UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Northwest Region
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BIN C15700
Seattle, WA 98115-0070

March 17, 2003

Thomas F. Mueller
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Department of the Army
Seattle District, Corps of Engineers
Post Office Box 3755
Seattle, Washington 98124-3755

Re: Biological Opinion and Essential Fish Habitat Consultation for the Duwamish/Diagonal Sediment Remediation Project, Duwamish Waterway, Seattle, Washington (NMFS No. 2002/01376, COE No. 2002-2-00548) (WRIA 9)

Dear Mr. Mueller:

In accordance with Section 7 of the Endangered Species Act (ESA) of 1973, as amended (16 U.S.C. 1531 *et seq*.) and the Magnuson Stevens Fishery Conservation and Management Act (MSA), as amended by the Sustainable Fisheries Act of 1996, the attached documents transmit the National Oceanic and Atmospheric Administration's National Marine Fisheries Service (NMFS) Biological Opinion (Opinion) and MSA consultation on the issuance of a permit for contaminated sediment removal and capping in the Duwamish Waterway, Seattle, Washington. The Army Corps of Engineers (COE) determined that the proposed action may affect, and is likely to adversely affect (LAA) the Puget Sound (PS) chinook (*Oncorhynchus tshawytscha*) Evolutionarily Significant Unit (ESU). NMFS concurred with the LAA determination but concluded that implementation of the proposed project is not likely to jeopardize the continued existence of PS chinook.

This Opinion reflects the results of a formal ESA consultation and contains an analysis of effects covering the PS chinook in the Duwamish Waterway, Washington. The Opinion is based on information provided in the Biological Assessment (BA) sent to NMFS by the COE, and additional information transmitted via meetings, telephone conversations, and e-mail. A complete administrative record of this consultation is on file at the Washington Habitat Branch Office.

In order to consult efficiently on anadromous fish with similar biological requirements, this consultation was prepared jointly with the U.S. Fish and Wildlife Service. Separate analyses were prepared by NMFS for PS chinook and by FWS for native char. Also included is a separate MSA consultation which concluded that the proposed project may adversely impact designated Essential Fish Habitat (EFH). The Conservation Measures identified therein would address the negative effects from the proposed COE action. Therefore, NMFS recommends that they be adopted as EFH conservation measures.

If you have any questions, please contact Shandra O'Haleck of the Washington Habitat Branch Office at (360)753-9533 or at shandra.o'haleck@noaa.gov.

Sincerely,

For Michael R Crouse

D. Robert Lohn
Regional Administrator

Enclosure

cc: Suzanne Skadowski, US Army Corps of Engineers

Endangered Species Act - Section 7 Consultation
Biological Opinion

NOAA FISHERIES No. 2002/01376
and
U.S. Fish and Wildlife No. 1-3-03-F-0356

Duwamish/Diagonal Sediment
Remediation Project
Duwamish Waterway, Seattle, Washington

Agency: United States Army Corps of Engineers

Consultation Conducted By: National Marine Fisheries Service
Northwest Region, and,
U.S. Fish and Wildlife Service
Western Washington Office

Issued by: For Michael R Crouse Date: March 17, 2003

D. Robert Lohn
Regional Administrator

_____ Date: March 11, 2003
Ken S. Berg, Manager
Western Washington Fish and Wildlife Office

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1.0 INTRODUCTION

1.1 Background and Consultation History

On November 21, 2002, the National Marine Fisheries Service (National Oceanic and Atmospheric Administration [NOAA Fisheries]) and the United States Fish and Wildlife Service (FWS) received a Biological Assessment (BA) and a request for Endangered Species Act (ESA) Section 7 consultation from the United States Army Corps of Engineers (COE) (2002-2-00548). The purpose of this Biological Opinion (Opinion) will most likely result in the issuance of a COE section 404 permit to King County. The COE concluded that, while it may be difficult to quantify effects on listed species from this action, the conservative position must be taken that the proposed dredging and capping activities are Likely to Adversely Affect (LAA) Puget Sound (PS) chinook salmon (*Oncorhynchus tshawytscha*) and PS/Coastal bull trout (*Salvelinus confluentus*) in the short term. NOAA Fisheries and FWS concurred with the COE effect determination of LAA and initiated formal consultation on December 17, 2002, and December 20, 2002, respectively. A complete administrative record of this consultation is on file at both the FWS and NOAA Fisheries office in Lacey, WA.

The King County Wasterwater Treatment Division (King County), on behalf of the Elliott Bay/Duwamish Restoration Program (EBDRP), has agreed to remove sediments contaminated with polychlorinated biphenyls (PCBs), mercury, bis (2-ethylhexyl) phthalate, and butyl benzyl phthalate and replace the removed sediments with an isolating cap in the lower Duwamish River estuary near Seattle, Washington [Water Resource Inventory Area (WRIA 9)]. Two contamination hot spots would be removed within cleanup Area A and cleanup Area B (collectively called the 'project area.' See Figures 1 and 2). Dredging contaminated material and returning the site to pre-project elevations with clean sand would ensure the future functions and stability of the existing habitat. The proposed project occurs within the PS chinook Evolutionary Significant Unit (ESU), and the PS/Coastal bull trout Distinct Population Segment (DPS).

Disposal of the contaminated sediments from this project will be in Slip 1 of the Blair Waterway, a nearshore confined disposal facility (NCD) in Commencement Bay operated by the Port of Tacoma and the Occidental Chemical Corporation under the United States Environmental Protection Agency (EPA) authority. The NCD is the subject of a separate Opinion being prepared for the remediation at the mouth of the Hylebos Waterway and for the disposal of contaminated sediments in Slip 1. Thus, to reduce repetition, the potential habitat effects associated with the placement of Duwamish/Diagonal contaminated sediments into Slip 1 are not being addressed as part of this Opinion (NOAA Fisheries WSB-01-501; FWS Reference 1-3-02-F-0462).

In the long-term, removal and isolation of the contaminated sediments will benefit the species that utilize the lower Duwamish River. However, short-term adverse effects on fish associated with the

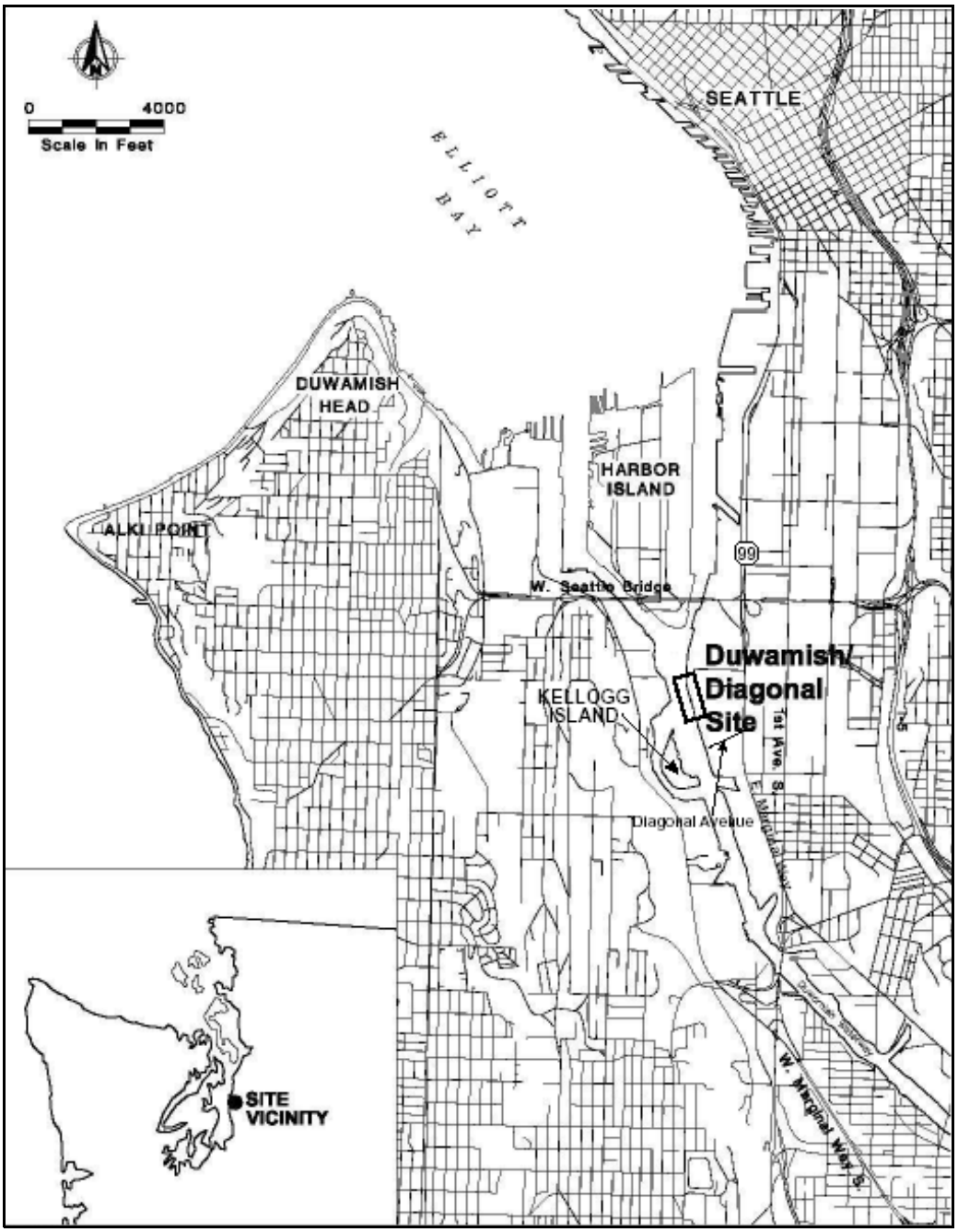

Figure 1. Diagonal/Duwamish clean up site. (Courtesy of King County Department of Natural Resources 2001.)

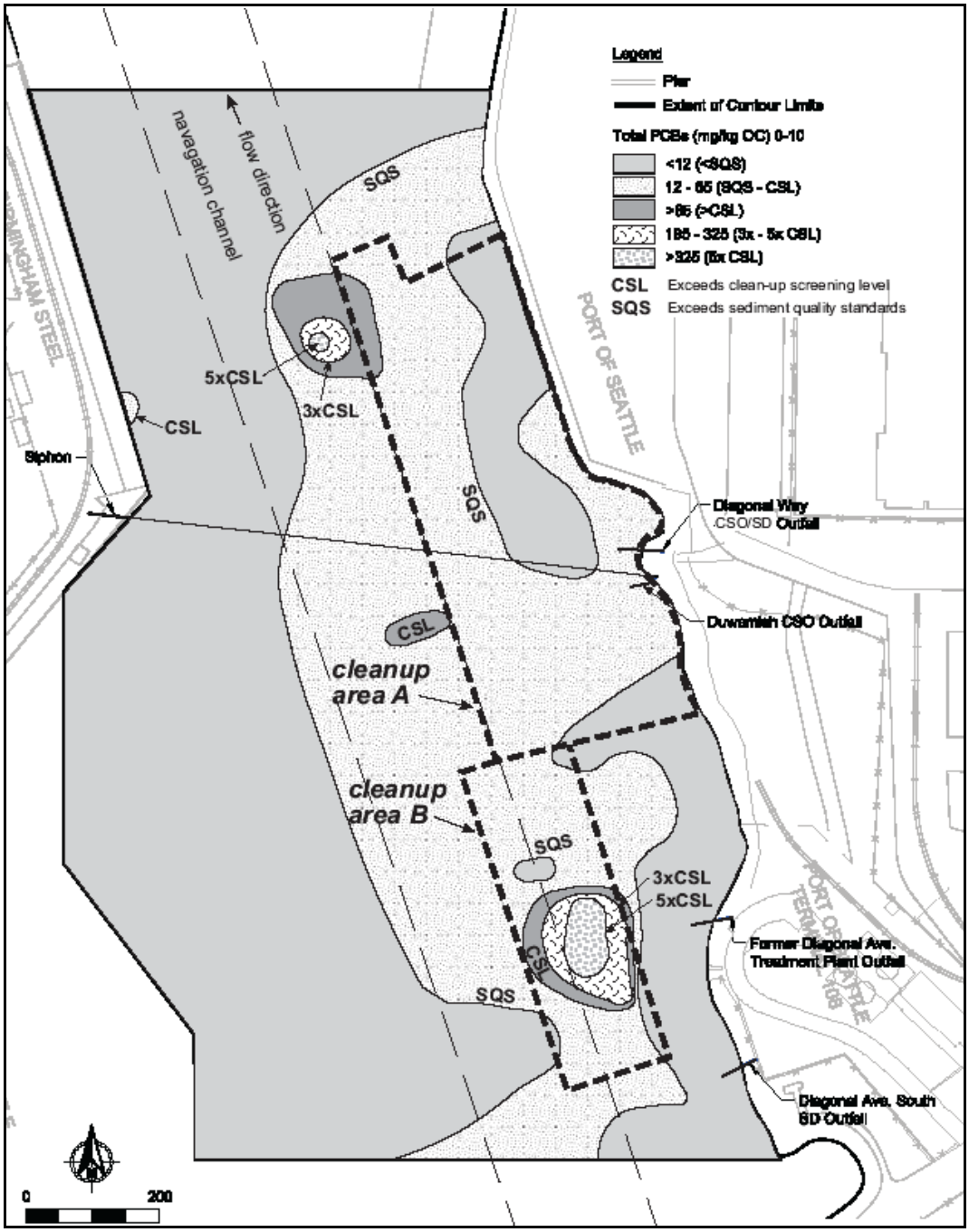

Figure 2. Duwamish/Diagonal CSO clean up sites A and B. (Courtesy of King County Department of Natural Resources 2001.)

project activities are possible, including harm resulting from increased turbidity, and potential fish

entrainment during dredging activities. These effects are expected to be temporary and would be minimized by project conservation measures and best management practices. NOAA Fisheries and the FWS concur with the COE effect determination of Likely to Adversely Affect.

The objective of this Opinion is to determine whether the proposed action is likely to jeopardize the continued existence of PS chinook and PS/Coastal bull trout, both listed as threatened under the ESA. The standards for determining jeopardy are described in Section 7(a)(2) of the ESA and further defined in 50 C.F.R. 402.14. This Opinion is based on information provided in the BA and correspondence with the applicant. The term "salmonids" refers to both PS chinook and PS/Coastal bull trout.

1.2 Description of the Proposed Action

The COE proposes to issue a Section 404 permit to King County for the dredging of contaminated sediments, transporting the dredged materials for disposal into Slip 1 of the Blair Waterway in Commencement Bay, and replacing the contaminated sediment with an isolating cap at the Duwamish/Diagonal site. The proposed cap would maintain existing water depths and river bottom elevations.

1.2.1 Dredging

Cleanup Area "A" is approximately 4.8 acres in size, and is rectangular in shape. Area A is approximately 750 feet parallel to the shore and 260 feet wide from inshore to offshore. The dredge prism includes areas that exceed the Washington State Sediment Quality Standards/Cleanup Screening Level (SQS/CSL) values for PCBs, mercury, bis (2-ethylhexyl) phthalate, and butyl benzyl phthalate (KCDNR et al. 2001). Cleanup Area A does not extend into the navigation channel, as defined by the COE, but borders the east navigation channel line. The eastern boundary of the dredging area would be near the Diagonal Way Combined Sewer Overflow (CSO)/Storm Drain (SD) Outfall and the Duwamish CSO Outfall. Dredging would occur up to the zero elevation contour (defined as zero feet above or below mean lower low water [MLLW]) of the shoreline. The offshore (western) boundary is down to the east edge of the navigation channel; excess dredging would occur in the dredge cut along the navigation channel line to provide a two-foot over-dredge (until final bottom elevation equals 32 feet below MLLW).

Approximately 43,100 cubic yards (cy) of contaminated sediment would be removed at cleanup Area A at an average depth of 5.5 feet (with a minimum of three feet per dredge cut). The sediment will most likely expand upon dredging by approximately 10 percent, making the total volume roughly 47,400 cy for disposal. The calculated volume of sediment to be removed could change by as much as 10 percent (either more or less than the current calculated volume) because of the refinement of the dredge cuts after new bottom surveys are conducted. An 8 to 12 cy bucket mechanical clamshell dredge would be used for all dredging. The depth range of dredging is approximately zero to minus 35 feet below MLLW.

Cleanup Area "B" is approximately 2.1 acres in size, and is rectangular in shape. Area B is

approximately 500 feet parallel to the shoreline, and 160 feet wide from inshore to offshore. The dredge prism includes areas that exceed the Washington State SQS/CSL values for PCBs and bis (2-ethylhexyl) phthalate (KCDNR et al. 2001). The eastern boundary of the dredging area would be near the offshore side of the loading pier where dredging would begin at the minus14 foot MLLW elevation contour. The area's offshore (western) boundary extends 50 feet into the navigation channel because sediments with PCB concentrations exceeding the CSL value were found at two sampling stations near the east channel boundary. Dredging would remove an existing shoal at this location such that the final bottom elevation would be minus 32 feet below MLLW, which would provide two feet of over-dredge. In Area B, the dredge cuts do not extend to the southeast corner because this is a steep slope and the sediment in this area would be removed as it slumped into the dredge cuts.

The sediment will most likely expand upon dredging by approximately 10 percent, making the total volume roughly 21,450 cy for disposal. The calculated volume of sediment to be removed could change by as much as 10 percent (either more or less than the current calculated volume) because of the refinement of dredge cuts after new bottom surveys are conducted.

The cleanup area extends downslope and into the navigation channel. Over half of the cleanup area is located on the side slope extending down to the navigation channel. The depth range of dredging is approximately minus 15 feet to 35 feet below MLLW. Cleanup Area B would be dredged first, followed by cleanup Area A. The purpose of following this upstream to downstream sequence is to minimize potential recontamination of Area A by dredging Area B, which is located immediately upstream. The entire project area (Area A and Area B) would be dredged, followed by capping the area.

A total of three barges would be used for the project if the preferred equipment are available. One barge would be used to hold the dredge crane. The dredge crane would fill the first haul-barge, and once filled, it would be delivered to the appropriate off-loading site. If the dredging contractor is unable to obtain two haul-barges with the desired capacity, a different number and/or size of haul-barges could be used to meet daily dredge quotas.

The proposed project would occur in the following sequence:

1. Core testing of contaminated sediments to determine concentrations of PCBs and other chemicals, and conduct all other testing required for approvals for disposal.

2. Dredge Area B and place contaminated sediments onto haul-barge using a clamshell bucket dredge. The haul-barge will be either a flat-top barge or a bottom-dump barge.

3. Dredge Area A and place contaminated sediments onto haul-barge using a clamshell bucket dredge. The haul-barge will be either a flat-top barge or a bottom-dump barge.

a) If flat-top haul-barges are used, water deposited on the haul-barge with

the dredge material would be allowed to drain back to the river after being filtered through hay bales and three layers of 150-micron pore size filter fabric or the equivalent.

b) If bottom-dump haul-barges are used, water deposited in the barge would be retained within the barge until the bottom of the barge is opened to release the barge's contents in the NCD.

Overall, the project would remove a total of 66,600 cy of contaminated sediment which, after dredging, would expand to 68,900 cy.

1.2.2 Transport of Dredged Materials

While the first haul-barge is being off-loaded, a second haul-barge would be positioned at the dredge site for filling with dredged material. Once filled, the second haul-barge will deliver the dredged material to the appropriate off-loading site. While the second haul-barge is being off-loaded, the first haul-barge will return to the dredge site for filling. The cycle would continue until all dredging is complete.

Sediments having PCB concentrations less than 45 parts per million (ppm) in the test samples would be transported by barge to the Slip 1 nearshore confined-disposal facility (NCD) in the Port of Tacoma's Blair Waterway (slip 1). The dredged sediment would be deposited in the NCD by one of several methods approved for disposal at the NCD.

If it is not possible, due to unforeseen circumstances, to transport material to the NCD, an upland disposal alternative would be used. Under this alternative dredge material having PCB concentrations less than 45 ppm in the test samples would be transported on flat-top haul-barges to a Harbor Island off-loading area or another suitable off-loading area along the lower Duwamish River where it would be transferred to sealed railcars (note: bottom-dump barges would not be used under this alternative). These railcars would be used to transport the material to the Rabanco Regional landfill in Goldendale, Washington.

Sediments having PCB concentrations greater than 45 ppm in test samples would be transported by rail or by sealed dump truck to the Columbia Ridge Landfill near Arlington, Oregon as described in the preceding paragraph. This facility is authorized to accept such material.

1.2.3 Capping

The project proposes to install an engineered isolating sediment cap after all dredging has been conducted. The isolating sediment cap would be formed by barging approximately 62,600 cy

of clean sediment (19,500 cy for Area B and 43,100 cy for Area A) to the site and spreading the clean sediment with the same crane used for dredging or with a split-hull barge. The volume of capping sediment deposited would be approximately equal to the volume of sediment removed. In addition, quarry spall and light riprap will be placed over Area B to stabilize sediment movement prior to capping.

The capping material will be obtained from the COE maintenance dredging of the upper turning basin or by purchasing material from a permitted, independently-operated, gravel quarry. This material will be transported to the project area by barge. Two haul-barges will be used to deliver capping sediment to the site and would be off-loaded in a similar alternating sequence unless split-hull barges were used. The isolating sediment cap that would be a minimum of three feet thick, and thicker in most areas.

If the crane option is used, it would be the same crane used for dredging. Two flat top haul-barges, (which may or may not be the same haul-barges used for transporting dredge material) would transport the capping sediment to the project site. A clamshell dredge bucket without teeth (to minimize the loss of sediment from the bucket) would then be used to off-load the capping sediment from the haul-barge and spread the material over the site.

If split-hull barges are used to spread capping material, the barges will be filled with capping material and moved to the site. The capping material in each barge would be deposited slowly onto the site by opening the split-hull only a small amount so that the material is deposited at a rate of approximately one barge load per hour. This method would allow a cap thickness of about one-half to one foot (6-12 inches) of sand to be placed as the barge was moved over the capping site. The barge would be accurately positioned across the area to be capped using one or two tug boats guided by a differential Global Positioning System. Several layers of sand would be spread with the split-hull barges to increase the cap thickness up to the required specification of three feet thick at a minimum over the entire site.

Another part of the action is the subsequent capping of the entire existing riprapped bank above the limits of the dredging/capping activities and Area B with clean fish-friendly substrate of appropriate sediment material (*i.e.,* "habitat mix"; 7,700 cy). The addition of the habitat mix is consistent with other bank protection projects within the Puget Sound. The use of this material is to provide additional surface area (habitat) for aquatic invertebrates.

1.2.4 Monitoring

Estuarine caps are subjected to hydrologic dynamics and can potentially be shifted by current flow. The design for the cap addresses this by using coarser size materials and monitoring to verify cap integrity and determine if maintenance of the cap is necessary. Maintenance of the cap is covered under this Opinion as long as all BMPs for capping listed in the BA and all Terms and Conditions in this opinion are adhered to. Furthermore, maintenance of the cap will not be conducted outside the normal work window of October 15 through February 15.

Accurate measurements of the dredging depths and capping elevations would be monitored to document that the construction of the cap adheres to the specifications in the dredging and capping plan. Detailed bottom surveys would be conducted a minimum of three times to monitor construction activities (before dredging, after dredging, and after capping), but additional surveys may be required if the contractor is directed to correct some part of the construction work.

The monitoring vessel for detailed bottom surveys and any potential water sampling would be equipped with a navigation system with a minimum accuracy of plus or minus three feet. The system would be capable of logging way-points so that the position of the construction operation can be recorded and the distance to potential water sampling stations can be determined.

After project completion, a long-term monitoring program would be carried out annually for a period of 10 years, as specified in the Cleanup Study Report (found in Appendix Q of KCDNR et al. 2001). Monitoring would follow protocols defined by KCDNR (found in Appendix Q of KCDNR et al. 2001), in compliance with WDOE water quality standards (WAC 173-201A-170). Cap stability would be assessed by monitoring for erosion through the use of either flexible bottom stakes or detailed bottom surveys. Recontamination would be monitored by sampling five surface grab stations at approximate intervals of every two years.

1.2.5 Duration and Timing

The project schedule in the BA calls for in-water construction work to commence in November 2003 and occur over roughly a 14-week period, with dredging operations completed before February 15, 2004. This construction schedule is conservative and falls well within the in-water work contaminated sediment period recommended for the protection of migrating juvenile salmonids (October 15 through February 15) by NOAA Fisheries, the FWS, and the Washington Department of Fish and Wildlife. However, an extension of the capping activities only may occur until March 1. Should unforeseen circumstances require, the project could be delayed for one year under this Opinion.

1.3 Description of the Action Area

The action area for the proposed project is considered to be that portion of the lower Duwamish River extending from north edge of Harbor Island south to the upstream limit of the winter salt wedge at approximately River Mile (RM) 9. The Duwamish River begins at the confluence of the Black and Green Rivers at RM 11 and flows into Elliott Bay. The lower six miles of the Duwamish River is maintained as a navigable waterway by the COE, and is known as the Duwamish Waterway.

The proposed project is located at RM 1.86 of the Lower Duwamish Waterway. The navigation channel is approximately 200 feet wide and 30 feet below MLLW (Weston 1993).

The eastern side of the navigation channel is approximately 249 feet from the east bank of the river. Depths in the navigation channel range from 26 to 35 feet below MLLW.

The dredging and capping area of the project area is located off the eastern riverbank of the Lower Duwamish Waterway, downstream of Kellogg Island and upstream of Harbor Island, north of the terminal end of Diagonal Avenue. The Lower Duwamish Waterway flows through the industrial section of south Seattle, Washington, and the project area is adjacent to three outfalls: the Duwamish CSO outfall, the Diagonal Way CSO/SD, and the former Diagonal Avenue Treatment Plant outfall. A fourth outfall, the Diagonal Avenue South SD outfall, is located near the upstream end of the project.

2.0 ENDANGERED SPECIES ACT

2.1 Biological Opinion

The purpose of consultation under the ESA is to ensure that any action authorized, funded or carried out by a Federal agency is not likely to jeopardize the continued existence of threatened or endangered species. Formal consultation concludes with the issuance of a Biological Opinion under section 7(b)(3) of the ESA.

2.1.1 Status of the Species, Puget Sound Chinook

PS chinook salmon were listed as threatened under the ESA on March 24, 1999 (64 Fed. Reg. 14308). The ESU includes all naturally spawned populations of chinook salmon from rivers and streams flowing into the Puget Sound. This area also includes the Straits of Juan de Fuca from the Elwha River, eastward, including rivers and streams flowing into Hood Canal, South Sound, North Sound, and the Strait of Georgia in Washington State. The species status review identified the high level of hatchery production which masks severe population depression in the ESU, as well as severe degradation of spawning and rearing habitats, and restriction or elimination of migratory access as causes for the range-wide decline in PS chinook salmon stocks (NOAA Fisheries 1998a, and 1998b). Critical habitat designation is not in effect for PS chinook.

Overall abundance of chinook salmon in this ESU has declined substantially from historical levels. Many populations are small enough that genetic and demographic risks are likely to be relatively high. Long-term trends in abundance are predominantly downward, with several populations exhibiting short-term declines. Factors contributing to the downward trend are widespread stream blockages, degraded habitat, with upper tributaries widely affected by poor forestry practices and lower tributaries and mainstream rivers affected by urbanization and agriculture. Hatchery production and releases of chinook salmon in Puget Sound are widespread and more than half of the recent total Puget Sound escapement returned to hatcheries.

2.1.1.1 Factors Affecting Species in the Action Area

The action area is a highly industrialized, salt wedge estuary influenced by river flow and tidal cycles. The urbanization and industrialization of this portion of the Green River watershed has resulted in an extensive system of filled tidelands and flood control revetments that have eliminated connectivity to the historic floodplain and decreased or eliminated stream channel complexity, functional riparian zones, and floodplain habitats. In the Duwamish estuary over 97 percent of the available intertidal marsh and mudflat habitat necessary for estuarine lifestage (smoltification) has been lost (Kerwin and Nelson 2000).

Of the Duwamish Waterway shoreline between the mouth and RM 6.5, 44 percent is riprapped, 34 percent covered by pier aprons and seven percent faced with vertical sheet piling (Tanner 1991). Dredging for navigational purposes coupled with industrial activities has resulted in adverse changes in the substrate characteristics and the amount of shallow water habitat available for fishery resources utilizing this estuary (Meyer et al. 1981). Furthermore, a considerable portion of the remaining intertidal and shallow subtidal portions of the Lower Duwamish Waterway are covered by barges (Muckleshoot Indian Tribe Fisheries Department [MITFD], unpub. data). The historical distribution of juvenile anadromous salmonids into off-channel distributary channels and sloughs have largely been eliminated and historical saltwater transition zones are lacking (Kerwin 1999). Additionally, the chemical contamination of sediments from stormwater and wastewater effluents in certain areas of the Waterway has compromised the effectiveness of the small amount of habitat surviving (EPA 2002).

2.1.1.2 Status of the Species within the Action Area

Chinook salmon migrating through the Duwamish River estuary are divided into two main stocks: the Duwamish/Green River summer/fall stock, and the Duwamish/Green River-Newaukum Creek summer/fall stock (WDFW 1994). Spring chinook were historically present in the Green/Duwamish River basin. However, returns from this run are in such low numbers that they are difficult to detect. It is possible that the spring run became extripated by the original construction effects of the Tacoma Headworks Dam in 1911, or became isolated from the basin by the diversion of the White River in 1906 (Kerwin and Nelson 2000).

Green/Duwamish summer/fall chinook salmon remain relatively abundant because of hatchery production. Although the Washington State Salmon and Steelhead Stock Inventory (WDFW 1994) rated the Green/Duwamish summer/fall chinook as “healthy,” the overall trend in abundance of PS chinook is predominantly downward. Stream spawning escapement estimates which includes hatchery strays can lead to significant overestimation of the natural chinook run. The confounding effect of hatchery strays on wild chinook production in systems such as the Green/Duwamish River was identified in the NOAA Fisheries status review as a key concern leading to the listing of chinook salmon (Meyers et al. 1998)

Summer/fall chinook salmon in the Duwamish/Green system are ocean-type fish that rear in freshwater for a few months after emerging from the gravel before migrating to the ocean in

the spring as sub-yearling smolts. Juveniles are abundant in the mainstem of the Green River from March through April and occur in the Lower Duwamish Waterway from early March through late July (Meyer et al. 1981; Low and Myers 2002). Other studies have found juvenile chinook salmon in the Duwamish as early as mid February (K. Fresh pers. comm. 2003). Although juvenile chinook are present in the Lower Duwamish Waterway over an 8-month period, catch data show an abrupt increase in smolts in mid-May followed by an equally abrupt decrease. This indicates that most of the fish represented in the pulse of abundance were not in the Lower Duwamish Waterway for more than two weeks (Warner and Fritz 1995).

Seiler (1999) found that chinook salmon preferred nighttime migration in the Cedar and Bear Rivers. For the first four weeks of trap operation, beginning January 23rd, weekly day/night ratios for chinook varied from 17% to 59% and declined as the season progressed. A comparison of the passage timing data with lunar data for Lake Washington and the Hiram M. Chittenden Locks suggested a strong correlation between moon location relative to the earth and emigration timing, particularly in the case of chinook and coho salmon. This correlation appeared to be stronger than the correlation between emigration and moon phase (illumination). Migration through the Locks increased markedly within a day or two of the moon being at apogee (i.e., when the moon is farthest from the earth). Emigration decreased by the time of the next apogee (R2 Resource Consultants 2002). Juvenile chinook salmon in the Duwamish/Green River would be expected to exhibit similar timing to Cedar River chinook, since the two rivers were connected until about 1917.

Similar to timing of juvenile chinook emigration peaks in the Duwamish estuary, increasing abundances of juvenile chinook have been observed in Elliot Bay, but only through the summer months. Taylor et al. (1999) found the greatest numbers of juvenile chinook at Terminal 5, located immediately west of Harbor Island, in mid-May, and at Pier 91, located 4 miles north of the Duwamish, in early June. Beamish et al. (1998) sampled salmonids throughout Puget Sound and observed that some juvenile chinook salmon remain in Puget Sound through fall and winter (Starkes 2001).

Generally, chinook salmon remain at sea for two to 4 years before returning to freshwater to spawn. The summer/fall stock migrate upstream through the Lower Duwamish Waterway to spawning grounds from late June into early November, with large numbers entering the river by July (Williams et al. 1975; Frissell et al. 2000; Kerwin and Nelson 2000). Adults primarily spawn between mid-September and October (WDFW 1994; Williams et al. 1975). No chinook salmon spawning is known to occur in the Lower Duwamish Waterway or in the smaller streams flowing into the estuary and lower reaches of the waterway (Weitkamp et al. 2000).

2.1.2 Status of the Species, Puget Sound/Coastal bull trout

The FWS listed all Distinct Population Segments (DPSs) of the bull trout within the coterminous United States in 1999 (USDI 1999). Five DPSs with 187 subpopulations were listed as “threatened” under the ESA. These DPS’s are identified as follows: 1) Coastal/Puget

Sound, 34 subpopulations[1]; 2) Columbia River, 141 subpopulations; 3) Jarbidge River, 1 subpopulation; 4) St. Mary-Belly River, 4 subpopulations; and, 5) Klamath River, seven subpopulations. Currently, critical habitat has been proposed for the Columbia River and Kalama DPSs. Bull trout populations have been affected for a variety of reasons but mainly due to loss of habitat (Fraley and Shepard 1989; Rieman and McIntyre 1993), competition (Leary et al. 1993), and overfishing (Fraley and Shepard 1989; Rieman and McIntyre 1993).

Cavendar (1978) determined bull trout and Dolly Varden (*Salvelinus malma*) were taxonomically diametric, and in 1980, bull trout and Dolly Varden were formally recognized as two discernible species by the American Fisheries Society.

Bull trout exhibit four different and very distinct life history forms: resident, fluvial, adfluvial, and anadromous. The resident form inhabits headwater streams and nearby tributaries in which they were hatched. Furthermore, the resident form may reach sexual maturity at a relatively small size. Fluvial forms reside in large rivers and are typically large in size. The adfluvial form resides primarily in lakes but migrates up river and into small tributaries for spawning. Anadromous forms of bull trout live part of their lives in the ocean and migrate into rivers and tributaries to spawn. The anadromous form has typically been the least studied of the four life history stages.

Bull trout are threatened by a variety of human-based activities (USDI 1999). Land management activities such as logging and road building and their associated effects have created increases in siltation, loss of pool habitat, decreases in large woody debris recruitment, increased stream temperatures, and an overall degradation of habitat and geomorphologic features. Dams, reservoirs, and water rights (irrigation) have also contributed to the decline of the bull trout. Dams and other human-made barriers have blocked migration corridors and have created fragmented population segments, which has lead to a decrease in genetic variability. Reservoirs have caused a degradation in water quality, and irrigation has caused a loss of base stream flow, especially during the summer months. Bull trout have also been subjected to over-harvest. It was believed that bull trout were the cause of population declines of other salmonids, and at one point, a bounty was rewarded to those who caught bull trout. Competition has also contributed to the population decline of the bull trout. Several nonnative fish such as brook trout have been introduced in streams and lakes in the northwest. The bull trout must compete with these species for space and forage opportunities. The introduction of nonnative species has also lead to hybridization, further depleting the genetic diversity of the bull trout.

Bull trout are known to be iteroparous (migrate from fresh water to salt water multiple times) (Kraemer 1994) and reach sexual maturity between five and seven years of age (Fraley and

[1]In the proposed rule to list the bull trout (USDI 1998c; FR 63 31693), the Service had delineated 35 subpopulations. Upon further review, we revised the total number to 34, when we concluded that the Puyallup River Basin had only two subpopulations as opposed to three. We made this revision in order to be consistent with the defined subpopulation criteria.

Shepard 1989). Bull trout typically spawn from August through November when stream temperatures fall between 40 and 48^0 Fahrenheit (F).

The embryos incubate over the winter and emerge during early spring. Depending on the life history form, bull trout may rear in small streams for several years before migrating to a lake, ocean, or larger river.

Bull trout habitat requirements are very specific and are typically found in headwater streams. Bull trout require clean, cold, clear, and complex habitats. Water temperature is critical in the early life history requirements of bull trout. Several studies show bull trout are rarely found in waters over 58^0 F (Goetz 1994; Dunham and Chandler 2001; Craig 1997). Spawning usually occurs when water temperatures drop below 50^0 F (Craig 1997; McPhail and Murray 1979; Fraley and Shepard 1989). Sediment composition is also a key component to bull trout survival. Bull trout spawn in clean substrate and, as juveniles, are usually observed in close proximity to stream beds free of fine sediments (Reiman and McIntyr 1993; Fraley and Shepard 1989). Fine sediments can have detrimental effects on egg and alevin survival and could impact the ability for bull trout to use interstitial spaces as a cover mechanism from predation or increases in stream flow during storm events (Goetz 1994; USDI 1999).

Bull trout distribution is highly correlated with complex habitats that include large woody debris, undercut banks, coarse substrates, and pools (Reiman and McIntyr 1993). Several studies show salmonid populations are directly affected by loss of large woody debris as a key habitat component (Bryant 1980; Toews and Moore 1982; Lestelle and Cederholm 1984; Dolloff 1996).

2.1.2.1 Coastal/Puget Sound Distinct Population Segment (DPS)

The FWS has identified 34 subpopulations of native char (bull trout and/or Dolly Varden) within the Coastal/Puget Sound distinct population segment of bull trout. These bull trout subpopulations were grouped into five analysis areas based on their geographic location: Coastal, Strait of Juan de Fuca, Hood Canal, Puget Sound, and Transboundary Independents. These groupings were made in order to identify trends that may be specific to certain geographic areas. In subpopulations where it is not known if the native char that occur there are bull trout, Dolly Varden or both, they are addressed together as “native char” in this discussion. This does not imply that both exist within a subpopulation when the words “native char” are used, but rather that the subpopulation of char has not been positively identified as bull trout and/or Dolly Varden.

Genetic analysis has been conducted on nine of the 34 native char subpopulations. Samples from five of the nine subpopulations were determined to contain only bull trout (Green River, Queets River, Upper Elwha River, Cushman Reservoir and Lower Skagit River). Two were determined to contain only Dolly Varden (Canyon Creek and Upper Sol Duc River). The Upper Quinault River contained both bull trout and Dolly Varden. No samples had evidence of hybridization.

Within the Coastal/Puget Sound distinct population segment, 12 of the 34 native char subpopulations are known to contain bull trout based on either genetic or morphometric measurement data. In seven of these 12 subpopulations, Dolly Varden are also believed to be present. In three out of the remaining 23 subpopulations, only Dolly Varden are currently known to be present. It should be noted that in most cases, identification was based on a limited number of samples, so it is possible that bull trout may also occur in the three subpopulations that to date, have only yielded Dolly Varden. The FWS believes that the current identification trend of subpopulations within the Coastal/Puget Sound population segment indicates the high likelihood of bull trout being present in the majority of remaining subpopulations.

The FWS rated a subpopulation as either "strong," "depressed," or "unknown," modified after Rieman *et al*. (1997). A classification of "strong" indicates that 1) spawning and rearing occurs within the subwatershed; 2) all major life history forms that once occurred are still present in the subwatershed; 3) abundance is stable or increasing; and 4) the population, or metapopulation of which this subwatershed is a part, supports an average of 5,000 individuals or 500 adults. A "depressed" subpopulation was defined as having either a major life history form eliminated, abundance that is declining or half of the historic abundance, or less than 5,000 total fish or 500 adults present. The FWS rated a subpopulation's status as "unknown" if insufficient information currently exists to determine whether the status of the subpopulation is either "strong" or "depressed." Within the Coastal/Puget Sound DPS, the FWS rates 1 of the 34 delineated native char subpopulations as "strong," 10 as "depressed," and 23 as "unknown."

The Washington State Department of Fish and Wildlife (WDFW) also has a rating system for native char subpopulations. Within the Coastal/Puget Sound DPS, four of the 34 delineated native char subpopulations are rated as "healthy" by WDFW, and the remaining 30 are of "unknown" status. The 1997 Washington Salmonid Stock Inventory for bull trout and Dolly Varden (WDFW 1997) states, "The 'healthy' category covers a wide range of stock performance levels, from consistently robust production to those stocks that may be maintaining sustainable levels without providing any surplus production for directed harvests. In other words, the fact that a stock may be classified as 'healthy' in the inventory process does not necessarily mean that managers have no current concerns about its production status."

WDFW (1997) defines a stock as "unknown" if sufficient trend information was not available or could not be used to assess stock status." WDFW further states that "[s]tocks rated as Unknown may be rated as healthy, depressed, critical, or extinct once more information is available."

Native char subpopulations rated as "healthy" by WDFW are: 1) Queets River; 2) Upper Dungeness River; 3) Cushman Reservoir on the Skokomish River; and, 4) the Lower Skagit River. Currently, all but the Upper Dungeness River subpopulation have been determined to consist of bull trout. The FWS believes that the "healthy" status designation for the Queets River, Cushman Reservoir, and Upper Dungeness River subpopulations is not appropriate. Because of information indicating recent declines in the Cushman Reservoir subpopulation

(WDFW 1997) and the lack of recent information for the Queets River subpopulation (general decline indicated by fish per day seining data between 1977 and 1991, and lack of trend information for 1991 to 1997) (WDFW 1997), an "unknown" rating better describes their status. The Upper Dungeness River subpopulation status is "tentatively considered healthy" by WDFW, based on a single distributional and abundance survey conducted in 1996 (WDFW 1997). Although the calculated linear densities for the areas sampled on the Upper Dungeness River appear to indicate that char are relatively numerous, the FWS believes this one year of distributional and abundance information is insufficient to conclude a "healthy" or "strong" status in this subpopulation. The FWS believes that the Upper Dungeness River subpopulation should be rated "unknown" at this time.

2.1.2.2 Status of the Green River/Duwamish subpopulation

The status of the Green River/Duwamish subpopulation is unknown. There is very limited information available on the status of bull trout in the Green/Duwamish River basin. Bull trout are presumed to occur in very low numbers in this system, and no spawning locations are known. The life history forms of bull trout in this drainage are also unknown. A historical account suggests that bull trout were once common (Suckley and Cooper 1860). Bull trout may have exclusively used the Green/Duwamish River as a migration corridor into the White River and its tributaries before the White River was artificially channeled into the Puyallup (J. Chan pers. comm. 2002). Creel counts on the Green River dating from 1940 indicate bull trout are extremely rare. With only four char taken by over 35,500 anglers checked between 1940 and 1973 (T. Cropp, WDW, in litt. 1993). Cropp indicated that though few in number, char are still occasionally caught in the Green River. A native char caught in May 1994 in the Duwamish River was positively identified as a bull trout both by Haas measurements (Haas and McPhail 1991) and by genetic work (Eric Warner, Muckleshoot Indian Tribe, pers. comm. 1997). Most recently, eight native char were captured in the Duwamish turning basin near RM 5.1 in August and September of 2000 (Taylor Associates 2001), and one bull trout was captured in September of 2002 (J. Chan. 2002. USFWS, pers. comm.).

2.1.2.3 Changes in Status Rangewide (Coastal/Puget Sound DPS)

The status of the bull trout Coastal/Puget Sound DPS has been affected by a number of actions authorized through biological opinions prepared under section 7 of the Act and section 10(a)(1)(B) permits issued for Habitat Conservation Plans (HCPs).

Biological Opinions: Appendix 1 summarizes the biological opinions issued for projects within the Coastal/Puget Sound DPS since the DPS was listed on November 1, 1999. Biological Opinions associated with HCP's are not incorporated into Appendix 1.

2.1.2.4 Habitat Conservation Plans (state wide)

The range-wide status of the bull trout has been affected by a number of recent HCPs that were prepared in conjunction with incidental take permit applications to the FWS pursuant to section 10(a)(1)(B) of the Act.

Six HCPs have been completed within Washington that affect the bull trout. It is important to note that permit holders are required to provide mitigation to the maximum extent practicable for any take that is permitted under an incidental take permit. This mitigation occurs whether the permitted take actually occurs or not. The following summarizes the anticipated and/or permitted take of bull trout for the HCPs which include this species. The required mitigation measures are not included in the following summaries. The six HCPs that include bull trout as covered species include:

- Seattle Public Utility's Cedar River Watershed HCP
- Plum Creek Timber Company I-90 HCP
- Washington Department of Natural Resources (WDNR) HCP
- Simpson Timber HCP
- Tacoma Public Utilities HCP
- Murray Pacific

<u>City of Seattle for the Seattle Public Utility's Cedar River Watershed HCP</u>

The Seattle Public Utility's Cedar River Watershed HCP permitted the take of bull trout over a 50-year period as a result of the proposed action. Two harm and harassment estimates of take were determined for bull trout based on the assumption that this species occurs throughout lands managed by the City of Seattle. The incidental take permit for the HCP allows the take of bull trout associated with 420 acres of restoration thinning (0 to 30-year-old trees) conducted in the first fifteen years of the HCP and 150 acres of ecological thinning (30 to 60-year-old trees) over the full term of the HCP. It also included take associated with maintenance of 520 miles of currently maintained roads, and with the ground disturbance associated with removing about 240 miles of existing roads during the first 20 years of the HCP. However, by year 20 of the HCP, the total maintained road mileage will drop to approximately 380. Some incidental take in the form of harm associated with improvement of about 4 miles to 10 miles of road per year is also anticipated.

Incidental take of bull trout in the Chester Morse Lake/Masonry Pool system occurs from entrainment through two intakes devices, the Cedar Falls Hydroelectric Project at Masonry Dam and the Overflow Dike into Masonry Pool. It is expected that no more than seven percent of the estimated bull trout population in that system will be killed per year through any combination of these intake devices.

Take is also expected to occur due to diminished water flow over and through the redds causing death of some developing eggs or alevins, and by preventing spawners from accessing

the tributaries of the reservoir by unusually low water levels in the reservoir. Studies have shown that less than ten percent of the bull trout redds in the Cedar River have been located below the normal high pool elevation of 1,563 ft. Nearly all (~95 percent) Rex River bull trout redds were annually located below 1,563 ft. The higher lake levels would inundate and create static water conditions in the redds. Water movement through the redds is needed to maintain high oxygen levels to the developing eggs and to flush organic material away from the eggs to prevent smothering. Consequently, when pool levels increase, survivability of the eggs is most likely going to decrease due to low oxygenation and smothering. The reduced survivorship of bull trout eggs would result in take.

Reservoir management zones of "Infrequent" (2) and "Very Infrequent" (1) are expected to take more bull trout than the "Normal" (3) operating zone. Zones (2) and (1) are expected to occur once every ten and fifty years, respectively, with durations exceeding one week. Short durations of spawner impedance can be expected to occur in the reservoir management zone (Appendix 38) of "Normal" (3) every year, but periods longer than one week will only occur once every four years. Spawner blockage is not expected to occur in the "Normal" (3) zone. The "Infrequent" zone (4) is expected to occur with a frequency of one in ten years where both spawner impedance and blockage is expected to occur with durations of one to three weeks. The "Very Infrequent" zone (5) will impede and block spawners, but is expected to occur only once in fifty years.

Plum Creek Timber Company I-90 HCP

The Plum Creek Timber Company I-90 HCP addressed about 170,600 acres for 50 to 100 years in King and Kittitas Counties, Washington. The Plum Creek Timber Company's HCP amended the original HCP (USDI 1998a) to include the Columbia River DPS of bull trout. The amendment allowed for the take of bull trout associated with habitat degradation/loss due to 150 acres of selective and thinning/restoration-oriented silvicultural harvest per year, two miles of stream restoration per year, and 20.2 miles of road construction, maintenance, and removal per year.

WDNR's HCP

The WDNR incidental take permit for 1.6 million acres of state forest land in the State of Washington was approved on January 30, 1997. The 70-year permit covers all WDNR-managed lands within the range of the spotted owl and authorizes incidental take occurring from commercial forest activities as well as non-timber resource activities. The WDNR prepared an HCP prior to the listing of bull trout, and then amended the HCP (USDI 1998b) to include the bull trout Coastal/Puget Sound DPS and the lower Columbia River downstream from Greenleaf and Hamilton Creeks in the Columbia River DPS. The amended HCP allowed for incidental take of bull trout associated with habitat degradation/loss due to 29 miles of road construction and maintenance per year, and 158 acres of selective and thinning harvest per year.

Simpson Timber HCP

The Simpson Timber incidental take permit was issued on October 12, 2000. The HCP encompasses the Plan Area of 261,575 acres and approximately 640,000 acres of additional lands (known as the Assessment Area) surrounding the Plan Area. The Assessment Area lands are not currently owned by Simpson, but may be in the future. All lands occur in Mason, Grays Harbor, and Thurston Counties. The incidental take permit authorizes take of bull trout associated with commercial timber harvest and land management activities for a period of 50 years.

The FWS authorized bull trout take as a result of timber harvest and experimental thinning associated with stream habitats on 2,987 acres (187 acres in the first 10 years of the permit term, and up to 5,973 acres (total of 6,160 acres minus 187 acres) for the remaining 40 years of the permit term. In addition, the FWS authorized take for bull trout associated with habitat adjacent to 250 acres of new road construction, and with habitat adjacent to potential remediation of 2,001 miles of system roads (during the first 15 years of the proposed permit term, 100 percent of all roads needing remediation would have such work completed). By year 15 of the HCP, effects to bull trout habitat resulting from road remediation should be eliminated.

Tacoma Public Utilities HCP

Tacoma Public Utilities, Tacoma Water Green River HCP encompasses nearly 15,000 acres in the upper Green River Watershed with approximately 110 stream miles and municipal water withdrawal from Green River at the Tacoma headworks facility at river mile 61.0. Distribution of bull trout in the upper watershed has not been documented and only a few individuals have been found in the lower Green River and the Duwamish Waterway (USFWS 2001). The FWS permitted bull trout take as a result of water withdrawal affecting the middle and lower Green River, even-aged harvest of 3,285 acres, uneven-aged harvest of 2,000 acres, and the construction, maintenance, and decommissioning of 113 miles of road. The term of the Tacoma HCP and permit is 50 years.

Murray Pacific

The original Murray Pacific Corporation (Murray) HCP for owls was completed in 1993. Soon after the initial HCP was completed, Murray discovered that they might have marbled murrelets on their property and decided to develop a habitat based multi-species HCP for their 55,000 acre tree farm as an amendment to their original owl HCP. On October 29, 2001, West Fork Timber (previously Murray) requested that the Service add the Puget Sound/Coastal bull trout Distinct Population Segment and the Canada lynx to their Incidental Take Permit. The Service completed the BO and Statement of Findings for the addition of these species on June 24, 2002. The HCP addresses listed species, as well as federal and state candidate species, to ensure that sufficient amounts of the habitat types are maintained or enhanced for all species that may occur on West Fork Timber's lands.

2.2 Evaluating Proposed Actions

The standards for determining jeopardy are set forth in Section 7(a)(2) of the ESA as defined by 50 C.F.R. Part 402 (the consultation regulations). NOAA Fisheries and the FWS must determine whether the action is likely to jeopardize the listed species. This analysis involves the initial steps of: (1) defining the biological requirements and current status of the listed species; and (2) evaluating the relevance of the environmental baseline to the species' current status.

NOAA Fisheries and the FWS are required to evaluate whether the action is likely to jeopardize the listed species by determining if the species can be expected to survive with an adequate potential for recovery. In making this determination, NOAA Fisheries and the FWS must consider the estimated level of injury and mortality attributable to: (1) collective effects of the proposed or continuing action, (2) the environmental baseline, and (3) any cumulative effects. This evaluation must take into account measures for survival and recovery specific to the listed species' life stages that occur beyond the action area. A finding of jeopardy is appropriate if the action, together with the baseline conditions and cumulative effects, appreciably reduces the species' likelihood of survival or recovery by reducing the numbers, distribution, or reproduction of the species. If NOAA Fisheries and the FWS find that the action is likely to jeopardize PS chinook and/or PS/Coastal bull trout, NOAA Fisheries and the FWS must identify reasonable and prudent alternatives for the action.

For this specific action, NOAA Fisheries' and the FWS analysis considers the extent to which the proposed action impairs the function of habitat elements necessary for rearing, and migration of PS chinook salmon and/or PS/Coastal bull trout. The Lower Duwamish Waterway is the major migratory pathway for chinook salmon in the Green/Duwamish Basin and is used for foraging and rearing by PS/Coastal bull trout. The Green/Duwamish may have historically been used as a migratory corridor for bull trout when the White River converged with the Green (J. Chan pers. comm.)

2.2.1 Biological Requirements

The first step NOAA Fisheries and the FWS use when conducting the ESA section 7(a)(2) analysis is to define the species' biological requirements within the action area. NOAA Fisheries and the FWS then considers the current status of the listed species taking into account species information, *e.g.,* population size, trends, distribution, and genetic diversity. To assess the current status of the listed species, NOAA Fisheries and the FWS start with the determinations made in its decision to list these species for ESA protection within the ESU and DPS considered in this Opinion and also considers any new data that are relevant to the determination.

Biological requirements are those necessary for the listed species within the ESU and DPS to survive and recover population parameters at which protection under the ESA would become unnecessary. This will occur when populations are large enough to safeguard the genetic

diversity of the listed species within the ESU and DPS, enhance their capacity to adapt to various environmental conditions, and allow them to become self-sustaining (chinook only since bull trout are not artificially propagated) in the natural environment. The biological requirements for PS chinook salmon and PS/Coastal bull trout include adequate food (energy) sources, flow regimes, water quality, habitat structures, passage conditions (migratory access to and from potential spawning and rearing areas), and biotic interactions (Spence *et al.* 1996). The specific biological requirements for PS chinook and PS/Coastal bull trout that are influenced by the action considered in this Opinion include food, water quality, habitat structure, and biotic interactions.

2.2.2 Environmental Baseline

The environmental baseline represents the current conditions to which the effects of the proposed action would be added. The term "environmental baseline" means "the past and present impacts of all Federal, state, or private actions and other human activities in the action area, the anticipated impacts of all proposed Federal projects in the action area that have already undergone formal or early section 7 consultation, and the impact of state or private actions which are contemporaneous with the consultation in process" (50 C.F.R. 402.02).

Lingering effects of more than a century of human development combined with numerous ongoing activities, form the present environmental baseline conditions in the action area. These activities include expanding urban development, railroads, shipping, logging, agriculture, and other industries. These expansions result in the increase of industrial waste, storm water runoff from impervious surface, freshwater diversions for industrial and domestic use, and flood control (Howard Hanson Dam, RM 64, and numerous levees).

Development began to affect the lower Duwamish River in the early 1900s. Diversion of tributaries reduced the river's drainage basin by 71 percent and its average flow by more than 70 percent. At about the same time, the river was dredged to create the Duwamish Waterway, replacing nine meandering miles of river with a straight, deep, four-mile-long navigation channel (EBDRP 1994).

Of the shoreline between the mouth and RM 6.5 (about 1.3 RM above the limit of navigation at the south end of the Duwamish Waterway), 44 percent is riprapped, 34 percent covered by pier aprons and seven percent faced with vertical sheet piling (derived from data by Tanner 1991). Furthermore, a considerable portion of the remaining intertidal and shallow subtidal portions of the Lower Duwamish Waterway is covered by barges (Muckleshoot Indian Tribe Fisheries Department [MITFD], unpub. data). The effects of eliminating natural shorelines were compounded by the filling of marshes and mudflats, the creation of steep bulkhead and riprap banks, the removal of vegetation, and the construction of buildings, piers, and impervious pavement. Altogether, these actions eliminated about 98 percent of the lower Duwamish River's emergent marshes and intertidal mudflats and 100 percent loss of tidal swamps (Blomberg et al. 1988). The surviving highly modified habitats generally provide poor habitat for salmon (Spence et al. 1996).

The Duwamish River was a major river estuary before 1853. Typically such an estuary provide habitat elements necessary for the survival of juvenile chinook salmon by providing osmoregulatory transitions (conversion from freshwater to saltwater habitats) and rearing habitat as well as holding habitats for adult salmon waiting to ascend the river to spawning grounds. Juvenile chinook salmon normally use side channels for feeding, avoiding predators, and resting, while undergoing their physiological change to salt water. Rapid growth also occurs in estuaries due to the abundance of preferred food. The historical migration routes of anadromous salmonids into off-channel distributary channels and sloughs have largely been eliminated and historical saltwater transition zones are lacking (Kerwin 1999). Bull trout, like other anadromous salmonids, utilize the estuarine environment as holding habitats before ascending the river to spawn and for feeding and rearing.

In the Lower Duwamish Waterway, the riverbanks have been straightened, steepened, hardened, and denuded of riparian vegetation. Warner and Fritz (1995) found the greatest abundance of juvenile salmon using shallow, sloping, soft mud beaches, compared to sites having sand, gravel, or cobble substrates. The project area has a steep, riprapped upper intertidal zone, with a small area of contaminated silty sand off the mouth of the CSO/SD, neither of which provide proper juvenile salmon habitat. However, directly across the Duwamish Waterway is the Kellogg Island area where both remnant intertidal shallows (Terminal 107 and Kellogg Island reserve) and restored upper intertidal habitats (Herring House Park) combined with extensive riparian zones are available for salmonid use. This area presents the majority of the remaining intertidal wetlands in the Duwamish estuary (Simenstad et al. 1991). Current research shows that juvenile chinook salmon are using these restoration sites on their emigration from the Green/Duwamish River (Goetz 2002, COE pers. comm)

Additionally, the chemical contamination of sediments in certain areas of the Waterway has compromised the effectiveness of the small amount of habitat surviving (EPA 2002). Chemicals of concern found at elevated concentrations included the polynuclear aromatic hydrocarbons, PCBs, metals (arsenic, mercury and zinc), phthalates, phenols, and pesticides (DDT, DDE, DDD). Varanasi et al. (1993) found juvenile chinook salmon from the Duwamish Waterway displayed a lower immune system response compared to juvenile chinook salmon from the Nisqually River, a comparable estuary without significant industrial contaminants. Species such as salmon often spend several weeks in urban estuaries where they can be exposed to urban-related contaminants that reside in the sediments and accumulate in the prey species. There is concern that these contaminants could bioaccumulate to levels that may impact the ability of the individual salmon to grow and mature properly (NOAA Fisheries 2002).

The EPA listed Lower Duwamish Waterway as a Federal Superfund site in 2001, and the clean up of contaminants has been a high priority. To further investigate the contamination and evaluate cleanup alternatives, EPA and the Washington State Department of Ecology (Ecology) signed an Administrative Order of Consent with four of the major property owners on the waterway with potential liability for cleanup of the site. An attachment to the order, the Statement of Work, outlines the tasks necessary to achieve these goals (EPA 2003).

In summary, the environmental baseline is substantially degraded. Ninety-eight percent of historically available intertidal marsh and mudflat habitat, necessary for the estuarine lifestage (smoltification) of juvenile salmonids, has been lost due to the above described human activities. The remaining two percent of estuarine habitat is seriously degraded by the presence of toxic and hazardous contaminants in the sediments, which is the habitat for the prey organisms of juvenile salmonids. The baseline conditions of the action area are a major factor in the current depressed status of PS chinook salmon.

2.3 Effects of the Proposed Action

NOAA Fisheries and the FWS must consider the estimated level of injury and mortality from the effects of the proposed action. ESA regulations define "effects of the action" as "the direct and indirect effects of an action on the species or habitat together with the effects of other activities that are interrelated or interdependent with that action, that will be added to the environmental baseline" (50 C.F.R. 402.02). "Indirect effects" are those that are caused by the proposed action and are later in time, but are still reasonably certain to occur.

2.3.1 Direct Effects

Direct effects are the immediate effects of the project on the species or its habitat. Direct effects result from the agency action and include the effects of interrelated and interdependent actions. Future federal actions that are not a direct, interdependent, or interrelated effect of the action under consideration (and not included in the environmental baseline or treated as indirect effects) are not evaluated (50 C.F.R. 402.02).

The direct effects of the project derive from the nature, extent, and duration of the construction activities in the water and whether the fish are migrating or rearing at that time. Direct effects of the project also include immediate habitat modifications resulting from the project. In the proposed project, immediate positive effects include the removal of highly contaminated materials from the area which juvenile salmonids use. Negative effects may occur during various construction activities, including the dredging of highly contaminated sediments and the capping of the remaining contaminated sediments underneath. However, these effects are confined to a relatively small area and short time period.

2.3.1.1 Dredging

The project area encompasses approximately 6.9 acres (Area A: 4.8 acres; Area B: 2.1 acres), the majority of which (6.4 acres) is subtidal habitat, below -10 ft MLLW. A limited amount of dredging will extend up to approximately -5 ft MLLW to the bottom of the existing shoreline armoring. Project dredging occurring above -10 ft MLLW will disturb a small amount of littoral habitat (approximately 0.5 acres). This action does not permanently convert littoral habitat to subtidal since subsequent engineering and capping will return the bottom contours back to existing grades.

Biological effects to PS chinook salmon and PS/Coastal bull trout may result from: 1) temporary reduction in water quality and increased noise disturbance associated with dredging that potentially could exclude chinook salmon and bull trout from estuarine habitat; 2) seasonal loss of benthic organisms and other prey due to disturbance of the channel substrate; 3) short term alteration to near shore habitat; and, 4) potential exposure to contaminated sediments or water.

Sediment plumes are often associated with dredging. Dredging activities disturb and suspend sediment creating discoloration of the water, reducing light penetration and visibility, and changing the chemical characteristics of the water. The size of the sediment particles and tidal currents are typically correlated with the duration of sediment suspension in the water column. Larger particles, such as sand and gravel, settle rapidly, but silt and very fine sediment may be suspended for several hours. Lasalle (1988) described a downstream plume that extended 900 feet at the surface and 1500 feet at the bottom. Lasalle (1998) also noted an increase in sediment levels upwards of 70 percent from the effect of the pressure wave created by the bucket as it descended through the water.

The affects on water quality (suspended sediments and chemical composition) from dredging can have a detrimental impact on salmonids. Suspended sediments can have an adverse affect on migratory and social behavior as well as foraging opportunities (Bisson and Bilby 1982; Sigler et al. 1984; Berg and Northcote 1985). Servizi (1988) observed an increase in sensitive biochemical stress indicators and an increase in gill flaring when salmonids were exposed to high levels of turbidity (gill flaring allows the fish to create sudden changes in buccal cavity pressure, which acts similar to a cough). Chemical composition of the water with suspended sediments is also affected by dredging activities. Estuarine sediments are typically anaerobic and create an oxygen demand when suspended in the water column, and in turn would decrease dissolved oxygen levels (Hicks et al. 1991; Morton 1976). Decreases in dissolved oxygen levels have been shown to affect swimming performance levels in salmonids (Bjornn and Reiser 1991). The decrease of swimming performance due to decreases in dissolved oxygen could directly affect the chinook salmon and bull trout's ability to escape potential predation or could affect their ability to forage on motile fish. Lasalle (1988) found a decrease in dissolved oxygen levels from 16-83 percent in the mid to upper water column and nearly 100 percent close to the bottom. Since bull trout are associated with the bottom, this extreme decrease in dissolved oxygen could directly affect the bull trout's ability to survive. Smith et al. (1976) found dissolved oxygen levels up to 2.9 milligrams per liter (mg/l) during dredging activities in Grays Harbor. Hicks (1999) observed salmon avoidance reactions when dissolved oxygen levels dropped below 5.5 mg/l. Dredging fine sediments such as those found in the lower Duwamish Waterway will create a sediment plume that may not disperse rapidly because of tidal fluctuations, especially during incoming tides. This could create poor water quality (i.e., decreased dissolved oxygen levels) that might preclude bull trout and chinook salmon from immigrating into the Duwamish River to gain access to foraging, rearing, and/or spawning grounds.

Approximately seven acres of physical habitat will also be disrupted by dredging. Even

though the sediment composition in the Duwamish River is primarily sand and silt, chinook salmon and bull trout must forage and migrate through the estuarine environment (J. Chan FWS pers. comm.). Dredging will temporarily eliminate littoral and shallow subtidal habitat for chinook salmon and bull trout and will likely reduce foraging opportunities. This may cause chinook salmon and bull trout to migrate into deeper waters where there is greater vulnerability to predation and less foraging opportunities.

Disruption of the channel bottom and entrainment by dredging has a negative impact on benthic biota and forage fish. Dredging physically disturbs the channel bottom, eliminating or displacing established benthic communities, thus reducing prey availability to bull trout and chinook salmon or their forage species. Filter feeding benthic organisms can suffer from clogged feeding structures, reduced feeding efficiency, and increased stress levels (Hynes 1970). Dredging may also suppress the ability of some benthic species to colonize in the dredged area, thus creating a loss of benthic diversity and food source for the chinook salmon and bull trout prey species. However, benthic communities at the proposed site are expected to recover within one year after dredging activities are completed, resulting in a temporal loss versus long term loss.

The dredging will use an 8 to 12 cy mechanical clamshell dredge. Clamshell dredging causes very limited, short-term localized turbidity. No long-term effects would result from this turbidity. The amount and duration of turbidity during mechanical dredging will be controlled by adhering to the procedures and standards set forth in the Water Quality Criteria and Ecology's Water Certification. Potential turbidity effects would be minimized by implementing Best Management Practices (BMPs) that include proper anchor handling, dredge bucket operations, and dredge material filtering. However, turbidity would still increase in the project area during dredging operations, even with implementation of the proposed BMPs. To limit turbidity effects on juvenile chinook salmon and adult/sub adult bull trout, the COE will ensure that dredging of contaminated sediments will not occur between February 15 and October 15, of any year, so that in-water work will occur when few juvenile chinook salmon or bull trout are expected to be present in the action area.

While dredging normally causes a short-term decrease in abundance and diversity of the littoral and subtidal benthic community, the benthic community in the project area is already seriously low in diversity and number of biota due to the level of contamination and the physical quality of the substrate. Therefore, the typical reduction in benthic prey from this type of dredging is not expected within the project area. The existing substrate is highly contaminated and therefore not considered good quality habitat. The proposed clean cap material (medium to fine sand) that would replace the existing contaminated sediments would provide improved substrate for benthic species in the project area over the long-term.

In summary, long-term ecosystem effects of dredging generally include changes in the volume and area of habitat, periodic changes to primary and secondary production (food web effects), and changes in hydrodynamics and sedimentology (Nightingale and Simenstad 2001). The COE will minimize the adverse effects of dredging on listed fish while providing long-term

increase in ecological functions by requiring timing restrictions to minimize fish presence and employing appropriate BMPs.

2.3.1.2 Transport of Dredged Material

Dredged contaminated sediments will be placed on haul barges (1,750 cy capacity) for transporting to the Slip 1 disposal site in Commencement Bay (if not possible, then to a Harbor Island upland transfer facility). If flat-top haul barges are used, river water that is deposited on the barge with the dredged material would be allowed to drain back to the river after being filtered through hay bales and three layers of 150-micron pore size filter fabric or equivalent per routine contaminated sediments BMPs. Experience has shown the incremental increase in turbidity using this technology is minimal (Romberg, 2000). Project plans suggest that vessel traffic on the Lower Duwamish Waterway would increase by approximately one tug and barge operation per day for the duration of the project. This increase in vessel traffic would not have demonstrable effects on listed species.

If bottom-dump haul barges are used, river water deposited in the barge would be retained within the barge until the bottom of the barge is opened to release the barge's contents in the Slip 1 NCD. The barges will be towed to the disposal site by tugboats. Once on the barges, there will be further impact from the contaminated sediments to the listed species until disposal. COE will implement the appropriate BMPs listed in the BA to minimize short-term effects. The Slip 1 NCD will have a turbidity monitoring program as part of its separate ESA consultation

2.3.1.3 Capping

Capping material will be obtained from either COE maintenance dredging projects (biennial Duwamish Waterway Turning Basin project or navigation projects in other nearby basins) or by purchase from an upland commercial borrow source. In the case of the former source, the dredging action was already subject to a prior ESA consultation. The isolating sediment cap would be formed by barging approximately 66,600 cy of clean sediment to the site and spreading with the same crane used for dredging or with a split-hull barge. To stabilize sediment movement in Area B, quarry spall and light riprap will be placed over about 2.5 - 3 acres prior to capping.

Although the existing contaminated sediments are composed of sand and silt, the capping material selected for this project would contain coarser material to minimize erosion. Medium to coarse sand would be used to cap most of the dredged areas, based on recent successes in other capping projects (EBDRP 1997). Using coarse material would also reduce turbidity effects to listed species during placement. The subtidal habitat would improve with the addition of large particle size and higher oxygen content associated with interstitial space in the new sediment cap material.

Another part of the action is the subsequent capping of the entire existing riprapped bank

above the limits of the dredging/capping activities with clean fish-friendly substrate of appropriate sediment material (*i.e.,* "habitat mix"; 7,700 cy). The addition of the habitat mix is consistent with other bank protection projects within the Puget Sound. While short-term adverse effects associated with the capping activities are possible, these effects are expected to be temporary and would be minimized by project conservation measures and best management practices. The long-term benefits will be that the use of this material will provide additional surface area (habitat) for aquatic invertebrates.

2.4 Indirect Effects

Indirect effects are caused by or result from the proposed action, are later in time, and are reasonably to occur (50 C.F.R. 402.02). Indirect effects may occur outside the area directly affected by the action. Indirect effects from this project are those impacts that would result from the future use of Slip 1 as a container terminal supporting shipping activities. However, these effects were addressed in a previous Opinion (Area 5106 Remedial Action; NWR 2002/00878; FWS reference 1-3-02-F-1857).

No long-term adverse changes to habitat are expected to occur as a result of the proposed action. The proposed project would reconstruct the project area to match existing elevations and slopes after completion. The nearshore side of the project dredge prism would be restored to the existing elevation, with improvements to the shoreline habitat using a fish-friendly habitat substrate.

There are no other indirect effects at the project site since this action will not change the use of the habitat beyond removing the sediment contaminants. Human activities and/or land use in the project area would not be altered in the long-term. No noticeable change above the waterline would occur and no current use of the dredge prism sediments exists. There are no new navigational developments, fish use activities, or other industrial uses planned for the site. Such future water-dependent uses occurring after the completion of this project would be subject to the required Federal permits and associated ESA consultations.

2.5 Cumulative Effects

Cumulative effects are defined as "those effects of future State or private activities, not involving Federal activities, that are reasonably certain to occur within the action area of the Federal action subject to consultation" (50 C.F.R. 402.02). The project involves actions within a portion of the Duwamish Waterway which has been previously altered by dredging, filling and other anthropogenic activities. However, future Federal actions that will impact the action area, such as navigational dredging and other activities permitted under Section 404 of the Clean Water Act or Section 10 of the Rivers and Harbors Act, will be reviewed under separate Section 7 consultations, and cannot be considered cumulative effects.

The Lower Duwamish Waterway is a major urban industrial waterway which supports marine container and barge shipping, fishing, rail and highway transportation, cement production,

shipbuilding and repair, marine construction, aircraft manufacturing, sand and gravel operations, and recreational boating, to name a few on-going non-federal activities. The face of the waterway is continually changing as new waterfront facilities and uses occur. The increased operation of the waterway's facilities may increase the number of truck and rail trips on existing roads and railroads. These are within the local or private actions that are considered to create potential cumulative effects. In this case, these uses are not expected to have any additional effect on the species of concern or their habitat.

Other effects in the action area are those from other restoration actions taking place as a part of Elliott Bay/Duwamish Restoration Program pursuant to a 1991 Consent Decree (EBDRP 1994). The Green Duwamish Ecosystem Restoration Program has identified several potential landscape and watershed scale restoration sites to increase connectivity between important salmon habitat transition regions (COE 2000).

2.6 Conclusion

NOAA Fisheries and the FWS evaluated the collective effects of the proposed action, the environmental baseline, and any direct, indirect and cumulative effects, and taking into account measures for survival and recovery specific to the listed species' life stage. We find that the project may result in short-term adverse effects on Duwamish/Green River populations of PS chinook salmon and PS/Coastal bull trout due to in-water work activities. Of the 14 indicators of the functional condition of salmon habitat (NMFS 1996), 11 would be maintained, three (chemical contaminants, substrate, and benthic community) would be improved, and two (sediment/turbidity and benthic community) would be temporarily degraded, then return to baseline conditions in the Lower Duwamish Waterway. Because of the potential for water quality effects, NOAA Fisheries and the FWS agree with the COE's conclusion that the proposed action could temporarily degrade the baseline condition for water quality at the point of dredging. Measures to avoid work in the juvenile salmonid migration period, and engineering controls, will minimize adverse short-term effects to chinook salmon and bull trout.

Over the long-term, removal of highly contaminated sediments is a beneficial aspect of the project that will restore the baseline condition for water quality. The baseline condition for benthic prey would also be temporarily degraded due to the short-term loss in productivity that would occur as a result of the project's temporary disturbance of littoral habitat. NOAA Fisheries and the FWS agree with the COE's conclusions that the remedial action will address risks to the environment and public health, reduce the levels of chemical constituents in sediment, and thereby help improve and restore chinook and bull trout habitat in the Lower Duwamish Waterway.

Based on the foregoing, it is NOAA Fisheries' biological opinion that the proposed action is not likely to jeopardize the continued existence of PS chinook salmon. Also, based on the foregoing, it is FWS's biological opinion that the proposed action is not likely to jeopardize the continued existence of PS/Coastal bull trout. In arriving at a non-jeopardy conclusion for this

action, the minimization measures were important to consider as is the ultimate goal of clean sediment substrates which would support increased benthic diversity and productivity. NOAA Fisheries and the FWS find the likely potential negative effects associated with the actual construction activities are minimized through adherence to the project design objectives and conservation measures.

2.7 Reinitiation of Consultation

This concludes formal consultation on the action outlined in the request. As provided in 50 CFR §402.16, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been retained (or is authorized by law) and if: (1) the amount or extent of incidental take is exceeded; (2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion; (3) the agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat not considered in this opinion; or (4) a new species is listed or critical habitat designated that may be affected by the action. In instances where the amount or extent of incidental take is exceeded, any operations causing such take must cease pending reinitiation.

2.8 Incidental Take Statement

Section 9 of the ESA and Federal regulations pursuant to Section 4(d) of the ESA prohibit the take of endangered and threatened species without special exemption. "Take" is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct of listed species without a specific permit or exemption (50 C.F.R. 17.3 and 222.102). "Harm" is further defined to include significant habitat modification or degradation that results in death or injury to a listed species by "significantly impairing essential behavioral patterns such as breeding, spawning, rearing, migrating, feeding, and sheltering" (NOAA Fisheries 50 C.F.R. 222.102; FWS 50 C.F.R. 17.3). "Incidental take" is take of listed animal species that results from, but is not the purpose of, the Federal agency or the applicant carrying out an otherwise lawful activity. Under the terms of Section 7(b)(4) and Section 7(o)(2), taking that is incidental to, and not intended as part of, the agency action, is not considered prohibited taking provided that such takings is in compliance with the terms and conditions of this incidental take statement.

An incidental take statement specifies the amount of any incidental taking of endangered or threatened species. It also provides reasonable and prudent measures that are necessary to minimize the effects and sets forth terms and conditions with which the action agency must comply in order to implement the reasonable and prudent measures.

2.8.1 Amount or Extent of Take Anticipated

In-water dredging and capping activities of this action are scheduled to occur during a period of time (October 15-March 1) when few individuals of the listed species are expected to be present. Capping activities will occur prior to March 1 where NOAA Fisheries and the FWS anticipate that some unquantifiable incidental take of PS chinook salmon and PS/Coastal bull trout is reasonably certain to occur during the project activities. While injury or death may unintentionally result during construction activities, harm is more likely to accrue by exposure of fish to unremediated contamination of the nearshore environment during rearing and migration (i.e. by not doing the proposed action).

Take also may result from harm caused by habitat modifications such that the extent of habitat affected by an action can be a surrogate measure for take. In this action, bull trout and chinook salmon can be expected to be taken throughout the 6.9 acres of the dredge footprint. This Opinion also authorizes a 10 percent exceedance of the dredge area (0.69 acres). Any amount of dredging over the 10 percent would exceed the authorized incidental take and require reinitiation of the consultation. Accordingly, the reasonable and prudent measures were developed to address the extent of habitat effects, as described below.

2.8.2 Effect of the Take

In the accompanying biological opinion, FWS and NOAA Fisheries determined that this level of anticipated take is not likely to result in jeopardy to the species or destruction or adverse modification of critical habitat.

2.8.3 Reasonable and Prudent Measures

The following reasonable and prudent measures (RPMs) are necessary and appropriate to minimize the take of PS chinook salmon and PS/Coastal bull trout.

1. The COE will minimize take during construction by avoiding or minimizing adverse effects of dredging activities on PS chinook salmon and PS/Coastal bull trout.

2. The COE will minimize take during construction by avoiding or minimizing adverse effects of transport activities on PS chinook salmon and PS/Coastal bull trout.

3. The COE will minimize take during construction by avoiding or minimizing adverse effects of capping activities on PS chinook salmon and PS/Coastal bull trout.

2.8.4 Terms and Conditions

In order to be exempt from the prohibitions of Section 9 of the ESA, the parties must comply with the following terms and conditions, which implement the reasonable and prudent measures described above. These terms are non-discretionary. The COE should include these terms and conditions as remedial requirements under Superfund orders to King County.

1. To implement RPM 1:

    a) COE shall comply with the work window of October 15 through February 15 when the chance of encountering chinook salmon and bull trout is minimal.

    b) Water quality measurements will be conducted during clean up activities for turbidity, total suspended solids and contaminants of concern at the dredge site. Appropriate monitoring would include turbidity, total suspended solids, and chemicals of concern for the first week at two tidal cycles and at two depths, and additional sampling if standards are exceeded. Samples will be taken at the edge of the mixing zone (as specified in the section 401 certification) and at the halfway point within the mixing zone. Water quality sampling will include up- or down -stream reference samples (depending on the tide) to allow for turbidity due to dredging, transport or disposal operations to be separated from background turbidity. If turbidity standards are not met at the mixing zone, the dredging/dewatering operations will be modified to decrease turbidity.

    c) The applicant will supply the contractor with more detailed information regarding the dredge operation so that the dredging will be carried out in a manner that minimizes spillage of excess sediments from the bucket and minimize the potential entrainment of fish.

    d) The applicant will provide the contractor specific directions regarding the most current, accurate GPS dredge positioning to control the horizontal and vertical extend of the dredge. A horizontal and vertical control plan will be prepared, submitted to the contractor, and adhered to by the dredge contractor to ensure dredging does not occur outside the limits of the dredge prism.

2. To implement RPM 2:

    a) The barge will not deviate from authorized shipping lanes when transporting material to NCD.

    b) An emergency clean up plan will be filed with the COE in the event the barge, truck, or railcar has an incident where the contaminated material is spilled. This plan will be on-board all of the transportation vehicles at all times.

3. To implement RPM 3:

a) The COE shall comply with the work window of October 15 through March 1 when the chance of encountering chinook salmon and bull trout is minimal.

b) Capping of the area will progress from nearshore to offshore to minimize the chance of encountering emigrant juvenile chinook salmon.

c) Minimal fine sediments will be used during the capping operation.

d) Water quality measurements will be conducted during clean up activities for turbidity, total suspended solids and contaminants of concern at the dredge site. Appropriate monitoring will include turbidity, total suspended solids, and chemicals of concern for the first week at two tidal cycles and at two depths, and additional sampling if standards are exceeded. Samples will be taken at the edge of the mixing zone (as specified the 401 certification) and at the halfway point within the mixing zone. Water quality sampling will include up- or down -stream reference samples (depending on the tide) to allow for turbidity due to dredging, transport or disposal operations to be separated from background turbidity. If turbidity standards are not met at the mixing zone, the capping operations will be modified to decrease turbidity.

e) If the capping material is from another dredge location, PSDDA analysis will be performed on that sediment prior to its use, and it must meet PSDDA standards.

In addition, the FWS and NOAA Fisheries is to be notified within three (3) working days upon locating a dead, injured, or sick endangered or threatened species specimen. Initial notification must be made to the nearest U.S. Fish and Wildlife Service Law Enforcement Office and/or NOAA Fisheries office. Notification must include the date, time, precise location of the injured animal or carcass, and any other pertinent information. Care should be taken in handling sick or injured specimens to preserve biological materials in the best possible state for later analysis of cause of death. In conjunction with the care of sick or injured endangered or threatened species or preservation of biological materials from a dead animal, the finder has the responsibility to ensure that evidence associated with the specimen is not unnecessarily disturbed. Contact FWS Law Enforcement office at (425) 883-8122 or the Western Washington Fish and Wildlife Office at (360) 753-9440 and/or contact NOAA Fisheries Law Enforcement at (360)753-4409 or the Lacey Habitat Conservation Branch at (360) 753-9440.

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APPENDIX 1. PS/Coastal bull trout Biological Opinions since listing.

Biological Opinion	Stream or River	Analysis Area Area
Aldon Creek Culvert		Puget Sound
Asarco Smelter - shoreline armoring	Lower Puyallup River	Puget Sound
Baker Lake Road Culvert Replacement	Lower Skagit River	Puget Sound
Baxter Timber Sale	Grays Harbor	Coastal
Bronze Billy Timber Sale	Nisqually River	Puget Sound
Buckshot Timber Sale	Lower Quinault River	Coastal
Buckshot Timber Sale	Queets River	Coastal
Buckshot Timber Sale	Moclips River	Coastal
Canyon River Emergency Relief for Federally Owned Roads		Coastal
Colonial Creek Campground Fishing Pier	Diablo Reservoir	Puget Sound
Crane Creek Timber Sale	Raft River	Coastal
Edman's Holding	Lower Puyallup	Puget Sound
Electron Dam Fish Ladders	Lower Puyallup	Puget Sound
Elwha River Ecosystem Restoration	Lower Elwha River	Strait of Juan de Fuca
Everett Bridges Seismic Retrofit	Snohomish/Skykomish	Puget Sound
Falls Creek Channel	Chehalis River/Grays Harbor	Coastal
Forest Rd. 2180 Decomissioning	Chehalis River/Grays Harbor	Coastal
Grays Harbor Dredging	Chehalis River/Grays Harbor	Coastal
Grandey Creek		Coastal
Greenwater River Channel Relocation	Lower Puyallup River	Coastal
Harris Creek Culvert Replacement	Snohomish/Skykomish	Puget Sound
Hoh Road Bank Stabilization in ONP	Hoh River	Coastal
Hoh Road Bank Stabilization (Reinitiation)	Hoh River	Coastal
Howard Hanson Additional Water Storage Project	Green River	Puget Sound
Jesse James II Quinault Indian Nation	Lower Nooksack	Puget Sound
Jorgenson	?	Puget Sound
KC1 Kendall Creek Riparian and Wetland Restoration	Nooksack	Puget Sound

APPENDIX 1. PS/Coastal bull trout Biological Opinions since listing.

Biological Opinion	Stream or River	Analysis Area Area
Kendall and Bonners Creek Riparian Planting and LWD Placement KC5 and 6	Nooksack	Puget Sound
Kendall and Bonners Creek Riparian Planting and LWD Placement BC4	Nooksack	Puget Sound
Lummi Island Ferry (Lummi Is. Gooseberry Point?)	Lower Nooksack	Puget Sound
La Conner Marina Maintenance Dredging	Skagit	Puget Sound
North Boundary Area Unit Management Plan	Queets, Lake Quinault	Coastal
North Fork SR-9 Bridge Scour (North Fork Nooksack River Bridge)	Lower Nooksack	Puget Sound
Plum Creek Timber Company Land Exchange	Cle Elum, Teanaway, Teanum-Manastash, Yakima, Little Naches, Green River	Puget Sound and Columbia Basin
Port of Tacoma - Maersk Dock (Tacoma Yacht club dock A?)	Lower Puyallup	Puget Sound
Programmatic on Removal of Fish Passage Barriers	multi	Coastal and Puget Sound
Proposed Operation and Maintenance Dredging of the Grays Harbor and Chehalis River Navigation Channel	Chehalis River/Grays Harbor	Coastal
Puyallup Tribe- Fish Ladder in the Puyallup River	Puyallup	Puget Sound
Quillayute River System Steelhead Surveys	Quillayute River	Coastal
Quinault North Boundary Timber Sales	Lower Quinault River	Coastal
Quinault North Boundary Timber Sales	Queets River	Coastal
Quinault Moclips Wastewater and Water Treatment Plant	Moclips	Coastal
Riverside Bridge Replacement	Lower Skagit River	Puget Sound
Rock Creek Bridge Replacement	Issaquah/Sammamish River	Puget Sound

APPENDIX 1. PS/Coastal bull trout Biological Opinions since listing.

Biological Opinion	Stream or River	Analysis Area Area
Rock Creek Culvert Replacement	Issaquah/Sammamish River	Puget Sound
Saxon Bank Stabilization	Lower Nooksack	Puget Sound
SC2- Schell Creek and Thomas Stream Buffer Restoration	Nooksack	Puget Sound
SF2-II River Farm Riparian Buffer Restoration Phase II	Nooksack	Puget Sound
NF2 Bottingers Pond Riparian Buffer Interplant	Nooksack	Puget Sound
South Fork Nooksack Engineered Logjam	Lower Nooksack	Puget Sound
SR 2 Snohomish River Bridge	Snohomish/Skykomish	Puget Sound
SR 9 Stillaguamish River to Lake Creek	Stillaguamish/Lower Skagit	Puget Sound
SR 20 Mudslide (Debris Flow Structure?)	Lower Skagit River	Puget Sound
Sunset Interchange	Issaquah/Sammamish River	Puget Sound
Stossel Creek	Nooksack	Puget Sound
Tacoma Yacht Club	Marine	Puget Sound
Tacoma Public Utilities Permit for work in the White River	White River	Puget Sound
TC2 Tenmile Creek	Puget Sound	
Tornow Bridge Scour Repair	Chehalis River/Grays Harbor	Coastal
Upper Dungeness Road	Dungeness	Puget Sound
USFWS Restoration Programmatic	Statewide	All
Washington Conservation Reserve Program	Statewide	All
Washington Department of Transportation-Programmatic Olympic Region	Several	Coastal, Puget Sound, and Strait of Juan de Fuca
Whitney Hill Bridge Replacement	Green River	Puget Sound
Wiggs Timber Sale	Lower Quinault River	Coastal

Magnuson-Stevens Act
Essential Fish Habitat Consultation

NMFS No. 2002-01376

Duwamish/Diagonal Sediment
Remediation Project
Duwamish Waterway, Seattle, Washington

Agency: US Army Corps of Engineers

Consultation Conducted By: National Marine Fisheries Service,
Northwest Region

Approved: For Michael R Crouse Date: March 17, 2003

D. Robert Lohn
Regional Administrator

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MAGNUSON-STEVENS FISHERY CONSERVATION AND MANAGEMENT ACT

1.0 Background

On November 21, 2002, the National Oceanic and Atmospheric Administration's National Marine Fisheries Service (NMFS) received an Essential Fish Habitat (EFH) Assessment and a request for Magnuson-Stevens Fishery Conservation and Management Act (MSA) consultation from the United States Army Corps of Engineers (COE) (2002-2-00548).

The King County Wastewater Treatment Division (King County), on behalf of the Elliott Bay/Duwamish Restoration Program (EBDRP), has agreed to remove sediments contaminated with PCBs (polychlorinated biphenyls), mercury, bis (2-ethylhexyl) phthalate, and butyl benzyl phthalate and replace the removed sediments with an isolating cap in the lower Duwamish River estuary near Seattle, Washington (WRIA 9). Two contamination hot spots would be removed within cleanup Area A and cleanup Area B. Dredging contaminated material and returning the site to pre project elevations with clean sand would ensure the future functions and stability of the existing habitat.

Disposal of the contaminated sediments from this project will be in Blair Waterway Slip 1, a nearshore confined disposal facility (NCD) in Commencement Bay operated by the Port of Tacoma and the Occidental Chemical Corporation under the United States Environmental Protection Agency (EPA) authority. The NCD is the subject of an EFH consultation being prepared for the remediation at the mouth of the Hylebos Waterway and for the disposal of contaminated sediments in Slip 1. Thus, to reduce repetition, the potential habitat effects associated with the placement of Duwamish/Diagonal contaminated sediments into Slip 1 are not being addressed as part of this consultation.

In the long-term, removal and isolation of the contaminated sediments will benefit the species that utilize the lower Duwamish River. However, short-term adverse impacts on fish associated with the project activities are possible, including harm resulting from increased turbidity, and potential fish entrainment during dredging activities. These impacts are expected to be temporary and would be minimized by project conservation measures and best management practices.

The Magnuson-Stevens Fishery Conservation and Management Act (MSA), as amended by the Sustainable Fisheries Act of 1996 (Public Law 104-267), established procedures designed to identify, conserve, and enhance Essential Fish Habitat (EFH) for those species regulated under a Federal fisheries management plan. Pursuant to the MSA:

- Federal agencies must consult with NMFS on all actions, or proposed actions, authorized, funded, or undertaken by the agency, that may adversely affect EFH (§305(b)(2));

- NMFS must provide conservation recommendations for any Federal or State action that would adversely affect EFH (§305(b)(4)(A));
- Federal agencies must provide a detailed response in writing to NMFS within 30 days after receiving EFH conservation recommendations. The response must include a description of measures proposed by the agency for avoiding, mitigating, or offsetting the impact of the activity on EFH. In the case of a response that is inconsistent with NMFS EFH conservation recommendations, the Federal agency must explain its reasons for not following the recommendations (§305(b)(4)(B)).

EFH means those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity (MSA §3). For the purpose of interpreting this definition of EFH: Waters include aquatic areas and their associated physical, chemical, and biological properties that are used by fish and may include aquatic areas historically used by fish where appropriate; substrate includes sediment, hard bottom, structures underlying the waters, and associated biological communities; necessary means the habitat required to support a sustainable fishery and the managed species' contribution to a healthy ecosystem; and "spawning, breeding, feeding, or growth to maturity" covers a species' full life cycle (50 C.F.R. 600.110). Adverse effect means any impact which reduces quality and/or quantity of EFH, and may include direct (*e.g.,* contamination or physical disruption), indirect (*e.g.,* loss of prey or reduction in species fecundity), site-specific or habitat-wide effects, including individual, cumulative, or synergistic consequences of actions (50 C.F.R. 600.810).

Any reasonable attempt to encourage the conservation of EFH must take into account actions that occur outside EFH, such as upstream and upslope activities, that may have an adverse effect on EFH. Therefore, EFH consultation with NMFS is required by Federal agencies regarding any activity that may adversely affect EFH, regardless of its location.

The objective of this EFH consultation is to determine whether the proposed action may adversely affect designated EFH, and to recommend conservation measures to avoid, minimize, or otherwise offset potential adverse effects to EFH resulting from the proposed action.

2.0 Identification of EFH

Pursuant to the MSA the Pacific Fisheries Management Council (PFMC) has designated EFH for federally-managed fisheries within the waters of Washington, Oregon, and California. The designated EFH for groundfish and coastal pelagic species encompasses all waters from the mean high water line, and upriver extent of saltwater intrusion in river mouths, along the coasts of Washington, Oregon and California, seaward to the boundary of the U.S. exclusive economic zone (370.4 km)(PFMC 1998a, 1998b). Freshwater EFH for Pacific salmon includes all those streams, lakes, ponds, wetlands, and other water bodies currently, or historically

accessible to salmon in Washington, Oregon, Idaho, and California, except areas upstream of certain impassable man-made barriers (as identified by the PFMC), and longstanding, naturally-impassable barriers (*i.e.*, natural waterfalls in existence for several hundred years) (PFMC 1999). In estuarine and marine areas, designated salmon EFH extends from the nearshore and tidal submerged environments within state territorial waters out to the full extent of the exclusive economic zone (370.4 km) offshore of Washington, Oregon, and California north of Point Conception to the Canadian border.

Detailed descriptions and identifications of EFH are contained in the fishery management plans for groundfish (Casillas *et al.* 1998, PFMC 1998a), coastal pelagic species (PFMC 1998b), and Pacific salmon (PFMC 1999). Assessment of the effects to these species' EFH from the proposed action is based on these descriptions and information provided by COE.

3.0 Proposed Actions

The proposed action and action area are detailed above in Section 1 of this document. The action area includes habitats that have been designated as EFH for various life-history stages of 17 species of groundfish, four coastal pelagic species, and three species of Pacific salmon (Table 1).

Table 1. Species of fishes with designated EFH in the estuarine composite of Puget Sound.

Groundfish Species	Sablefish *Anoplopoma fimbria*	**Coastal Pelagic Species**
Spiny Dogfish *Squalus acanthias*	Bocaccio *S. paucispinis*	anchovy *Engraulis mordax*
California Skate *R. inornata*	Brown Rockfish *S. auriculatus*	Pacific sardine *Sardinops sagax*
Ratfish *Hydrolagus colliei*	Copper Rockfish *S. caurinus*	Pacific mackerel *Scomber japonicus*
Lingcod *Ophiodon elongatus*	Quillback Rockfish *S. maliger*	market squid *Loligo opalescens*
Cabezon *Scorpaenichthys marmoratus*	English Sole *Parophrys vetulus*	**Pacific Salmon Species**
Kelp Greenling *Hexagrammos decagrammus*	Pacific Sanddab *Citharichthys sordidus*	chinook salmon *Oncorhychus tshawytscha*
Pacific Cod *Gadus macrocephalus*	Rex Sole *Glyptocephalus zachirus*	coho salmon *O. kisutch*
Pacific Whiting (Hake) *Merluccius productus*	Starry Flounder *Platichthys stellatus*	Puget Sound pink salmon *O. gorbuscha*

4.0 Effects of Proposed Action

The proposed action may result in detrimental short- and long-term effects to a variety of habitat parameters. These adverse effects include temporary reduction in water quality and increased noise disturbance, short term degradation of benthic foraging habitat, temporary loss of nearshore habitat, and potential exposure to contaminants during dredging activities.

4.1 Dredging

The project area encompasses approximately 6.9 acres (Area A: 4.8 acres; Area B: 2.1 acres), the majority of which (6.4 acres) is subtidal habitat, below –10 ft MLLW. A limited amount of dredging will extend up to approximately -5 ft MLLW to the bottom of the existing shoreline riprapped armoring. Limited project dredging occurring above –10 ft MLLW will disturb a small amount of littoral habitat (approximately 0.5 acres). This action does not permanently convert littoral habitat to subtidal since subsequent engineering capping will return the bottom contours back to existing grades. The project includes dredging of approximately 62,600 cubic yards of contaminated sediments.

Sediment plumes are often associated with dredging. Dredging activities disturb and suspend sediment creating discoloration of the water, reducing light penetration and visibility, and changing the chemical characteristics of the water. The size of the sediment particles and tidal currents are typically correlated with the duration of sediment suspension in the water column. Larger particles, such as sand and gravel, settle rapidly, but silt and very fine sediment may be suspended for several hours. Lasalle (1988) described a downstream plume that extended 900 feet at the surface and 1500 feet at the bottom. Lasalle (1998) also noted an increase in sediment levels upwards of 70 percent from the effect of the pressure wave created by the bucket as it descends through the water.

The effects on water quality (suspended sediments and chemical composition) from dredging can have a detrimental impact on aquatic species. Suspended sediments can have an adverse effect on migratory and social behavior as well as foraging opportunities (Bisson and Bilby 1982; Sigler et al. 1984; Berg and Northcote 1985). Servizi (1988) observed an increase in sensitive biochemical stress indicators and an increase in gill flaring when salmonids were exposed to high levels of turbidity (gill flaring allows the fish to create sudden changes in buccal cavity pressure, which acts similar to a cough). Chemical composition of the water when sediments are suspended is also affected by dredging activities. Estuarine sediments are typically anaerobic and create an oxygen demand when suspended in the water column, and in turn would decrease dissolved oxygen levels (Hicks et al. 1991; Morton 1976). Decreases in dissolved oxygen levels have been shown to affect swimming performance levels in salmonids (Bjornn and Reiser 1991). The decrease of swimming performance due to decreases in dissolved oxygen could directly affect the ability to escape potential predation or could affect

their ability to forage on motile fish. Lasalle (1988) found a decrease in dissolved oxygen levels from 16-83 percent in the mid to upper water column and nearly 100 percent close to the bottom. Smith et al. (1976) found dissolved oxygen levels up to 2.9 milligrams per liter (mg/l) during dredging activities in Grays Harbor. Dredging fine sediments such as those found in the lower Duwamish Waterway will create a sediment plume that may not disperse rapidly because of tidal fluctuations, especially during incoming tides.

Disruption of the channel bottom and entrainment by dredging has a negative impact on benthic and prey fish resources. Dredging physically disturbs the channel bottom, eliminating or displacing established benthic communities, thus reducing prey availability to aquatic species or their forage species. Filter feeding benthic organisms can suffer from clogged feeding structures, reduced feeding efficiency, and increased stress levels (Hynes 1970). Dredging may also suppress the ability of some benthic species to colonize in the dredged area, thus creating a loss of benthic diversity and food source. However, benthic communities at the proposed site are expected to recover within one year after dredging activities are completed resulting in a temporal loss versus long term loss.

4.2 Transport of Dredged Material

Dredged contaminated sediments will be placed on haul barges (1,750 cy capacity) for transporting to the Slip 1 disposal site in Commencement Bay (if not possible, then to a Harbor Island upland transfer facility). If flat-top haul barges are used, river water that is deposited on the barge with the dredged material would be allowed to drain back to the river after being filtered through hay bales and three layers of 150-micron pore size filter fabric or equivalent to retain particles, as per routine contaminated sediments BMPs. Experience has shown the incremental increase in turbidity using this technology is minimal (Romberg, 2000). Project plans suggest that vessel traffic on the Lower Duwamish Waterway would increase by approximately one tug and barge operation per day for the duration of the project. This increase in vessel traffic should not have demonstrable effects on aquatic species.

If bottom-dump haul barges are used, river water deposited in the barge would be retained within the barge until the bottom of the barge is opened to release the barge's contents in the Slip 1 NCD. The barges will be towed to the disposal site by tugboats. Once on the barges, there is no further impact from the contaminated sediments to aquatic species until disposal.

4.3 Capping

Capping material will be obtained from either COE maintenance dredging projects (biennial Duwamish Waterway Turning Basin project or navigation projects in other nearby basins) or by purchase from an upland commercial borrow source. In the case of the former source, the dredging action would be subject to a prior independent Federal EFH consultation. The isolating sediment cap would be formed by barging approximately 62,600 cy of clean sediment to the site and spreading with the same crane used for dredging or with a split-hull barge.

Although the existing contaminated sediments are composed of sand and silt, the capping material selected for this project would contain coarser sediments material to protect against erosion. Medium to coarse sand would be used to cap most of the dredged areas, based on recent successes in other capping projects (EBDRP 1997). Using coarse material would also reduce turbidity impacts to listed species during placement. The subtidal habitat would improve with the addition of large particle size and higher oxygen content associated with interstitial space in the new sediment cap material.

Interrelated with the dredging is the subsequent capping of the entire existing riprapped bank above the limits of the dredging/capping activities with clean fish-friendly substrate of appropriate sediment material (*i.e.,* "habitat mix"; 1,700 cy). The addition of the habitat mix is consistent with other bank protection projects within the Puget Sound. The use of this material is to provide additional surface area (habitat) for aquatic invertebrates.

5.0 Conclusion

NMFS believes the project biological impacts to groundfish, coastal pelagic, and Pacific salmon species EFH listed in Table 1. may result from: 1) temporary reduction in water quality and increased noise disturbance associated with dredging that potentially could exclude aquatic species from estuarine habitat; 2) loss of benthic organisms and other prey due to disturbance of the channel substrate; 3) short term loss of near shore environment; and 4) potential exposure to contaminated sediments or water

6.0 EFH Conservation Recommendations

Pursuant to Section 305(b)(4)(A) of the MSA, NMFS is required to provide EFH conservation recommendations to Federal agencies regarding actions that would adversely affect EFH. While the conservation measures that COE has built into this sediment cleanup and disposal project have minimized the effects associated with the loss of benthic organisms and loss of near shore environment to the greatest extent possible, NMFS recommends the following measures to further minimize the potential adverse effects of the proposed project and conserve EFH:

1. To address adverse effects #1 and #4 as described in section 5.0:

   a) Water quality measurements should be conducted during clean up activities for turbidity, total suspended solids and contaminants of concern at the dredge site. Appropriate monitoring would include turbidity, total suspended solids, and chemicals of concern for the first week at two tidal cycles and at two depths, and additional sampling if standards are exceeded. Samples should be taken at the edge of the mixing zone (as specified the 401 certification) and at the halfway point within the mixing zone. Water quality sampling should include up- or down -stream reference samples (depending on the tide) to allow for turbidity due to dredging, transport or disposal

operations to be separated from background turbidity. If turbidity standards are not met at the mixing zone, the dredging/dewatering operations should be modified to decrease turbidity.

b) Minimal fine sediments will be used during the capping operation.

7.0 Statutory Response Requirement

Please note that the MSA and 50 C.F.R. 600.920(j) require the Federal agency to provide a written response to NMFS' EFH conservation recommendations within 30 days of its receipt of this letter. The response must include a description of measures proposed to avoid, mitigate, or offset the adverse effects of the activity. In the case of a response that is inconsistent with the EFH Conservation Recommendations, the response must explain the reasons for not following the recommendations, including the scientific justification for any disagreements over the anticipated effects of the proposed action and the measures needed to avoid, minimize, mitigate, or offset such effects.

8.0 Supplemental Consultation

COE must reinitiate EFH consultation with NMFS if the proposed action is substantially revised in a manner that may adversely affect EFH, or if new information becomes available that affects the basis for NMFS' EFH conservation recommendations (50 C.F.R. 600.920(k)).

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