benthic organisms will return to the disposal site and resume their normal life style. As a result, the USACE does not anticipate any detectable effect of dredged material disposal to benthic animal fauna in aquatic beneficial disposal sites.

8.2.2.3 Pelagic Fauna

Numerous species of fishes and invertebrates occupy the pelagic region near the intertidal beach beneficial disposal sites. These species include salmonids, herring, surf perches, smelts, pteropods, and larval life stages of various invertebrates (an example is crab zoea) to name a few. Since these species are not associated with one location, the USACE does not anticipate any detectable effect of dredged material disposal on pelagic species abundance or behavior.

8.2.2.4 Primary Producers

Primary producers include eelgrass (rooted plant), macroalgae, and plankton that photosynthesize. Rooted plants and macroalgae are not found in intertidal beach beneficial disposal sites. Photosynthesizing plankton do occur in the water column above disposal sites, but phytoplankton are unlikely to be affected by dredged material disposal because phytoplankton are located in the photic zone of the water column above disposal sites and move with the currents, thus passing through disposal sites. The USACE does not anticipate any detectable effect of maintenance dredging disposal on the phytoplankton community.

8.2.2.5 Zooplankton

Zooplankton are pelagic and subject to wind generated waves and currents. They are not permanently associated with a given location, but pass through disposal sites with water movement. In addition, dredged material is released from the bottom of transport vessels typically below near-surface zooplankton. The USACE does not anticipate any detectable effect of maintenance dredging disposal on the zooplankton community.

8.2.2.6 Forage Fish

Most forage fish species are highly mobile and can avoid dredged material as it descends through the water column. However, sand lance burrow into sandy substrate at dusk where they remain until dawn; therefore, they are at risk of burial during nighttime disposal. It is assumed that any sand lance in a disposal site would flee the area if disturbed at night, or would likely not choose to burrow into an active disposal zone. Therefore, the USACE does not anticipate any detectable effect of dredged material disposal on forage fish species.

8.2.2.7 Birds

Birds, including marbled murrelets, snowy plover, and streaked horned lark can occur in the water above disposal sites depending on geographic location; snowy plover and streaked horned lark are primarily located along the Washington Coast. Estuaries and ocean beaches are fertile areas where prey is likely available; birds are therefore expected to be located in the water above the aquatic beneficial disposal sites. However, birds could easily avoid the transport vessel. The USACE does not expect any detectable effects to birds because of deposition of dredged material in disposal sites.

9 EFFECTS OF THE MAINTENANCE DREDGING PROGRAM ON ENDANGERED SPECIES ACT LISTED SPECIES

This section assesses the effects of the maintenance-dredging program on ESA-listed species and their designated critical habitat that occur in the action area. Each ESA-listed species, dredge site, and disposal site considered in this BA appears in Table 7. A check mark indicates presence of the species in a given project area; a blank indicates no occurrence in the given project area.

9.1 Coastal/Puget Sound Bull Trout

9.1.1 Effects of Maintenance Dredging and Disposal on Coastal/Puget Sound Bull Trout

Critical habitat for bull trout occurs at all of the maintenance dredging sites in this BA except for Quillayute Navigation Channel and its associated disposal sites. Maintenance dredging via clamshell in Puget Sound and on the coast is conducted mid-July to mid-February, when bull trout are not expected to be present; even if bull trout were present, the clamshell dredge bucket will not entrain bull trout. The in-water work window is limited to October to February at Snohomish to avoid bull trout. Maintenance dredging by hopper dredge, April and May in Grays Harbor, occurs when bull trout may be present, but is conducted in deep water away from shore where bull trout are not expected to be located. If adult or sub-adult bull trout were present during maintenance dredging with a clamshell bucket or disposal, they could easily avoid areas where a clamshell dredge is operating and its associated elevated total suspended solids (TSS), especially since maintenance dredging is restricted to the central portion of waterways allowing fish passage along either shoreline away from the maintenance dredge operation. Because of maintenance dredge timing, dredge type, and location of dredges, there will be discountable effects to bull trout.

Effects of Maintenance Dredging and Disposal on Coastal/Puget Sound Bull Trout Critical Habitat. Designated critical habitat for Coastal/Puget Sound bull trout (75 FR 63898) includes many of the navigation channels in Puget Sound and on the Coast. This section evaluates the potential for effects to the bull trout PCEs determined to be essential to the conservation of Coastal/Puget Sound bull trout:

PCE #1. Springs, seeps, groundwater sources, and subsurface water connectivity (hyporheic flows) to contribute to water quality and quantity and provide thermal refugia.

> *Maintenance dredging and disposal will not have any effect to springs, seeps, groundwater sources, or subsurface water connectivity that contributes to water quality and quantity because this PCE does not occur in the project areas. Therefore, maintenance dredging and disposal will have no effect on this PCE.*

PCE #2. Migration habitats with minimal physical, biological, or water quality impediments between spawning, rearing, overwintering, and freshwater and marine foraging habitats, including but not limited to permanent, partial, intermittent, or seasonal barriers.

> *Maintenance dredging of navigation channels and disposal of dredged material will not create physical impediments to migration or change migration habitats. Maintenance dredging and disposal could result in a temporary, localized elevation of TSS in the water column, which*

could affect localized movements of bull trout (but would not block the migratory corridor). Disposal sites are located in areas where the dredged material is disposed upland or where it will be used for beach nourishment eventually leaving the disposal area as it was prior to disposal. Therefore, maintenance dredging and disposal will have a discountable adverse effect on this PCE.

PCE #3. An abundant food base, including terrestrial organisms of riparian origin, aquatic macroinvertebrates, and forage fish.

Maintenance dredging will not affect terrestrial organisms because dredging occurs in the central portions of waterways and will not affect shorelines or riparian vegetation. Maintenance dredging could affect benthic organisms in, and some short distance downstream of, the dredge footprint. However, the aquatic macroinvertebrates (benthic only) do not constitute significant prey for subadult and adult bull trout, which are the life stages likely to be found in lower rivers and nearshore estuarine areas. Bull trout that might occur in navigation channels are likely there to feed on emigrating juvenile salmonids and forage fish. Regardless, because of the relatively small size of the dredge footprint, the loss of benthic organisms from dredging would be insignificant compared to the total area of benthic forage areas available. Maintenance dredging could have a small, but negligible indirect effect on bull trout through potential short-term effects to prey items (juvenile salmonids and forage fish) and their habitat. However, bull trout prey is unlikely to be significantly affected by maintenance dredging operations. Disposal will not affect the food base because disposal sites are located in areas where prey items area adapted to the dynamic conditions and the sediment disperses rapidly. Therefore, maintenance dredging and disposal will have discountable adverse effects on this PCE.

PCE #4. Complex river, stream, lake, reservoir, and marine shoreline aquatic environments, and processes that establish and maintain these aquatic environments, with features such as large wood, side channels, pools, undercut banks and un-embedded substrates, to provide a variety of depths, gradients, velocities, and structure.

Maintenance dredging and disposal will not result in the degradation of shoreline complexity. The area to be dredged is in the central portion of waterways in areas that have been dredged for decades and the effects of maintaining this prism therefore fall within the environmental baseline. Because the actions will take place in the center of waterways, side channels, pools, and undercut banks will not be affected. Further, maintenance dredging will return the dredge area to its authorized (baseline) depth and will not affect stream velocities or other hydraulic characteristics. Disposal will not affect the food base because disposal sites are located in areas where prey items are adapted to the dynamic conditions and the sediment disperses rapidly. Therefore, maintenance dredging and disposal will have discountable adverse effects on this PCE.

PCE #5. Water temperatures ranging from 2 to 15 °C (36 to 59 °F), with adequate thermal refugia available for temperatures that exceed the upper end of this range. Specific temperatures within this range will depend on bull trout life-history stage and form; geography; elevation; diurnal and seasonal variation; shading, such as that provided by riparian habitat; streamflow; and local groundwater influence.

Maintenance dredging and disposal will not affect water temperatures. There is nothing inherent to maintenance dredging or disposal that will affect this PCE. Maintenance dredging removes sediment and in the process generates heat, which raises the temperature of the water around the hull of the powered vessels through the heat exchange systems of the diesel engines associated with the dredge barge and tug boats. However, the amount of heat added to the navigation channel water is likely undetectable when the entire volume of water in the project area is considered. Therefore, maintenance dredging and disposal will not have adverse effects on this PCE.

PCE #6. In spawning and rearing areas, substrate of sufficient amount, size, and composition to ensure success of egg and embryo overwinter survival, fry emergence, and young-of-the-year and juvenile survival. A minimal amount of fine sediment, generally ranging in size from silt to coarse sand, embedded in larger substrates, is characteristic of these conditions. The size and amounts of fine sediment suitable to bull trout will likely vary from system to system.

Maintenance dredging and disposal will not affect sediments suitable for success of eggs, embryos, fry, or young of the year because this PCE does not occur in the project areas. Navigation channels and disposal sites are not located in suitable spawning habitat for bull trout. Therefore, maintenance dredging and disposal will have no effect on this PCE.

PCE #7. A natural hydrograph, including peak, high, low, and base flows within historic and seasonal ranges or, if flows are controlled, minimal flow departure from a natural hydrograph.

Maintenance dredging and disposal will not affect river hydrographs. Nothing inherent in maintenance dredging or disposal, which occur in the most downstream portions of watersheds, could affect the natural hydrograph, which is controlled by precipitation and snowmelt in portions of watersheds that are upstream from dredging and disposal operations. Maintenance dredging does not impair water flow. Disposal will not affect this PCE because disposal sites are located in the outer Grays Harbor or the adjacent Pacific Ocean South Beach and the disposal sites in Puget Sound are either upland or beneficial use in the nearshore zone. Therefore, maintenance dredging and disposal will have no effect on this PCE.

PCE #8. Sufficient water quality and quantity such that normal reproduction, growth, and survival are not inhibited.

Maintenance dredging and disposal will not affect the quantity of water available at any time. Maintenance dredging will not impede water flow because the operation will not create any blockages. If minor (localized) short-term water quality degradation were to occur, it would not affect reproduction and will have negligible and discountable effects on growth and survival primarily because maintenance dredging will occur when bull trout are not present and water quality will return to pre-maintenance dredge conditions within days of project completion. Therefore, maintenance dredging and disposal will have discountable adverse effects on this PCE.

PCE #9. Sufficiently low levels of occurrence of non-native predatory (e.g., lake trout, walleye, northern pike, smallmouth bass); interbreeding (e.g., brook trout); or competing (e.g., brown trout) species that, if present, are adequately temporally and spatially isolated from bull trout.

Maintenance dredging and disposal do not affect nonnative predatory fish abundance or occurrence in navigation channels or at disposal sites. Therefore, maintenance dredging and disposal will have no effect on this PCE.

9.1.2 Effect Determination for Bull Trout

To date, no bull trout have been observed in navigation channels or disposal sites during the maintenance dredging windows. However, in the unlikely event of bull trout presence during maintenance dredging and disposal, bull trout would be expected to readily avoid the project area during operations and conservation measures (as described in section 6) would minimize the potential for direct or indirect effects to bull trout. Should any bull trout be present, they would experience negligible effects from maintenance dredging and disposal. Overall, the effects of the proposed action on bull trout would be insignificant and discountable. Therefore, the effects determination for the USACE's proposed maintenance dredging and disposal is "**may affect, not likely to adversely affect**" Coastal/Puget Sound bull trout. Potential effects of maintenance dredging and disposal on Coastal/Puget Sound bull trout critical habitat PCEs are considered discountable or will not adversely affect the PCEs; therefore, the USACE's proposed maintenance dredging and disposal effects determination is, "**may affect, not likely to adversely affect**" bull trout designated critical habitat.

9.2 Lower Columbia River Chinook Salmon, Upper Willamette River Chinook Salmon, and Columbia River Chum Salmon

9.2.1 Effects of Maintenance Dredging and Disposal on Lower Columbia River Chinook Salmon, Upper Willamette River Chinook Salmon, and Columbia River Chum Salmon

The juvenile life stage of the lower Columbia River Chinook salmon, the upper Willamette River Chinook salmon, and the Columbia River chum salmon may use the nearshore habitat in Grays Harbor, but are not known to use any other project areas in this BA. The effects of the maintenance dredging and disposal on these three species will be similar and they occupy similar habitat in their juvenile life history stages, thus they are treated as a single group.

Any juveniles of these three ESUs that occur in Grays Harbor would typically be found in the nearshore areas of the outer portion of Grays Harbor. Dredging occurs in April through May and mid-July through mid-February in navigation channels offshore of the areas where juveniles of these three species will likely be found. There will be no effects to spawning habitat or behaviors. There may be some water quality degradation (suspended sediment) in the area of the dredges but it will be localized and short in duration. Entrainment in hopper, hydraulic, or clamshell dredges is extremely unlikely because the dredges operate offshore, away from where juvenile salmon migrate. In addition, the clamshell bucket does not entrain mobile organisms.

Transport and placement of dredged material at the disposal sites in and adjacent to Grays Harbor is not expected to result in adverse impacts to these three species. Although there may be some suspended sediment in the area when hopper dredges and bottom dump barges release material, this turbidity is limited in both time and space and will not linger once material is released and dredging is stopped.

9.2.2 Effects of Maintenance Dredging and Disposal on Critical Habitat of Lower Columbia River Chinook Salmon, Upper Willamette River Chinook Salmon, and Columbia River Chum Salmon

Critical habitat for these three species has been designated, but does not occur in the maintenance dredging action area.

9.2.3 Effect Determination for Lower Columbia River Chinook Salmon, Upper Willamette River Chinook Salmon, and Columbia River Chum Salmon

Because the juvenile life stage of the lower Columbia River Chinook salmon, the upper Willamette River Chinook salmon, and the Columbia River chum salmon occupy the nearshore area, the clamshell maintenance dredging is conducted when juveniles are not present, and the hopper dredge operates offshore away from the areas where juveniles will be located, the USACE's determination is "**may affect, not likely to adversely affect**" for lower Columbia River Chinook salmon, upper Willamette River Chinook salmon, and Columbia River chum salmon. Dredging and disposal activities will have **no effect** on designated critical habitat for those species.

9.3 Puget Sound Steelhead

9.3.1 Effects of Maintenance Dredging and Disposal on Puget Sound Steelhead

Effects of maintenance dredging and disposal on Puget Sound steelhead include disturbance from the dredging activities and increased turbidity during dredging that may cause a minor delay of adults during immigration of the winter run steelhead. Winter run adults immigrate from December through April, summer run steelhead immigration takes place between May and October, and both runs may encounter the noise (operating heavy equipment) and temporary increases in turbidity during dredging as they immigrate. However, adult Puget Sound steelhead are unlikely to be delayed or diverted by an active dredge because the adults can easily swim around a maintenance dredge operation without any delay in their migration. Since juvenile steelhead typically emigrate in spring and move quickly though nearshore areas, they are unlikely to be impacted by maintenance dredge and disposal operations.

The conservation measures described in section 6 (specifically use of a mechanical dredge), as well as compliance with water quality monitoring requirements, are expected to limit effects of maintenance dredging to steelhead.

9.3.2 Effects of Maintenance Dredging and Disposal on Puget Sound Steelhead Proposed Critical Habitat

Proposed critical habitat for Puget Sound steelhead includes the navigation channels and disposal sites in Puget Sound. This section evaluates the potential for effects to the Puget Sound steelhead PCEs proposed to be essential to their conservation:

PCE #1. Freshwater spawning sites with water quantity and quality conditions and substrate supporting spawning, incubation and larval development.

> *Maintenance dredging and disposal will not affect Puget Sound steelhead spawning and juvenile rearing sites because steelhead spawning occurs upstream of maintenance dredge project sites and typically these sites are many miles upstream of navigation channels.*

Steelhead young rear in streams and rivers many miles upstream of maintenance dredging sites. The disposal sites are all located in marine or brackish waters where juvenile Puget Sound steelhead critical habitat does not occur. Therefore, the project will have no effect on this PCE.

PCE #2. 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.

Navigation channels are located in lower, tidally influenced reaches of rivers and river deltas, and marine estuarine areas, downstream of freshwater rearing areas. Disposal of dredged material occurs in sites located in uplands and estuarine nearshore zones away from freshwater areas supporting juvenile development; therefore, maintenance dredging and disposal will have no effect on this PCE.

PCE #3. Freshwater migration corridors free of obstruction with water quantity and quality conditions and natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, side channel, and undercut banks supporting juvenile and adult mobility and survival.

Maintenance dredging and disposal will not affect freshwater migration corridors because navigation channels are downstream of freshwater habitat and the critical habitat does not occur in the project areas. Maintenance dredging does not disturb natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, side channel, and undercut banks supporting juvenile and adult mobility and survival because these natural features do not occur in maintained navigation channels. Disposal sites are located in the nearshore zone or uplands away from river deltas and freshwater areas. Therefore, maintenance dredging and disposal will have no effect on this PCE.

PCE #4. Estuarine areas free of obstruction with water quality, water quantity, and salinity conditions supporting juvenile and adult physiological transitions between fresh- and saltwater; natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, and side channels; and juvenile and adult forage, including aquatic invertebrates and fishes, supporting growth and maturation.

Maintenance dredging typically occurs in areas where physiological transition occurs between fresh- and saltwater. Adult Puget Sound steelhead may be present in the waterways during dredging, but can easily avoid the active dredge machinery. Since dredging occurs only in the central portion of waterways, it is expected to have a negligible effect on forage food organisms for emigrating Puget Sound steelhead (e.g. insects and epibenthic organisms in shallower, nearshore areas). There will be no impact to salinity regimes or natural cover that occurs along the shoreline. Disposal of dredged material will occur in offshore marine waters away from shorelines in areas that are not used for transition between fresh- and saltwater or in upland beneficial use sites. The effects of maintenance dredging and disposal to this PCE are expected to be insignificant and discountable.

PCE #5. Nearshore marine areas free of obstruction with water quality and quantity conditions and forage, including aquatic invertebrates and fishes, supporting growth and maturation; and natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, and side channels.

Maintenance dredging sites are typically located in mid-channel areas of river delta channels where aquatic vegetation, large rocks and boulders and side channels are usually not found. Large wood can occasionally be found, but is usually removed as a navigation hazard. Disposal will have short-term and minimal effects on nearshore marine areas because disposal sites are either located offshore away from the shoreline, are in upland beneficial use sites, or contain the same type of sediment being disposed and are enhanced by the material placement. Therefore, maintenance dredging and disposal will have discountable effects on this PCE.

PCE #6. Offshore marine areas with water quality conditions and forage, including aquatic invertebrates and fishes, supporting growth and maturation.

In contrast to maintenance dredge sites, disposal sites are located in the nearshore zone for beneficial use or in upland areas. The effects of disposal to this PCE are expected to be insignificant and discountable.

9.3.3 Effect Determination for Puget Sound Steelhead

Proposed maintenance dredging activities will not result in any long-term degradation of habitat or other significant adverse effects to steelhead. Short-term effects such as noise disturbance and increased turbidity will occur, but will be small in magnitude, as discussed above. The survival or reproductive success of steelhead in the project area will not be affected because the maintenance dredge projects are not located where reproduction and rearing occur. Therefore, the USACE's effect determination for the proposed maintenance dredging activities is "**may affect, not likely to adversely affect**" Puget Sound steelhead. Potential effects of maintenance dredging and disposal on Puget Sound steelhead critical habitat PCEs are no effect or discountable. Therefore, the USACE's proposed maintenance dredging and disposal effects determination is, "**may affect, not likely to adversely affect**" Puget Sound steelhead proposed critical habitat.

9.4 Puget Sound Chinook Salmon

9.4.1 Effect of Maintenance Dredging and Disposal on Puget Sound Chinook Salmon

Although dredging observes in-water work windows to avoid juvenile Chinook salmon, the proposed maintenance dredging operations may overlap with early or late downstream migration periods. Therefore, a small portion of a year class of juvenile Chinook salmon could be susceptible to short-term turbidity and noise or visual disturbance during their emigration periods, and from elevated PCB levels in the sediment (Meador 2013) in each dredging year. Dredge noise is of low concern for migrating fish due to the sound pressure levels of up to 169 dB from the dredging machinery being generally lower than the injury threshold for salmon set by NMFS and USFWS at 187 dB (Erbe 2002, SAIC and RPS Evans Hamilton 2011). Maintenance dredging could disrupt normal behavior patterns. However, adherence to in-water work windows

avoids peak migration periods, and adoption of the conservation measures listed in section 6, restricting elevated turbidity to within 600 feet down current of the dredge, and monitoring during maintenance dredging reduces the potential for incidental take. These conservation measures do not eliminate the effects of PCBs on survival of juvenile salmon that emigrate through contaminated waterways. However, dredging or disposal will have minimal effects on juvenile salmon survival.

Adult Chinook salmon immigration occurs through the project areas during the anticipated dredging period (15 July through 14 February) based on the timing of adult upstream migration (mid-August through November) and spawning (September through November). Noise and turbidity are the primary concerns. Tugboats and vessels with similarly sized engines have a dominant frequency range of 100-500Hz with a peak output at 170dB$_{RMS}$, which is above the threshold for Level B harassment for salmonids (150 dB) in close proximity to the tug but this sound pressure level is expected to attenuate quickly with distance from the vessel. Fish behavior studies have shown that fish will avoid the area of noise and resume normal behaviors just beyond range of harassment noise levels, indicating discountable levels of effect would be occurring near dredging operations (Hastings and Popper 2005). Turbidity typically dissipates below criteria levels within 300 to 600 feet downcurrent from the vessel. Based on these minor and discountable effects, adult Chinook salmon can easily avoid the dredge machinery and will not be deterred or diverted from their spawning migration by maintenance dredging.

Disposal is the subject of a separate consultation (USACE 2015). Based on the evaluation in the USACE (2015) document the USACE expects potential effects of disposal on Chinook salmon to be discountable.

9.4.2 Effect of Maintenance Dredging and Disposal on Puget Sound Chinook Salmon Critical Habitat

NMFS designated critical habitat for 12 ESUs of salmon and steelhead in the Pacific Northwest and California, including Puget Sound Chinook salmon (70 FR 52630). The disposal sites associated with the navigation channels are included in the critical habitat designation. This section evaluates the potential for effects to the Puget Sound Chinook PCEs:

PCE #1. Freshwater spawning sites with water quantity and quality conditions and substrate supporting spawning, incubation and larval development.

> *Maintenance dredging will not affect Chinook salmon spawning and larval rearing sites. Spawning and rearing sites are upstream of maintenance dredging project sites. Disposal sites are located in the nearshore zone or uplands. Therefore, maintenance dredging and disposal will have no effect on this PCE.*

PCE #2. 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.

Maintenance dredging occurs in deep-water areas away from the shoreline in the middle of waterways. Navigation channels are typically located in areas where freshwater and saltwater mix and are considered estuarine, not freshwater. Thus, maintenance dredging will not adversely affect freshwater rearing conditions. Disposal occurs in the nearshore zone or uplands away from freshwater habitat. Therefore, maintenance dredging and disposal will have no effect on this PCE.

PCE #3. Freshwater migration corridors free of obstruction with water quantity and quality conditions and natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, side channel, and undercut banks supporting juvenile and adult mobility and survival.

Maintenance dredging is conducted in estuarine portions of waterways away from the shoreline in the middle of waterways in areas where freshwater and saltwater mix. Adult immigrants can easily avoid dredge machinery and continue on their way to the spawning grounds without delay. Thus, maintenance dredging will not adversely affect freshwater rearing conditions. Disposal occurs in the nearshore zone or uplands away from freshwater habitat. Therefore, maintenance dredging and disposal will have no effect on this PCE.

PCE #4. Estuarine areas free of obstruction with water quality, water quantity, and salinity conditions supporting juvenile and adult physiological transitions between fresh-and saltwater; natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, and side channels; and juvenile and adult forage, including aquatic invertebrates and fishes, supporting growth and maturation.

Maintenance dredging will be conducted in areas where physiological transition occurs between freshwater and saltwater. Adult Chinook salmon may be present in the navigation channels during maintenance dredging. Adult immigrants can easily avoid dredge machinery and continue on their way to the spawning grounds without delay. Since maintenance dredging will occur only in the central portions of waterways, it is expected to have a negligible effect on forage food organisms for emigrating juvenile salmon (e.g. insects and epibenthic organisms in shallower, nearshore areas). There will be no effect on salinity regimes. Baseline conditions of natural cover will be maintained. Disposal sites are located in the nearshore zone or uplands out of the aquatic habitat to the extent possible. Material can be placed in beneficial use sites located onshore, such as Jetty Island, during established work windows when juvenile salmonids are not expected to be present. The effects of maintenance dredging and disposal to this PCE are expected to be insignificant and discountable. Therefore, maintenance dredging and disposal will have discountable adverse effects on this PCE.

PCE #5. Nearshore marine areas free of obstruction with water quality and quantity conditions and forage, including aquatic invertebrates and fishes, supporting growth and maturation; and natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, and side channels.

Maintenance dredging will occur only in the central portions of waterways away from the shoreline and riparian areas and will not affect forage fish. Aquatic invertebrates will be disrupted during each dredge event, but on a small scale. The natural cover such as

submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, and side channels will be maintained. Disposal sites are located in established placement areas in the nearshore zone and uplands. Consequently, maintenance dredging and disposal will have a negligible effect on nearshore marine areas. The effects of disposal to this PCE are expected to be insignificant and discountable. Therefore, maintenance dredging and disposal will have discountable adverse effects on this PCE.

PCE #6. Offshore marine areas with water quality conditions and forage, including aquatic invertebrates and fishes, supporting growth and maturation.

Maintenance dredging will have no effect on offshore marine areas because navigation channels are located in embayments and lower reaches of rivers in water depths reaching no deeper than 51 feet. Disposal sites are located in nearshore marine areas in areas where deposited dredged material will rapidly disperse leaving the disposal area as it existed prior to disposal. The effects of disposal to this PCE are expected to be insignificant and discountable. Therefore, maintenance dredging and disposal will have discountable adverse effects on this PCE.

9.4.3 Effect Determination for Puget Sound Chinook Salmon

Adult, sub-adult, and juvenile Chinook salmon use navigation channels. Therefore, the project may affect the threatened Puget Sound Chinook salmon. However, adult Chinook salmon are expected to easily avoid the dredge machinery not delaying their spawning migration. Juvenile Chinook salmon may be present as they emigrate through navigation channels. However, the dredging will not occur directly in juvenile Chinook salmon habitat, and conservation measures (see section 6) including work windows will minimize the potential for juvenile salmon to be exposed to elevated TSS and noise. The effects of dredging and disposal on survival of juvenile Chinook salmon are expected to be minimal; the potential effects of maintenance dredging are not expected to result in adverse effects to Puget Sound Chinook salmon ESU. Therefore, the USACE's effect determination for maintenance dredging and disposal is "**may affect, not likely to adversely affect**" Puget Sound Chinook salmon. Maintenance dredging has either no effect or discountable effects on the PCEs. Therefore, the USACE's effect determination for the effects of maintenance dredging and disposal is, "**may affect, not likely to adversely affect**" Puget Sound Chinook salmon critical habitat.

9.5 Hood Canal Summer Run Chum Salmon

Status: The Hood Canal summer run chum salmon was listed as threatened on 28 June 2005 (70 FR 37160).

Critical habitat was designated on 2 September 2005 (70 FR 52630) for Hood Canal summer run chum salmon.

9.5.1 Effect of Maintenance Dredging and Disposal on Hood Canal Summer Run Chum Salmon

Adult Hood Canal summer run chum salmon return to spawn during the summer, with spawning occurring in September into mid-October. Juvenile outmigration occurs from January through May. Juveniles use shallow water along the shoreline inshore of any dredge operation and away

from elevated TSS. Adult Hood Canal summer chum salmon immigration occurs through the Port Townsend project area during the anticipated dredging period (15 July through February 14) based on the timing of adult upstream migration (mid-August through November) and spawning (September through November). However, adult salmon are not likely to occur in the navigation channel, can easily avoid the dredge machinery, and will not be deterred or diverted from their spawning migration by maintenance dredging.

Disposal occurs in a marine offshore site where adults may occur; however, the effects of disposal are discussed in a separate consultation document (USACE 2015). Therefore, the USACE expects potential effects to be discountable.

9.5.2 Effect of Maintenance Dredging and Disposal on Hood Canal Summer Run Salmon Critical Habitat

Within these areas, the PCEs essential for the conservation of the Hood Canal summer run chum salmon ESUs are those sites and habitat components that support one or more life stages, including:

PCE 1. Freshwater spawning sites with water quantity and quality conditions and substrate supporting spawning, incubation and larval development.

Maintenance dredging will not affect Hood Canal summer run chum salmon spawning and larval rearing sites. Spawning and rearing sites are upstream of maintenance dredging sites. Disposal sites are for beneficial use in the nearshore zone. Therefore, maintenance dredging and disposal will have no effect on this PCE.

PCE 2. Freshwater rearing sites with:

(i) Water quantity and floodplain connectivity to form and maintain physical habitat conditions and support juvenile growth and mobility.

(ii) Water quality and forage supporting juvenile development.

(iii) Natural cover such as shade, submerged and overhanging large wood, log jams and beaver dams, aquatic side channels, and undercut banks.

Maintenance dredging is conducted away from the shoreline in the middle of waterways. Navigation channels are typically located in areas where freshwater and saltwater mix and are considered estuarine, not freshwater. Thus, maintenance dredging will not adversely affect freshwater rearing conditions. Disposal occurs in the marine nearshore or upland areas away from freshwater habitat. Therefore, maintenance dredging and disposal will have no effect on this PCE.

PCE 3. Freshwater migration corridors free of obstruction and excessive predation with water quantity and quality conditions and natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, side channels, and undercut banks supporting juvenile and adult mobility and survival.

Maintenance dredging is conducted in the central portions of waterways away from the shorelines. Adult immigrants can easily avoid dredge machinery and continue on their way to the spawning grounds without delay. Navigation channels are typically located in estuaries,

not freshwater. Thus, maintenance dredging will not adversely affect freshwater migration corridors. Disposal occurs in areas away from freshwater habitat for this ESU. Therefore, maintenance dredging and disposal will have discountable adverse effects on this PCE.

PCE 4. Estuarine areas free of obstruction and excessive predation with:

(i) Water quality, water quantity, and salinity conditions supporting juvenile and adult physiological transitions between fresh- and saltwater.

(ii) Natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, side channels.

(iii) Juvenile and adult forage, including aquatic invertebrates and fishes, supporting growth and maturation.

Maintenance dredging will be conducted in areas where physiological transition occurs between freshwater and saltwater. Adult chum salmon may be present in the navigation channels during maintenance dredging. Adult immigrants can easily avoid dredge machinery and continue on their way to the spawning grounds without delay. Since maintenance dredging will occur only in the central portions of waterways, it is expected to have a negligible effect on forage food organisms for emigrating juvenile chum salmon (e.g. insects and epibenthic organisms in shallower, nearshore areas). There will be no effect on salinity regimes and natural cover conditions will be maintained. Disposal sites are located in the marine nearshore areas, or are onshore for beneficial use, but away from rivers where Hood Canal summer chum are emigrating. Therefore, maintenance dredging and disposal will have insignificant and discountable effects on this PCE.

PCE 5. Nearshore marine areas free of obstruction and excessive predation with:

(i) Water quality and quantity conditions and forage, including aquatic invertebrates and fishes, supporting growth and maturation.

(ii) Natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, and side channels.

Maintenance dredging will occur only in the central portions of waterways away from the shoreline and riparian areas and will not affect forage fish, natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, and side channels. Aquatic invertebrates will be disrupted on a small scale. Disposal sites are located in marine areas away from the shore, or at beneficial use sites away from natal rivers used by Hood Canal summer chum. Disposal sites are in uplands or along beaches for beneficial use. Consequently, the effects of the project to this PCE are expected to be insignificant and discountable.

PCE 6. Offshore marine areas with water quality conditions and forage, including aquatic invertebrates and fishes, supporting growth and maturation.

Maintenance dredging will have no effect on offshore marine areas because navigation channels are located in embayments and lower reaches of rivers. In contrast, some disposal

sites are located in the upland or higher intertidal zone of the nearshore areas where critical habitat is not located. The effects of disposal to this PCE are expected to be discountable.

9.5.3 Effect Determination for Hood Canal Summer Run Chum Salmon

Juvenile Hood Canal summer run chum salmon migrate along the shoreline along the west side of Puget Sound (but do not use the navigation channel at Port Townsend). Therefore, the project may affect the threatened Hood Canal summer run chum salmon. Adult salmon migrate in deeper water and would not be present near the navigation channel. Adult Hood Canal summer run chum salmon are expected to easily avoid the dredge machinery not delaying their spawning migration. It is unlikely that juveniles would be present near operating dredges because juveniles emigrate along the shoreline away from operating dredges and conservation measures (see section 6) will minimize the potential for Hood Canal summer run chum salmon to be exposed to elevated TSS. Thus, the potential effects of maintenance dredging are not expected to result in adverse effects to the Hood Canal summer run chum salmon ESU. Therefore, the USACE's effect determination for maintenance dredging and disposal is "**may affect, not likely to adversely affect**" Hood Canal Summer Run chum salmon. Maintenance dredging has either no effect or discountable effects on the PCEs. Therefore, the USACE's determination for maintenance dredging and disposal is, "**may affect, not likely to adversely affect**" Hood Canal Summer Run chum salmon critical habitat.

9.6 Western Snowy Plover and their Critical Habitat

9.6.1 Effect of Maintenance Dredging and Disposal on Western Snowy Plover and their Critical Habitat

Maintenance dredging and disposal will have no effect on the western snowy plover's intertidal prey resources. Of the possible navigation sites that are dredged, maintenance dredging and disposal will occur far enough from Damon Point and the Oyhut Wildlife area where snowy plover are found that noise disturbance is not of concern and potential effects to nesting behavior will be discountable.

Maintenance dredging and disposal operations are not anticipated to affect sediment transport and disposition patterns related to shoreline position at Damon Point. Shoreline change at Damon Point is associated with North Beach sediment bypassing the North Jetty (Kraus and Arden 2003).

Effects to western snowy plover foraging and nesting habitat are not anticipated. Potential noise disturbance effects are unlikely. Maintenance dredging and disposal "**may affect, but is not likely to adversely affect**" western snowy plover or its designated critical habitat.

9.7 Marbled Murrelet and their Critical Habitat

9.7.1 Effect of Maintenance Dredging and Disposal on Marbled Murrelet and their Critical Habitat

Marbled murrelet are generally present in the action areas during the fall, winter, and spring (Speich and Wahl 1995). Sightings are rare during the nesting season (May to September). The highest numbers occur in habitats close to shore, usually out to the 50m depth contour.

Murrelets are commonly seen in navigation channels (Speich and Wahl 1995). No designated critical habitat is located in navigation channels or marine areas.

Maintenance dredging and disposal will have no effect on marbled murrelet nests or nesting habitat because nesting habitat is in old growth forests many miles from navigation channels and disposal sites with the exception at the Quillayute site in which a nesting area has been surveyed at just over 1 mile north of the navigation channel area (WDFW 2016). Activities will have minimal effect on nesting season foraging behaviors given the minor area that navigation channels occupy compared to the total amount of available habitat. Disposal of dredged material occurs in and adjacent to foraging habitat. Again, the amount of area occupied by disposal sites is minor compared to the total amount of available habitat. Since marbled murrelets are not likely to be present through most of the nesting season when the effects of dredging would be most noticeable, the impact of dredging on marbled murrelets is likely small, especially considering the total amount of forage habitat available in relation to the amount of forage habitat disturbed by dredging operations.

Noise produced by dredge vessels may disturb foraging marbled murrelet and cause them to move to other forage areas. However, dredges move very slowly and thus will have little impact on marbled murrelets. The effects of anthropogenic disturbance on marbled murrelet at sea are not well documented, but marbled murrelet have been shown to habituate to heavy levels of boat traffic (Strachan et al. 1995). The underwater sound generated by dredges is not considered significant (Martha Jensen, USFWS Biologist, pers. comm. March 2011).

Increases in turbidity associated with maintenance work could reduce visibility around dredging activities, thereby reducing foraging success for any murrelets that remain in the area. This effect will be highly localized and subside rapidly upon completion of the dredging and disposal operations. Marbled murrelets are relatively opportunistic foragers; they have flexibility in prey choice, which likely enables them to respond to changes in prey abundance and location (USFWS 1996). This indicates that if marbled murrelets are present in the immediate vicinity of maintenance activities, and they are disturbed while foraging, they will likely move without significant injury.

Maintenance dredging and disposal will have no effect on nests or nesting habitat. All work is aquatic-oriented and will not affect any terrestrial habitat that marbled murrelets would be using. Any disruption to foraging activities and marbled murrelet prey base are expected to be insignificant since marbled murrelet will be highly localized relative to their foraging range. Therefore, the USACE has determined that the proposed project "**may affect, but is not likely to adversely affect**" marbled murrelet and will have "**no effect**" on designated critical habitat, as none occurs within the action area.

9.8 Streaked Horned Lark and their Critical Habitat

9.8.1 Effect of Maintenance Dredging and Disposal on Streaked Horned Lark and their Critical Habitat

The streaked horned lark's distribution is limited to areas in the Puget Lowlands, coastal Washington between Grays Harbor and Leadbetter Point, and on dredged-material islands in the Columbia River.

PCEs of designated critical habitat of the streaked horned lark are (USFWS 2013) areas having a minimum of 16 percent bare ground that have sparse, low-stature vegetation composed primarily of grasses and forbs less than 13 inches (33 centimeters) in height found in these areas:

(i) Large (300-acre (120-hectare)), flat (0–5 percent slope) areas within a landscape context that provides visual access to open areas such as open water or fields; or

(ii) Areas smaller than described in paragraph (2)(i) of this entry, but that provide visual access to open areas such as open water or fields.

The only places that meet this criterion in areas where the USACE conducts maintenance dredging and disposal are Damon Point and the Oyhut Wildlife Area in Grays Harbor. These are all sandy areas with visual access to open spaces.

Maintenance dredging is unlikely to have a measureable effect, beyond the effects under the environmental baseline, on the amount of exposed sand at Damon Point or the Oyhut Wildlife Area. Therefore, the USACE has determined that the maintenance dredging **may affect, but is not likely to adversely affect streaked horned lark and its critical habitat**.

9.9 Eulachon

9.9.1 Effect of Maintenance Dredging and Disposal on Eulachon

Eulachon spawn in the lower portions of certain rivers (primarily large river systems and their associated lower river tributaries) draining into the northeastern Pacific Ocean. They range from Northern California to the southeastern Bering Sea in Bristol Bay, Alaska (Hubbs 1925, Schultz and DeLacy 1935, McAllister 1963, Scott and Crossman 1973, Willson et al. 2006). For example, eulachon are common in the Columbia River and its lower river tributaries. However, outside of the Columbia River Basin, eulachon are far less common on the coast of Washington and have been reported only occasionally from other coastal Washington rivers (Thompson and Associates 1936, QIN 2014).

Adult eulachon have been reported in rivers draining into Grays Harbor, especially the Wynoochee River (WDFW and ODFW 2001, Willson et al. 2006). The Oregon Department of Fish and Wildlife (ODFW) and the WDFW (2001) noted that “in 1993, when the eulachon run into the Columbia River was delayed (presumably due to cold water conditions), they were noted in large abundance in the Quinault and Wynoochee rivers, outside the Columbia Basin.” Deschamps et al. (1970,) reported the capture of a single adult eulachon in a seine catch in March 1966 and stated, “It is unlikely that the Chehalis system (which drains into Grays Harbor) has a run of any consequence, although strays or feeding fish from other areas probably visit the upper harbor at times.” WDFW and ODFW (2001) reported that eulachon “were noted in large abundance in the … Wynoochee” River, a tributary of the Chehalis River, in 1993. Simenstad et al. (2001) recorded eulachon as “rare” occurrence in sloughs of the Chehalis River estuary in 1990 and 1995. It appears that eulachon are sporadic visitors to Grays Harbor and occasionally spawn in Grays Harbor Rivers (QIN 2014). Spawning migration into Grays Harbor probably occurs in extremely low numbers or on those unusual occasions when environmental conditions in the Columbia River are suboptimal resulting adult eulachon straying into other river systems. Therefore, the occurrence of eulachon in Grays Harbor likely is limited, or they only occur occasionally in

significant observable abundance, and the likelihood of dredging causing a measureable impact to the eulachon southern DPS is slight.

Eulachon have been reported sporadically, though not commonly, in Puget Sound drainages. The most recent that the USACE is aware of is a report by R. Ladley (Puyallup Tribe, pers. comm. 2013) of small numbers of adult eulachon captured in a salmon fry trap in the Puyallup River, with confirmation by NMFS. To the USACE's knowledge, this is the southernmost documentation of eulachon in Puget Sound. It is possible, though not likely that eulachon adults could be present during dredging and disposal operations in Commencement Bay.

9.9.2 Effect of Maintenance Dredging and Disposal on Eulachon Critical Habitat

In Washington other than the lower Columbia, eulachon critical habitat is designated only in the lower Quinault and Elwha rivers, neither of which contains USACE maintenance dredging projects. Thus, the proposed action will not affect designated critical habitat for eulachon.

As there is a possibility that eulachon may be nearby in Grays Harbor during nearshore disposal operations, even though unlikely, the operation could disrupt behavior of adults and juveniles. These potential effects are considered discountable. Therefore, the USACE has determined that the proposed project "**may affect, but is not likely to adversely affect**" the southern eulachon DPS because of their very sporadic occurrence and unusual insignificant abundance in areas where work is proposed. Regarding Grays Harbor the number of individuals (larvae) taken will be minor compared to the entire run in Grays Harbor in any year when a run occurs. Since no critical habitat for eulachon occurs where dredging or disposal is proposed, the USACE's determination is that the proposed action will have "**no effect**" on eulachon critical habitat.

9.10 North American Green Sturgeon

9.10.1 Effect of Maintenance Dredging and Disposal on North American Green Sturgeon

The Southern green sturgeon spawns in the Sacramento River (NMFS 2005). Adults immigrate into the river to spawn from April to July. Juveniles spend one to four years in freshwater before migrating to the ocean. During the late summer, they concentrate in coastal estuaries, particularly the Columbia River estuary, Willapa Bay, and Grays Harbor (Moyle et al. 1992). Lindley et al. (2011) documented tagged individuals in Grays Harbor during June to October, and in Willapa Bay during April to October; some fish moved among Grays Harbor, Willapa Bay, and the Columbia. Large juveniles and small adult green sturgeon are common in the seawater and mixing zones of Grays Harbor and Willapa Bay during high salinity periods, with the highest abundances from July through early October (Monaco et al. 1990). The species is not known to use the lower Chehalis River at any time (Deschamps et al. 1970).

Due to a lack of spawning habitat in the Chehalis River basin, and juvenile life history characteristics, maintenance dredging and disposal will have no effect on juvenile (freshwater phase) green sturgeon or their spawning. Maintenance dredging does occur during periods when green sturgeon are present in Grays Harbor. Hopper dredges operate in outer Grays Harbor from about 15 March through May when green sturgeon are likely present. By the time North American green sturgeon reach Grays Harbor, they are sufficiently large to be able to avoid the drag heads of a hopper dredge. The same can be said of a cutterhead hydraulic dredge if one

were to be used. A clamshell bucket is unlikely to entrain North American green sturgeon because the top of the dredge bucket is open allowing fish to escape. Harassment due to noise will be limited in spatial extent. Reduction in water quality (turbidity) from clamshell dredging is not a concern because North American green sturgeon cause sediment re-suspension during feeding, thus they are adapted to elevated amounts of TSS. Regarding disposal of dredged material, the North American green sturgeon that occur in Grays Harbor are sufficiently large and mobile to avoid the nearshore disposal operations.

Prey resources could be lost due to their entrainment and habitat disturbances associated with maintenance dredging and disposal. Green sturgeon are opportunistic predators that eat a variety of prey and switch foods as prey availability changes (Turner 1966). Green sturgeon typically feed on benthic invertebrates, such as shrimp, crabs, worms, mollusks, and epibenthic crustaceans. Impacts to prey resources will be most acute in outer Grays Harbor, where sand lance and Dungeness crab populations are impacted by hopper dredge entrainment and mortality of other benthic organisms occurs during dredged material disposal. The loss of prey because of entrainment will be insignificant because the total area affected by hopper dredging is small compared to the available forage habitat. Monitoring in the Fraser River found rapid recruitment of sand lance into dredged sites after disturbance (Fraser River Estuary Management Program, 2006). Effects to the green sturgeon prey base will be minor and temporary given the small portion of their foraging range impacted and the wide variety of prey used by this species.

Therefore, the USACE has determined that the proposed project "**may affect, but is not likely to adversely affect**" North American green sturgeon because of their very ability to avoid dredge machinery and adaptation to suspended sediment.

9.10.2 Effect of Maintenance Dredging and Disposal on North American Green Sturgeon Critical Habitat

Grays Harbor and Willapa Bay are hundreds of miles from the known spawning habitat of green sturgeon. However, Grays Harbor is estuarine critical habitat for green sturgeon. The PCEs and impacts of maintenance dredging on each PCE for green sturgeon estuarine critical habitat follow:

PCE # 1 Food resources. Abundant prey items within estuarine habitats and substrates for juvenile, subadult, and adult life stages.

> *Grays Harbor navigation channel reaches are not located in freshwater riverine systems. Maintenance dredging will not affect this PCE because it does not occur in the project areas. Therefore, maintenance dredging and disposal will have no effect on this PCE.*

PCE # 2 Water flow. Within bays and estuaries adjacent to the Sacramento River (i.e., the Sacramento-San Joaquin Delta and the Suisun, San Pablo, and San Francisco bays).

> *Maintenance dredging and disposal on the Washington Coast is several hundred miles north of Central California. Therefore, the project will have no effect on this PCE.*

PCE # 3 Water quality. Water quality, including temperature, salinity, oxygen content, and other chemical characteristics, necessary for normal behavior, growth, and viability of all life stages.

During maintenance dredging and disposal, DO may be depressed slightly below ambient conditions, but only within the sediment plume caused by the dredging and disposal, and not to levels that are detrimental to North American green sturgeon because what DO depression that does occur will be in a small area and for a short period. Thus, the amount of DO depression will not reach sufficiently low levels to cause stress or death of North American green sturgeon, which are mobile. Temperatures will not be detectably changed from ambient conditions because the only source of heat is from the diesel engines associated with dredging equipment and this heated water will be undetectable within a few feet of the heated water outlet. The material to be dredged is clean (meets DMMP criteria for open-water disposal) and will not increase contaminant levels in the water column. Therefore, the project will have discountable adverse effects on this PCE.

PCE # 4 Migratory corridor. A migratory pathway necessary for the safe and timely passage of Southern DPS fish within estuarine habitats and between estuarine and riverine or marine habitats.

There is nothing in maintenance dredging and disposal that will prevent safe and timely passage between Grays Harbor and the ocean. North American green sturgeon will easily be able to avoid maintenance dredging equipment since the equipment footprint will be a small fraction of the available habitat in these two embayments. Therefore, the project will have no effect on this PCE.

PCE # 5 Water depth. A diversity of depths necessary for shelter, foraging, and migration of juvenile, subadult, and adult life stages.

Maintenance dredging and disposal will maintain deepened channels within Grays Harbor that will provide additional deep-water habitat (at least deep relative to estuarine embayment usual depths). Grays Harbor provides a wide variety of depths. The maintenance dredging will not alter these circumstances as compared with those of the environmental baseline in any substantial way. Therefore, the project will have discountable adverse effects on this PCE.

PCE # 6 Sediment quality. Sediment quality (i.e., chemical characteristics) necessary for normal behavior, growth, and viability of all life stages.

Maintenance dredging and disposal will not change any sediment characteristics (i.e., chemical characteristics). The project will repeatedly expose the sediment layer that occurs at the authorized channel depth. This depth layer is tested along with the material above it to be removed during suitability testing for aquatic disposal. In addition, regular maintenance dredging exposes the authorized depth layer that has become the usual substrate surface in the navigation channel. Maintenance dredging and disposal will move sediment from one location to another (from navigation channels to disposal sites), but will not add anything to the sediment. Therefore, the dredge project will have no effect on this PCE.

9.10.3 Effect Determination for North American Green Sturgeon

Maintenance dredging and disposal will have only minor effects on estuarine habitat and feeding areas. Short-term effects of any disturbance related to maintenance dredging and disposal will

likely result in displacement of green sturgeon rather than injury. Any reduction in availability of food will be highly localized, and will recover rapidly upon completion of the dredging and disposal operations. Habitats for groundfish and other benthic prey items will be affected by dredging and dredged material disposal. However, effects to the prey base will be discountable given the small area of their foraging range affected and the wide variety of prey used by this species. Therefore, the USACE has determined that maintenance dredging and disposal "**may affect, but is not likely to adversely affect**" North American green sturgeon. Maintenance dredging and disposal will have only minor effects on critical habitat and habitat recovery will occur quickly once dredging is completed. The USACE's effect determination for maintenance dredging and disposal is "**may affect, not likely to adversely affect**" for North American green sturgeon critical habitat.

9.11 Southern Resident Killer Whale

9.11.1 Effect of Maintenance Dredging and Disposal on Southern Resident Killer Whale

Potential effects of maintenance dredging and disposal to Southern Resident killer whales involve possible sound disturbance and interactions with tugs towing transport barges. The NMFS considers dredging to be a low impact activity for marine mammals, producing non-pulsed sound and being substantially quieter in terms of acoustic energy output than sources such as seismic airguns and impact pile driving (78 FR 30875). Generally, the effects of dredging on marine mammals are not expected to rise to the level of take (78 FR 30875, 78 FR 4541). NMFS does not require incidental harassment authorization with regard to dredging operations (Reine and Dickerson 2014).

It is far more likely that killer whales will be encountered during transport of the dredged material to disposal sites. Tugs towing barges travel slowly and predictably. If a killer whale were to move close to a tug towing a transport barge, conservation measure 11 (see section 6) will be implemented if it is safe to do so[2]. As a further precaution, bottom dump barges will not dump when killer whales are nearby; this is to eliminate the possibility of the material hitting a killer whale as it descends through the water column.

Underwater noise is an issue for killer whales. While the operation of the tug and barge would increase ambient noise levels along the immediate travel route, impacts of any sound disturbance would likely result in temporary, short-range displacement of animals rather than injury (see section 7.3.10 for additional information on this subject). The operation of most large marine vessels, including tugs that would have the barges for open-water sediment disposal, produce up to 180 dB, but mostly within the range of 80 to 1,000 Hz, which is mostly below the hearing threshold of killer whales (generally above 6kHz) (Kipple and Gabriele 2007). Clarke et al. (2002) found that sound attenuation from dredging related equipment subsumes to ambient levels as close as 500 m.

[2] The Corps acknowledges the 2011 expansion of the required vessel separation zone around killer whales (76 FR 20870). Contract terms will define whether a hired vessel is considered Federal or not, but in general, a tug with tow is considered limited in its maneuverability.

9.11.2 Effect of Maintenance Dredging and Disposal on Southern Resident Killer Whale Critical Habitat

PCE#1: Water quality to support growth and development.

Maintenance dredging will generate some turbidity when dredges are operating. The amount and extent are minor compared to the habitat range of Southern Resident killer whales in Western Washington. Further, most of the maintenance dredging is in navigation channels located in the lower reaches of modified river deltas where Southern Resident killer whales typically do not occur.

PCE#2: Prey species of sufficient quantity, quality, and availability to support individual growth, reproduction, and development as well as overall population growth.

Southern Resident killer whales feed primarily on Chinook salmon and chum salmon. Maintenance dredging and disposal has minor effects on these salmonid species abundance as dredging and disposal is conducted in the central portions of waterways and away from the shorelines where juvenile Chinook and chum salmon are typically found. Adult salmon can easily avoid an active dredge. Thus, maintenance dredging will likely have insignificant effects on Southern Resident killer whales' food supply.

PCE#3: Passage conditions to allow for migration, resting, and foraging.

Short-term effects to migration from transport vessels of materials should a killer whale coincidentally be present en route during a discharge event, might result in a short period of non-lethal discomfort due to suspended sediments in the water column. The water column turbidity elevation is localized and of short duration (approximately 12 minutes in mid-water areas studied by Truitt [1986a, 1986b]). Killer whales would likely move away from the area affected and recover quickly from any discomfort. Effects of elevated water column suspended sediments would be short in duration and localized (as noted above), and are not expected to be lethal or significantly affect killer whales.

Maintenance dredging of navigation channels will not impede passage and could improve it in some circumstances. Simultaneously Southern Resident killer whales typically do not forage in maintained navigation channels. Disposal will not likely affect passage, forage, resting, or migration because disposing of dredged material on the substrate is unlikely to cause impediments to Southern Resident killer whales' movement.

9.11.3 Effect Determination for Southern Resident killer whale

The potential for toxic effects of contaminants re-suspended in the water column during dredging and disposal is minimal. Sediments are tested by the DMMP prior to maintenance dredging and disposal and only suitable material is deposited in open-water disposal sites. Killer whale preference for pelagic prey limits the indirect effects of dredging and disposal to this species' prey base. Another consideration is scale: the size of the dredged sites relative to the surrounding water bodies is small.

In summary, due to the wide distribution of these species within the action area; the nearshore and upland disposal locations; the low probability of the species coming in contact with the areas affected by a disposal activity; the infrequent and short-lived nature of disposal events; and the

ability of these mobile species to quickly leave the affected area, the overall effects of disposal activities on killer whales would be insignificant. Therefore, the USACE has determined that maintenance dredging and disposal "**may affect, but is not likely to adversely affect**" Southern Resident killer whale. Maintenance dredging and disposal will have only minor effects on critical habitat. The USACE's effect determination for maintenance dredging and disposal is "**may affect, not likely to adversely affect**" for Southern Resident killer whale critical habitat.

9.12 Humpback Whale

9.12.1 Effect of Maintenance Dredging and Disposal on Humpback Whale

Potential effects to humpback whales involve possible sound disturbance caused by vessel operations and potential effects to their prey base. Humpback whale responses to sound disturbance may include avoidance, startle, annoyance, and slowed rate of travel (Calambokidis et al. 1987, NMFS 1991, Barlow et al. 1997, Calambokidis et al. 2004). Humpback whales forage offshore of coastal estuaries and feed on schooling fish. The USACE does not expect humpback whales to occur in areas where maintenance dredging occurs inside coastal estuaries. The exception is Bar Channel offshore of Grays Harbor in the adjacent Pacific Ocean. Bar Channel maintenance is extremely rare. Effects from maintenance dredging in Bar Channel would be extremely rare and will likely result in temporary displacement of humpback whales rather than injury or noise effects.

Maintenance dredging and disposal are not expected to result in reductions in abundance and distribution of prey items (which consist of schooling fish). The potential for long-term or indirect impacts of the proposed work to humpback whales is minimal.

9.12.2 Effect of Maintenance Dredging and Disposal on Humpback Whale Critical Habitat

Critical habitat for humpback whale is not designated or proposed.

9.12.3 Effect Determination for Humpback Whale

The USACE has determined that maintenance dredging and disposal "**may affect, but is not likely to adversely affect**" humpback whales because humpback whales are typically not found in coastal navigation channels with the possible exception of Bar Channel offshore of the mouth of Grays Harbor. Humpback whales do occur in the Pacific Ocean, but far enough from dredges operating in Grays Harbor and at Quillayute estuary that underwater sound generated by dredges will be attenuated and will not affect humpback whales. In addition, NMFS considers dredging to be a low impact activity for marine mammals, producing non-pulsed sound and being substantially quieter in terms of acoustic energy output than sources such as seismic airguns and impact pile driving (78 FR 30875). Generally, the effects of dredging on marine mammals are not expected to rise to the level of take (78 FR 30875, 78 FR 4541). NMFS does not require incidental harassment authorization with regard to dredging operations (Reine and Dickerson 2014).

9.13 Leatherback Sea Turtle

9.13.1 Effect of Maintenance Dredging and Disposal on Leatherback Sea Turtle

Leatherback turtle (*Dermochelys coriacea*) nesting grounds occur between 40 degrees north latitude and 35 degrees south latitude (Plotkin 1995); therefore, no nesting areas are located in

Washington. This species may use oceanic areas off the coast of Washington as foraging grounds during the summer and fall months. Aerial surveys indicate that when off the U.S. Pacific coast, leatherbacks usually occur in continental slope waters (NMFS and USFWS 1998a). Eastern Pacific waters may be used as foraging grounds and migratory corridors; however, sightings in this area were confined to the summer months off southern California (NMFS and USFWS 1998b).

9.13.2 Effect of Maintenance Dredging and Disposal on Leatherback Sea Turtle Proposed Critical Habitat

Designated critical habitat for leatherback sea turtle in the northeastern Pacific Ocean is the nearshore area from Cape Flattery, Washington, to Umpqua River (Winchester Bay), Oregon. Critical habitat extends to a water depth of 80m from the ocean surface and is delineated along the shoreline at the line of extreme low water, except in the case of estuaries and bays where COLREGS lines (defined at 33 CFR part 80) shall be used as the shoreward boundary of critical habitat; it extends offshore to a line approximating the 2,000m isobath. This area is the principal Oregon/Washington foraging area and includes important habitat associated with Heceta Bank, Oregon. The greatest densities of a primary prey species, *Cyanea fuscescens,* occur north of Cape Blanco, Oregon and in shallow inner shelf waters. The PCE and impacts of maintenance dredging and disposal on that PCE for leatherback sea turtle estuarine critical habitat follow: the occurrence of prey species, primarily Scyphomedusae of the order Semaeostomeae (*Chrysaora*, *Aurelia*, *Phacellophora*, and *Cyanea*), of sufficient condition, distribution, diversity, abundance and density necessary to support individual as well as population growth, reproduction, and development of leatherbacks.

> *Maintenance dredging and disposal will have little or no effect of this PCE because the majority of maintenance dredging is conducted within the Quillayute River and Grays Harbor, all shoreward of the COLREGs demarcations. Only infrequent maintenance dredging is conducted in the ocean adjacent to Grays Harbor. Therefore, maintenance dredging will have discountable adverse effects on this PCE.*

9.13.3 Effect Determination for Leatherback Sea Turtle

No effects on prey quantity or quality are anticipated. In-water noise from disposal would have a discountable effect on leatherback sea turtle passage because only infrequent maintenance dredging is conducted in the ocean adjacent to Grays Harbor. The effects of the action will be either insignificant or discountable. Therefore, the USACE's effects determination is "**may affect, not likely to adversely affect**" leatherback sea turtle. Maintenance dredging and disposal will have only minor effects on critical habitat because the maintenance dredging typically occurs within the embayments, not in the Pacific Ocean. Therefore, the USACE's effect determination for maintenance dredging and disposal is "**may affect, not likely to adversely affect**" for leatherback sea turtle designated critical habitat.

9.14 Other Marine Mammals and Sea Turtles

9.14.1 Effect of Maintenance Dredging and Disposal on Other Marine Mammals and Sea Turtles

Evidence suggests that the other species listed in Table 1 are not likely to occur in the action area. Although blue whales (*Balaenoptera musculus*) feed on the continental shelf off Washington and Oregon during the summer months, the species is most abundant off the coast of California (Reeves et al. 1998a). North Pacific fin whale (*Balaenoptera physalus*) concentrations generally form along frontal boundaries or mixing zones between coastal and oceanic waters; no regular occurrences off the coast of Washington have been noted (Reeves et al. 1998b). Sei whales (*Balaenoptera borealis*) inhabit areas along the continental slope and rarely enter semi-enclosed marginal seas or gulfs (Reeves et al. 1998b). Sperm whales (*Physeter macrocephalus*) are frequently present off the coast of Washington; however, they typically inhabit deep waters and seldom venture close to coastal areas (Barlow et al. 1997). The preferred habitat for all of these whale species is the open ocean, not coastal waters.

Primary nesting sites for the green sea turtle (*Chelonia mydas*) are located in Mexico and the Galapagos Islands, although a resident population is also present in San Diego Bay (NMFS and USFWS 1998b). Beach strandings and gillnet captures were documented off the Washington coast, but it has been suggested that these individuals were vagrants that strayed northward with El Niño currents (NMFS and USFWS 1998b). No regular occurrences off the coast of Washington were noted in a 1998 draft recovery plan for this species. Olive Ridley turtles (*Lepidochelys olivacea*) occur in tropical and warm temperate ocean waters. Eastern Pacific populations nest in southern Mexico and northern Costa Rica (NMFS and USFWS 1998a). There is evidence that they undergo regular migrations from breeding areas to feeding areas in the south. Occasionally, they move north with warm water associated with El Niño events (NMFS and USFWS 1998a), but they are unlikely to be found in coastal bays. Loggerhead sea turtles (*Caretta caretta*) are found offshore of the west coast of Washington, but not inshore. Therefore, maintenance dredging and disposal will have "**no effect**" on this species.

9.14.2 Effect Determination for Other Marine Mammals and Sea Turtles

Given the distributions of these marine mammals and sea turtles, combined with their high mobility, the USACE has determined that maintenance dredging and disposal will have "**no effect**" on these species.

9.15 Bocaccio, Canary, and Yelloweye Rockfish

9.15.1 Effect of Maintenance Dredging and Disposal on Bocaccio, Canary, and Yelloweye Rockfish

The ESA-listed rockfish at any life history stage are not expected to occur in navigation channels as the channels are in shallower brackish water away from typical rockfish deep-water rocky habitat, are not near typical spawning locations, and have low likelihood for having larval rockfish drift through as ichthyoplankton due to the distance from spawning habitat. According to Love et al. (2002), the larval stage of the ESA-listed rockfish species do not occur in the intertidal, subtidal nearshore, or shallow shelf habitats of Puget Sound. Juveniles may settle in nearshore

rocky habitat or in kelp forests (Love et al. 1991), but this habitat type is not associated with the maintenance dredging or disposal sites. Since dredging occurs in areas where ESA-listed rockfish are not expected to occur, the effect of maintenance dredging is likely discountable.

9.15.2 Effect of Maintenance Dredging and Disposal on Bocaccio, Canary, and Yelloweye Rockfish Proposed Critical Habitat

Proposed critical habitat for these species occurs from extreme high water out to the deepest areas of Puget Sound and includes some, but not all of the navigation channels. Examples of navigation channels not included are the lower Snohomish River, Duwamish River, and Tacoma Harbor. Critical habitat is designated from extreme high water out to 30m (lower limit of photic zone) for juveniles, and from 30m and out for adults and where rugosity is high enough.

PCEs include the following:

PCE#1: Quantity, quality, and availability of prey species to support individual growth, survival, and reproduction, and feeding opportunities.

Maintenance dredging is conducted in authorized navigation channels with relatively shallow water and unconsolidated substrate, areas where rockfish are rarely found. Therefore, maintenance dredging and disposal will have discountable adverse effects on this PCE.

PCE#2: Water quality and sufficient levels of DO to support growth, survival, reproduction, and feeding opportunities.

Maintenance dredging has some effect on water quality, specifically minor increases in turbidity during maintenance dredging; however, this is localized and short duration and likely has an undetectable effect on listed rockfish. Maintenance dredging is conducted in project areas where the accumulated sediment is unconsolidated. This material is routinely perturbed by infauna, minimizing or eliminating the buildup of biological oxygen demand or chemical oxygen demand. Therefore, maintenance dredging and disposal will have discountable adverse effects on this PCE.

PCE#3: The type and amount of structure and rugosity that supports feeding opportunities and predator avoidance.

Maintenance dredging will have only minor effects on the structure and rugosity that supports feeding opportunities and predator avoidance. Maintenance dredging sites are deepened areas in harbors and river deltas that add to rugosity in a small way. Therefore, maintenance dredging and disposal will have discountable adverse effects on this PCE.

9.15.3 Effect Determination for Bocaccio, Canary, and Yelloweye Rockfish

Undetectable effects on prey and water quality, and insignificant effects on rugosity, and insignificant effects of dredged material on ESA-listed rockfish larvae are anticipated. The effects of the action will be either insignificant or discountable. Therefore, the USACE's effects determination is "**may affect, not likely to adversely affect**" bocaccio, canary, and yelloweye rockfish. Maintenance dredging will have only minor effects on critical habitat. The USACE's effect determination for maintenance dredging and disposal is "**may affect, not likely to adversely affect**" for bocaccio, canary, and yelloweye rockfish critical habitat.

9.16 Interrelated and Interdependent Effects

Per 50 CFR 402.02, interdependent actions are those that have no independent utility apart from the proposed action. Interrelated actions are those that are part of a larger action and depend on the larger action for justification.

The USACE's maintenance dredging maintains navigation projects for vessel use. However, the USACE does not have any authority over vessel use of navigation channels. Vessel use of navigation channels is regulated and controlled by the USCG. The USACE does not expect continued maintenance of authorized dimensions of the navigation channels to facilitate or prompt changes in vessel use frequency or patterns over and above environmental baseline conditions. Non-Federal dredging of the boat slips at the Westhaven Cove Small Boat Basin and berth dredging by Port of Grays Harbor are dependent on the dredging of the entrance channels and turning basin proposed in this BA.

The USACE is unaware of any other interrelated and interdependent activities that result from maintenance dredging.

9.17 Cumulative Effects

"Cumulative effects include the effects of future State, tribal, local, and private actions not involving a Federal action that are reasonably certain to occur within the action area under consideration. Future Federal actions requiring separate consultation (unrelated to the proposed action) are not considered in the cumulative effects section" (50 CFR 402.12).

The USACE is unaware of any cumulative effects that would not require application for a USACE permit and consequent Section 7 consultation. No significant cumulative effects on the ESA-listed species are expected from maintenance dredging and disposal activities when considered in the overall context of maintenance dredging and disposal.

9.18 Summary

The USACE has determined that the maintenance dredging and disposal program "**may affect, but is not likely to adversely affect**" the ESA-listed species and their designated critical habitat that occurs in the areas where maintenance dredging and disposal is conducted. For the Quillayute River Project, the USACE has determined that this dredging and disposal action will have "**no effect**" on any ESA-listed species or their critical habitat. The reasons for these effect determinations include the following:

- maintenance dredging and disposal operations are scheduled to occur during in-water work windows;
- each navigation channel is a small portion of all the available habitat in the area where each navigation channel is located;
- navigation channels are located in the central portions of waterways away from the shorelines where vulnerable juvenile salmonids can be found;
- the infauna and epifauna in navigation channels are similar to the infauna and epifauna in areas adjacent to navigation channels;

- clamshell dredges are used in all but three maintenance dredge locations (outer Grays Harbor: hopper dredge; Quillayute and Snohomish rivers, and occasionally Keystone Harbor and Westhaven Cove: hydraulic dredge), to minimize or eliminate entrainment;
- sediment to be removed is tested using DMMP procedures and if the sediment is unsuitable for open-water disposal, and must be removed it is subject to a separate Section 7 consultation with the Services if projected effects trigger Section 7 obligations;
- aquatic beneficial dispersive disposal sites are placed in locations where dredged material will move inshore and not accumulate and therefore reduce the likelihood that changes in the epibenthic or infaunal community will occur; and
- all appropriate conservation measures (see section 6) will be applied to each maintenance dredge and disposal operation as appropriate.

The effect determination of "**may affect, not likely to adversely affect**" is based on the effects of maintenance dredging and disposal on ESA-listed species and their designated or proposed critical habitat; and taking into consideration interrelated, interdependent, and cumulative effects of maintenance dredging and disposal.

10 ESSENTIAL FISH HABITAT

The Magnuson-Stevens Sustainable Fisheries Act requires Federal agencies to consult with NMFS regarding actions that may adversely affect EFH for Pacific coast groundfish, coastal pelagic species, and Pacific salmon. The Act defined EFH as "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity." EFH is the habitat (waters and substrate) required to support a sustainable fishery and a managed species' contribution to a healthy ecosystem. Waters include aquatic areas and their associated physical, chemical, and biological properties that are used by fish. Substrate includes sediment, hard bottom, structures underlying the waters, and associated biological communities.

The project areas previously described in this document are part of the Puget Sound Basin and Washington State coastal estuaries. The EFH for Puget Sound and the southern coast of the Strait of Juan de Fuca has been designated as EFH for various life stages of 29 species of groundfish, four coastal pelagic species, and three species of salmon (Table 9). The EFH composite for the Washington coastal estuaries has been designated as EFH for various life stages of 24 species of groundfish, four coastal pelagic species, and two species of Pacific salmon (Table 10) according to the NMFS Fisheries Management Plans (PFMC 1998, 2003, 2004). The proposed actions may affect EFH of groundfish, coastal pelagic species, and Pacific salmon species listed in Table 9 and Table 10.

Table 9. EFH use in Puget Sound and Strait of Juan de Fuca by species and life history stage based on the NMFS EFH habitat data base.

Scientific Name	Common Name	Adult	Juvenile	Larvae	Egg
Groundfish Species					
Anoplopoma fimbria	Sablefish	X	X	X	X
Citharichthys sordidus	Pacific sanddab	X			
Eopsetta jordani	Petrale sole	X			
Glyptocephalus zachirus	Rex sole	X			
Hexagrammos decagrammus	Kelp greenling	X		X	
Hippoglossoides elassodon	Flathead sole	X			
Hydrolagus colliei	Spotted ratfish	X	X		
Isopsetta isolepis	Butter sole	X			
Lepidopsetta bilineata	Rock sole	X			
Merluccius productus	Pacific hake	X	X		
Ophiodon elongatus	Lingcod			X	
Parophrys vetulus	English sole	X	X		
Platichthys stellatus	Starry flounder	X	X		
Psettichthys melanostictus	Sand sole	X	X		
Raja binoculata	Big skate	X			

Scientific Name	Common Name	Adult	Juvenile	Larvae	Egg
Raja rhina	Longnose skate	X	X		X
Scorpaenichthys marmoratus	Cabezon	X	X	X	X
Sebastes auriculatus	Brown rockfish	X			
Sebastes caurinus	Copper rockfish	X	X		
Sebastes diploproa	Splitnose rockfish		X	X	
Sebastes entomelas	Widow rockfish		X		
Sebastes flavidus	Yellowtail rockfish	X			
Sebastes maliger	Quillback rockfish	X	X		
Sebastes melanops	Black rockfish	X	X		
Sebastes mystinus	Blue rockfish	X	X	X	
Sebastes nebulosus	China rockfish	X	X		
Sebastes nigrocinctus	Tiger rockfish	X			
Sebastes paucispinis	Bocaccio		X		
Squalus acanthias	Spiny dogfish	X			
Coastal Pelagic Species					
Engraulis mordax	Anchovy	X	X	X	X
Sardinops sagax	Pacific sardine	X	X	X	X
Scomber japonicus	Pacific mackerel	X			
Loligo opalescens	Market squid	X	X	X	
Pacific Salmon					
Oncorhynchus tshawytscha	Chinook salmon	X	X		
Oncorhynchus kisutch	Coho salmon	X	X		
Oncorhynchus gorbuscha	Pink salmon	X	X		

Note: The Fishery Management Plan groups juveniles/larvae/eggs together; any could be in the area.

Table 10. EFH use in Washington coastal estuaries by species and life history stage based on the NMFS EFH habitat data base.

Scientific Name	Common Name	Adult	Juvenile	Larvae	Egg
Groundfish Species					
Citharichthys sordidus	Pacific sanddab			X	
Eopsetta jordani	Petrale sole			X	X
Gadus macrocephalus	Pacific cod			X	
Galeorhinus galeus	Soupfin shark	X	X		
Hippoglossoides elassodon	Flathead sole		X	X	X
Hydrolagus colliei	Spotted ratfish	X	X		

Scientific Name	Common Name	Adult	Juvenile	Larvae	Egg
Lepidopsetta bilineata	Rock sole			X	X
Microstomus pacificus	Dover sole				X
Ophiodon elongatus	Lingcod		X		X
Parophrys vetulus	English sole	X	X		X
Platichthys stellatus	Starry flounder	X	X	X	X
Psettichthys melanostictus	Sand sole				X
Raja inornata	California skate	X			X
Sebastes auriculatus	Brown rockfish			X	
Sebastes caurinus	Copper rockfish			X	
Sebastes melanops	Black rockfish		X		
Sebastes proriger	Redstripe rockfish			X	
Squalus acanthias	Spiny dogfish	X	X		
Coastal Pelagic Species					
Engraulis mordax	Northern anchovy	X	X*	X*	X*
Loligo opalescens	Market Squid	X	X*	X*	X*
Sardinops sagax	Pacific sardine	X	X*	X*	X*
Scomber japonicas	Pacific (chub) mackerel	X	X*	X*	X*
Pacific Salmon					
Oncorhynchus kisutch	Coho salmon	X	X		
Oncorhynchus tshawytscha	Chinook salmon	X	X		

Note (*): The Fishery Management Plan groups juveniles/larvae/eggs together, any of which could be in the area. All life history stages can be found in waters off Washington, but this is dependent upon surface water temperatures being higher than 10 degrees Celsius (C).

10.1 Effects of Maintenance Dredging and Disposal on EFH

Maintenance dredging and disposal may affect EFH of the species listed in Tables 9 and 10 through the following influences:

- Reducing the suitability of the navigation project footprint for settlement and recruitment of early life history stages. This reduction will be minor because the substrate in the channel after maintenance dredging will still be predominantly sand (although likely more compact than the sand in the top layers of the dredge prism), which will still provide substrate for settlement and recruitment of early life history stages of many of the invertebrate and vertebrate species associated with the substrate in Puget Sound and Grays Harbor.
- Entraining substantial numbers of prey items, such as benthic invertebrates and sand lance. Even though there will be removal of prey items, the vertebrate prey items

(forage fish) will re-colonize the area rapidly, while the invertebrate prey items, such as worms, will take somewhat longer to reestablish.

- Reducing the quality of habitats adjacent to the navigation project footprint through temporary increases in turbidity. Elevated turbidity levels will be temporary and rapidly dissipate once dredging is complete. Further, since the dredge operations constantly move, the effect to any one location will be short.
- Reducing the availability of prey resources through disturbance to the benthic invertebrate community. Forage fish abundance reductions are minor since forage fish re-colonize the dredge area rapidly. However, sedentary organisms such as tube worms will take longer to reestablish since they will need to re-colonize via settlement of early life history stages.

Therefore, the USACE has determined that maintenance dredging and disposal may adversely affect EFH, because removal or open-water disposal of dredged material would constitute a detectable effect to EFH. The conservation measures below are designed to mitigate the adverse effects caused by dredging.

10.2 Conservation Measures

The USACE has incorporated the following conservation measures in its maintenance dredging and disposal program to reduce potential impacts to EFH:

- All applicable conditions of the Ecology's Section 401 Water Quality Certification, covering the discharge of dredged or fill material into waters of the U.S., are implemented to minimize turbidity and DO impacts, as well as impacts to commercially important species.
- Only previously disturbed navigation channel areas will be impacted by any proposed maintenance dredging actions
- Only one new intertidal beach disposal site is proposed and this will combine and lengthen two previously used disposal sites to broaden the beneficial use of dredged material
- Care will be taken during the formulation of proposed projects to manage dredging volumes and consequently effects to EFH.
- Sediments will be tested for contaminants and approved for unconfined open-water disposal under the DMMP guidelines administered by the USACE, EPA, Ecology, and the Washington State Department of Natural Resources.
- Beneficial re-use and disposal of dredged materials will be used to the maximum extent practicable. Disposal in open-water multi-user sites is covered in a separate consultation document.

11 POTENTIAL CHANGES TO PROJECTS

Looking into the future of maintenance dredging projects and disposal sites, there are several subjects to consider: 1) changes in disposal site locations and/or boundaries; 2) changes in dredging techniques; 3) changes in navigation channels; and 4) changes in upstream input that could affect sediment suitability. Any of these changes would be subject to reinitiation of consultation.

11.1 Changes to Disposal Sites

The USACE anticipates some changes in disposal sites. At least one site, Site "O" in Everett, will likely close. The Port of Everett and the City of Everett are seeking a replacement for Site "O", which is where material from the upstream portion of the navigation channel is placed for later rehandling. The replacement site would need to meet the same requirements that Site "O" meets. Site A at La Push (Quillayute River) may expand to better accommodate material dredged from the river channel, although this is unlikely. Additional disposal sites may be added to the Swinomish dredging site, which would require ESA consultation.

11.2 Changes in Dredging Techniques

The dredging techniques and where each is used have remained relatively fixed for many decades. The USACE does not anticipate any changes in the types of dredges (clamshell, hydraulic, and hopper dredges) used in Western Washington. Other types of dredges that are used in other locations could be introduced into Western Washington, but given the environmental constraints, this is unlikely.

11.3 Changes to Navigation Channels

Occasionally, changes are made in navigation channels including location or alignment, width, and depth. Recently, some reaches of the Grays Harbor Chehalis River Navigation Channel were shifted about half of the channel width north or south to take advantage of changes in the thalweg through natural scouring and to reduce the amount of material that must be removed to maintain the navigation channel. Additionally, a single dredging event underway in 2016 and continuing into 2017 will increase the depth of the navigation channel by two feet from -36 feet MLLW to -38 feet MLLW; this Navigation Improvement Project is subject to a distinct concluded consultation. As of 2016, the USACE is investigating the feasibility of navigation improvements in the East and West Waterways in Seattle in cooperation with the Port of Seattle. Consultation on this action is occurring separately.

Although no other changes to the eight Federal navigation channels listed in this document are anticipated at this time, the USACE may take advantage of changes in bathymetry to adjust channel locations and alignments to reduce the amount of material that must be dredged to maintain authorized navigation channel dimensions at each project site.

11.4 Changes in Sediment Suitability Determinations

The DMMP updates the protocols as needed based on the scientific studies in the field of sediment toxicology. Therefore, the USACE anticipates that there will be changes in the protocols used to determine the suitability of placing dredged material in open-water disposal sites. This

BA extends only to the dredging and placement of materials that have been determined suitable for unconfined aquatic disposal, applying the suitability criteria established by the DMMP that are in effect at the time of the determination.

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