Biological Evaluation and Essential Fish Habitat Assessment - Rich Passage Beach Nourishment Demonstration Project

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EXECUTIVE SUMMARY

A beach nourishment demonstration project is proposed by Kitsap Transit for two sites in Rich Passage in Kitsap County, Washington. The demonstration project is part of a larger, on-going study into the feasibility of providing environmentally-sound passenger-only fast-ferry (POFF) operations on the Seattle-Bremerton route. The proposed beach nourishment investigation will involve placement of selected sands and gravels at two beaches in Rich Passage. The nourished sites and adjacent, non-nourished sites will be monitored over time to measure their response to typical existing conditions, extreme (i.e., storm) conditions, and exposure to wakes generated by conventional and high-speed vessels.

It is important to note that the demonstration project is intended solely as a research study. The study is designed to evaluate the ability of beach nourishment to enhance sediment supply and provide a dynamic buffer for storm wave and vessel wake energy, both under existing conditions and with potential future POFF operations. The study will also evaluate the nourishment program in terms of potential habitat changes through a biological monitoring program. The results of the demonstration project will be used to guide future actions for protecting and enhancing the health of shorelines along Rich Passage.

The locations of the beaches proposed for nourishment include Point White on Bainbridge Island and Point Glover in Port Orchard. These locations were selected based on data gathered during earlier phases of the POFF Study which suggest that these sites are representative of beaches in Rich Passage in terms of their sediment supply, exposure, and potential for erosion from natural forces, existing vessel traffic, high-speed vessel wakes, or a combination of these factors.

The work will involve placement of mixed sand, gravel, and cobble compatible with existing sediments in the upper intertidal zone of the beaches to be nourished. The size fractions selected for placement at each location are based on sieve analyses of the existing sediments on the beaches to be nourished and adjacent areas.

The material will be placed from the waterward side using a barge. The barge will be maneuvered to the foreshore of each site during high tide, and the material will be offloaded using a backhoe or small dozer at high tide. The material will then be redistributed and graded on the foreshore at low tide.

Proposed monitoring activities associated with the demonstration project include beach profiling and collection of wave data before and after placement, sampling and analysis of nearshore biological resources before and after construction, and monitoring of turbidity during construction.

The Endangered Species Act of 1973, as amended (ESA), requires federal agencies to ensure that they do not authorize, fund, or carry out actions that are likely to jeopardize the continued existence of endangered or threatened species or result in the destruction or

adverse modification of designated critical habitat for such species. The Sustainable Fisheries Act of 1996 amended the Magnuson-Stevens Fishery Conservation and Management Act (now called the Magnuson-Stevens Act) to require federal agencies to consult with NOAA Fisheries on activities that may affect Essential Fish Habitat (EFH). EFH is defined as "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity." This Biological Evaluation has been prepared as part of the informal consultation process with NOAA Fisheries and the U. S. Fish and Wildlife Service (USFWS).

The following table summarizes the species currently listed under the ESA that may occur in the project vicinity and the findings for each species:

Table ES-1. Summary of Listed Species and Determinations of Effect

Common Name	Scientific Name	Listing Status	Determination
Marbled murrelet	*Brachyramphus marmoratus*	Threatened	No effect
Chinook salmon	*Oncorhynchus tshawytscha*	Threatened	May affect, not likely to adversely affect
Bull trout	*Salvelinus confluentus*	Threatened	May affect, not likely to adversely affect
Steelhead	*Oncorhynchus mykiss*	Threatened	May affect, not likely to adversely affect
Leatherback sea turtle	*Dermochelys coriacea*	Endangered	No effect
Steller sea lion	*Eumetopias jubatus*	Threatened	No effect
Humpback whale	*Megaptera novaeangliae*	Endangered	No effect
Killer whale	*Orcinus orca*	Endangered	No effect

In addition to these findings, the project may affect, but is not likely to adversely affect critical habitat for Chinook salmon, bull trout, and killer whale. The project will have no effect on critical habitat for the marbled murrelet, leatherback sea turtle, or Steller sea lion.

1. INTRODUCTION

A beach nourishment demonstration project is proposed for two sites within Rich Passage in Kitsap County, Washington. In connection with the proposed project, Kitsap Transit is submitting an application to the U.S. Army Corps of Engineers for a Section 10/Section 404 permit.

The Endangered Species Act of 1973, as amended (ESA), requires federal agencies to ensure that they do not authorize, fund, or carry out actions that are likely to jeopardize the continued existence of endangered or threatened species or result in the destruction or adverse modification of designated critical habitat for such species.

The Magnuson-Stevens Fishery Conservation and Management Act (MSA) and the 1996 Sustainable Fisheries Act (SFA) require federal agencies to consult with NOAA Fisheries on actions that may affect Essential Fish Habitat (EFH). EFH is defined as "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity."

1.1 Listed Species Information

The following listed species may occur in the vicinity of the project:

Table 1. Listed Species, Federal Status, and Critical Habitat Designation

Common Name	Species Name	Federal Status	Critical Habitat Designation
Marbled murrelet	*Brachyramphus marmoratus*	Threatened	Yes
Bull trout	*Salvelinus confluentus*	Threatened	Yes
Chinook salmon	*Oncorhynchus tshawytscha*	Threatened	Yes
Steelhead	*Oncorhynchus mykiss*	Threatened	Under development
Leatherback sea turtle	*Dermochelys coriacea*	Endangered	Yes
Steller sea lion	*Eumetopias jubatus*	Threatened	Yes
Humpback whale	*Megaptera novaeangliae*	Endangered	None
Killer whale	*Orcinus orca*	Endangered	Yes

Salmon, steelhead, sea turtles, and marine mammals are listed under the jurisdiction of the NOAA Fisheries whereas bull trout and marbled murrelet are listed under the jurisdiction of USFWS. Information on listed species and critical habitats known to occur or potentially occurring in the project vicinity was provided by state and federal agencies and is summarized below in Table 2.

Table 2. Data and Data Sources for Information on Listed Species in the Vicinity of the Project

Species and Habitats	Agency/Data Source	Data Provided
Federally threatened and endangered plants, fish, and wildlife species	USFWS http://westernwashington.fws.gov/se/SE_List/KITSAP.htm	Two species could occur in the project vicinity: (1) Coastal - Puget Sound DPS of bull trout (*Salvelinus confluentus*) (threatened) (2) Marbled murrelet (*Brachyramphus marmoratus marmoratus*) (threatened)
Federally threatened, endangered, and candidate anadromous fish species	NOAA Fisheries http://www.nwr.noaa.gov/1salmon/salmesa/index.htm http://www.nwr.noaa.gov/Other-Marine-Species/ESA-Turtle-List.cfm http://www.nwr.noaa.gov/Marine-Mammals/ESA-MM-List.cfm	Six threatened species could occur in the project vicinity: (1) Puget Sound ESU of Chinook salmon (*Oncorhynchus tshawytscha*) (threatened) (2) Puget Sound DPS of steelhead (*O. mykiss*) (threatened) (3) Leatherback sea turtle (*Dermochelys coriacea*) (endangered) (4) Steller sea lion (*Eumetopias jubatus*) (threatened) (5) Humpback whale (*Megaptera novaeangliae*) (endangered) (6) Southern resident killer whale (*Orcinus orca*) (endangered)
Critical habitat for federally threatened and endangered species	NOAA Fisheries (1999, 2005) USFWS (1996, 2005)	Critical habitat currently is designated for the marbled murrelet, the Puget Sound ESU of Chinook salmon, the Coastal-Puget Sound DPS of bull trout, the leatherback sea turtle, the Steller sea lion, and the southern resident killer whale.
Priority Habitats and Species (PHS)	Washington Department of Fish and Wildlife (WDFW 2008)	Puget Sound coho salmon (a federal species of concern) occur in Beaver Creek and unidentified streams that empty into Rich Passage and Port Orchard Bay.

1.2 Project Location

Beach nourishment is proposed at Point White and Point Glover on the northern and southern shorelines, respectively, of Rich Passage. The Point White site has been subdivided into the "Point White West" and "Point White East" sites, and encompasses several properties. The Point Glover site includes a single property on the western side of the Point. The beach nourishment sites are located within the north half of Section 9, Township 24 North, Range 2 East, W.M., Kitsap County, Washington (Figures 1, 2, and 3).

1.3 Action Areas

The "Action Areas" for the demonstration project encompass the locations where beach nourishment materials would be placed (i.e., the Project Area), as well as all areas that may be directly or indirectly affected by the proposed project. The geographic limits of the Action Areas were defined by considering the potential geographic reach of mechanisms that may lead to impacts on the species of concern. Therefore, the Action Areas include, in addition to the Project Areas at Point White and Point Glover, all marine waters within a 150-foot radius of the nourishment placement sites. This is based on the region that could potentially be affected by turbidity caused by placement of nourishment material within the upper intertidal zone. Washington State surface water quality standards (WAC 173-201A-110) limit turbidity from in-water construction to a radius of 150 feet, unless a larger mixing zone is specifically approved by the Department of Ecology.

1.4 Background

The shorelines of Rich Passage comprise several discrete littoral cells ranging from a few tens of meters in length up to a kilometer or more. The sediment distribution is relatively complex, with beaches that may consist of a hard bottom, sand, gravel, cobble, shell, or some combination of these. Historically, the source of most beach sediment in Puget Sound outside of major river deltas is the erosion of bluffs of glacially derived sediment (Shipman, 2001). In Rich Passage a number of small streams also contribute sediment to the adjacent beaches.

Accelerated waterfront property development in the last half century has led to the implementation of substantial shoreline erosion control, primarily through construction of bulkheads and revetments. Most beaches in the Rich Passage area are now backed by hard structures and only a small percentage of the shoreline in the area remains unprotected. The construction of bulkheads along most of the Rich Passage shoreline has significantly reduced the primary long term supply of sediment in the study area (e.g. Shipman 2001) and in many cases may interrupt the natural alongshore and cross-shore patterns of sediment transport on the intertidal foreshore. As a result, the beaches along Rich Passage are less healthy than they would be if the upper shoreline had remained in its natural state.

Episodes of beach erosion in the Rich Passage area correlate with the occurrence of seasonal storms and with the occurrence of wake wash from vessels. In particular, waterfront property owners along Rich Passage have reported changes to the shoreline from ferry wakes including erosion of sand and gravel beaches since the introduction of Issaquah-class car ferry service on the Seattle-Bremerton ferry route by Washington State Ferries (WSF) in 1983 and following the introduction of passenger-only fast ferries in 1985. Passenger-only fast ferry service has since been discontinued by WSF.

In addition to vessel-generated waves, the beaches are exposed to fetch-limited wind waves, macro-tidal water level shifts and, in some instances, strong tidal currents. The long-term reduction in sediment supply to the beaches caused by the construction of bulkheads and revetments has been exacerbated by an increase in the exposure of the beaches to vessel-generated waves from both commercial and recreational vessels.

Although a substantial part of the effort of the Rich Passage POFF Study is focused on studying low-wake vessels and their impacts to shorelines, a complementary effort involves developing and evaluating methods to protect and enhance the health of the shorelines. The proposed beach nourishment program is designed specifically to address this issue.

1.5 Project Description

Beach nourishment will involve placement of selected sands and gravels at Point White and Point Glover within Rich Passage. These locations were selected based on data gathered during earlier of the POFF Study which suggest these areas are representative of beaches in the study area in terms of their sediment supply and exposure, as well as potential for erosion from natural forces, existing vessel traffic, high-speed vessel wakes, or a combination of these factors.

The work involves placement of mixed sand, gravel, and cobble compatible with existing sediments in the upper intertidal zone of the beaches to be nourished. The size fractions selected for placement at each location are based on sieve analyses of the existing sediments on the beaches to be nourished and adjacent areas. The proposed placement volumes and dimensions are shown in Table 3, below.

Table 3. Beach Nourishment Basic Design Parameters

Site	Volume (yd^3)	Approximate Placement Length (ft)	Approximate Placement Width (ft)
Point White West	1900	405	85
Point White East	2100	575	70
Point Glover	500	140	70

The volume of material to be placed at each location will be approximately equal to the volume that was displaced during previous operations of fast ferries by WSF and the seasonal response of beaches to the existing wake and wave climate. The beach profile response during the operation of the Chinook and Snohomish passenger-only ferries is well documented and was therefore used as a basis for the project design.

Placement of the material is proposed for the fall season during the approved salmon/bull trout in-water work window (July 2-March 2). The material will be placed from the waterward side using a barge. The barge will be maneuvered to the foreshore of each site during high tide, and the material will be offloaded using a backhoe or small dozer at high tide. The material will then be redistributed and graded on the foreshore at low tide. The barge will not be allowed to settle on the beach during placement in order to

minimize disruption to the intertidal habitat areas where beach nourishment will be conducted.

Data collected during the demonstration project will be used in validating numerical models for beach response and impact assessment as part of the larger POFF Study. The investigation will provide information on the level of protection and performance that can be anticipated from beach nourishment in this environment and on typical project design elements that include potential maintenance requirements, advance nourishment requirements, and appropriate sediment gradations. Further, it is expected that the proposed nourishment and subsequent monitoring will provide additional information on how sediment moves within the study area.

A biological monitoring plan for the beach nourishment study has been developed in cooperation with the Washington Department of Fish and Wildlife (WDFW). The monitoring will focus on those biological groups that have previously been identified of concern and groups likely to be affected by the changes in substrate resulting from beach nourishment. These include: 1) epibenthic zooplankton that provide prey for young salmon and other fishes, and 2) macroalgae/bull kelp (macrophytes). Monitoring will occur in the intertidal areas where the nourishment material is placed, but will also include the shallow subtidal elevations (< -6 ft MLLW) where beach nourishment material may be transported by shore processes.

Monitoring activities will also include physical data collection, including beach profiling and monitoring of wave conditions, as well as monitoring of turbidity during placement of the nourishment material.

1.6 Conservation Measures

As described above, conservation measures for the beach nourishment study include adhering to approved in-water work schedules, placement of the material from the waterward side during high tide to minimize habitat disturbance, and monitoring of turbidity during placement. Other conservation measures include:

- Presence of a habitat biologist on site during material placement and grading. The biologist will help identify suitable spots for maneuvering the barge to avoid sensitive flora, fauna, and habitat in the intertidal area.

- Development and implementation of a spill prevention plan. Since machinery will be operated over and near marine waters, a plan for spill prevention, control, and countermeasures is essential. The construction contractor will be required to adhere to the written plan at all times during project construction.

2. EXISTING ENVIRONMENTAL CONDITIONS

Rich Passage is a relatively narrow, shallow channel approximately 3 miles long that separates Bainbridge Island from the mainland shore of the Kitsap Peninsula. Because of activities at the Puget Sound Naval Shipyard at Bremerton as well as car ferries and recreational boating, Rich Passage has a high volume of marine traffic.

The waters of Rich Passage are biologically productive because of the shallow depth and the tidal construction provided by the narrow passage between Point White and Point Glover. Obstruction of tidal flows causes localized upwelling and enhanced vertical flux of nutrients, which results in elevated primary production (Kruckeberg 1991).

As described above, most beaches in the Rich Passage area are backed by bulkheads and revetments that are designed to protect the properties behind the structures from erosion. Only a small percentage of the shoreline in the area remains unprotected.

Significant areas of native shoreline vegetation have been eliminated as a result of residential development, and the vegetation along much of the shoreline in Rich Passage is dominated by introduced ornamental species and lawn grasses. Fort Ward State Park, located near the southern tip of Bainbridge Island, supports areas of dense second-growth forest.

The Washington Department of Fish and Wildlife has designated a Conservation Area (CA) at Orchard Rocks near the southern end of Bainbridge Island, east of the Seattle-Bremerton ferry route. Commercial and recreational harvesting of all types of marine invertebrates and fish is prohibited within the CA. A large commercial aquaculture facility consisting of net pens containing Atlantic salmon is located at the eastern periphery of the conservation area.

Battelle (2001) conducted aerial and dive surveys in 2000 and 2001 to obtain information on the presence and condition of eelgrass (*Zostera marina*) beds in Rich Passage. Individual eelgrass beds in the area were not found to be extensive although the cumulative area of eelgrass was significant. Patchy to dense eelgrass beds were observed at Waterman Point, along Point Glover and at Middle Point and Clam Bay. Patchy to dense beds were also observed along the Bainbridge Island shoreline from Lynwood Bay south along Pleasant Beach to Beans Point. No eelgrass was observed at Point White during the 2000-2001 WSF surveys. An eelgrass survey conducted in 2006 as part of the POFF Study showed eelgrass between -5.0 and -15.0 ft MLLW at multiple locations along the Port Orchard and Bainbridge Island shorelines (Grette 2007). The locations of eelgrass observed in this survey roughly approximated the extent of eelgrass noted by Battelle.

Anecdotal reports by Point White property owners indicate that kelp which had been present off the Point has decreased in abundance in recent years. In 1999, WSF mapped the kelp bed offshore of Point White and evaluated its structure and health. That survey identified two distinct areas of bullwhip kelp (*Nereocystis luetkeana*). The more

southerly of the two beds was approximately 1,248 feet long 90 feet wide; the more northerly bed was approximately 1,848 feet long and 60 to 70 feet wide. Kelp density varied throughout the beds. Holdfast condition was observed to be generally strong and healthy (WSF 2000). During WSF's 2001 shoreline sampling, it was noted that at MLLW no kelp appeared in the previously-mapped Point White kelp bed (Applied Environmental Services 2001). Monitoring conducted in 2006 and 2007 (Grette 2007; Parametrix, unpublished data) showed no presence of kelp in the vicinity of Point White.

Biological sampling along Rich Passage in 2005 and 2006 indicated that the macrophyte assemblage consisted of green macroalgae in the upper intertidal zone, a mix of green, red, and sparse brown algae in the mid- to low-intertidal zone, and red and brown algae in the shallow subtidal zone (Grette 2007). The invertebrate assemblage was composed mainly of mussels, barnacles, snails, and limpets in the upper to mid-intertidal zone, and crabs, anemones, shrimps, tube worms, sea starts, clams, and cockles in the lower intertidal to shallow subtidal zones.

Birds that are known to occur in the area include bald eagles, cormorants, ospreys, great blue herons, ducks, and songbirds, as well as others that use Rich Passage as a resting and feeding area during their spring and fall migrations along the Pacific Flyway. Harbor seals (*Phoca vitulina*) and California sea lions (*Zalophus californianus*) are frequently observed hauled out at Orchard Rocks and nearby navigational buoys (WDFW 2008).

3. LISTED SPECIES INFORMATION

3.1 Marbled Murrelet

The Washington, Oregon, and California population of the marbled murrelet was listed by USFWS as threatened on October 1, 1992.

In the Pacific Northwest, marbled murrelets forage in the nearshore environment and nest inland in old growth forests within approximately 50 miles of the shoreline. Adults feeding their young generally fly between terrestrial nest sites and ocean feeding areas at dawn and dusk.

Although marine habitat is important for the survival of marbled murrelets, the primary concern with respect to declining murrelet populations is loss of terrestrial nesting habitat. Critical habitat for the marbled murrelet was designated on May 24, 1996. Critical habitat units are located on the west side of Hood Canal in the Olympic National Forest approximately 20 miles from the Action Areas in Rich Passage.

There are no known nesting sites for marbled murrelets in the Action Areas. Marbled murrelets occur in Puget Sound marine habitats in relatively low numbers. Regional patterns of distribution tend to be seasonal and are tied to exposure to winter storms. Murrelets may use the Action Areas for foraging.

3.2 Bull Trout

The Coastal/Puget Sound Distinct Population Segment (DPS) of bull trout was listed as threatened on June 10, 1998. Approximately 3,828 miles of streams and 143,218 acres of lakes and reservoirs in Oregon, Washington, Idaho, and Montana have been designated as critical habitat for bull trout. In Washington, 985 miles of marine shoreline have also been designated as critical habitat.

The primary constituent elements (PCEs) of critical habitat for bull trout are: (1) water temperatures that support bull trout use; (2) complex stream channels with features such as woody debris, side channels, pools, and undercut banks to provide a variety of depths, velocities, and instream structures; (3) substrates of sufficient amount, size, and composition to ensure success of egg and embryo overwinter survival, fry emergence, and young-of-the-year and juvenile survival; (4) a natural hydrograph, including peak, high, low and base flows within historic ranges; (5) springs, seeps, groundwater sources, and subsurface water to contribute to water quality and quantity as a cold water source; (6) migratory corridors with minimal physical, biological, or water quality impediments between spawning, rearing, overwintering, and foraging habitats; (7) an abundant food base including terrestrial organisms of riparian origin, aquatic macroinvertebrates, and forage fish; and (8) permanent water of sufficient quantity and quality such that normal reproduction, growth, and survival are not inhibited.

Bull trout spawn in the headwaters of mountain streams upstream of areas used by most other anadromous fish. For successful spawning and egg incubation, bull trout require very cold water with spawning occurring in the fall as the water temperature drops below 48° F. Successful incubation of the eggs requires temperatures below 42° F. In this region, the downstream limit of successful char spawning is nearly always upstream of the winter snow line (Kraemer 1994). Spawning generally occurs from late September to early November. The exact timing of the each year's spawning can vary depending on water temperatures. Adult bull trout avoid temperatures over 59° F and temperatures reaching 64-68° F can be lethal.

Strict cold water temperature requirements make bull trout vulnerable to activities that warm spawning and rearing waters. Bull trout fry remain in the intragravel environment for an extended time between hatching and emerging from the gravel. Their juvenile life phase is also closely associated with the stream bottom and the intragravel environment. This extended relationship with the intragravel environment may be a major reason why bull trout populations are suppressed in unstable stream channels or where substrates have a high percentage of fine sediments.

Foraging juvenile and subadult bull trout may migrate throughout a basin seeking feeding opportunities, even following prey species up tributary streams. If coho salmon juveniles are found in an area, then it is likely that foraging char may be present (Kraemer 1994). The distribution of bull trout within Puget Sound marine waters is not completely known, but bull trout have been documented as occurring in the Sound from the Canadian border south to Commencement Bay. It is thought that bull trout primarily use the nearshore

waters along the eastern shore of Puget Sound and occasionally use or cross deeper water to access locations along the west shore of the Sound.

Bull trout do not spawn in any of the East Kitsap drainages due to a lack of appropriate habitat, but adult bull trout may use portions of Rich Passage on an incidental basis. Bull trout present in the area would likely be foraging on juvenile salmonids or other fishes.

3.3 Chinook Salmon

Chinook salmon within the Rich Passage Action Areas are considered part of the Puget Sound ESU, which was listed as threatened on August 2, 1999. Critical habitat for this ESU includes all marine, estuarine, and river reaches accessible to the species in Puget Sound. Critical habitat consists of the water, substrate, and the adjacent riparian zone of accessible estuarine and riverine reaches.

The PCEs for Chinook salmon critical habitat are: (1) freshwater spawning sites with water quality and quantity conditions and substrate supporting spawning, incubation, and larval development; (2) freshwater rearing sites with water quantity and floodplain connectivity to form and maintain physical habitat conditions and support juvenile growth and mobility; water quality and forage supporting juvenile development; and natural cover such as shade, submerged and overhanging large wood, log jams and beaver dams, aquatic vegetation, large rocks and boulders, side channels, and undercut banks; (3) freshwater migration corridors free of obstruction with water quantity and quality conditions and natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, side channels, and undercut banks supporting juvenile and adult mobility and survival; (4) estuarine areas free of obstruction with water quality, water quantity, and salinity conditions supporting juvenile and adult physiological transitions between fresh- and saltwater; natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, and side channels; and juvenile and adult forage, including aquatic invertebrates and fishes, supporting growth and maturation; (5) nearshore marine areas free of obstruction with water quality and quantity conditions and forage, including aquatic invertebrates and fishes, supporting growth and maturation; and natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, and side channels; and (6) offshore marine areas with water quality conditions and forage, including aquatic invertebrates and fishes, supporting growth and maturation.

Puget Sound Chinook are of the ocean-type race, which migrate to sea during their first year of like. Growth and development to adulthood occur primarily in estuarine and coastal waters. Ocean-type Chinook return to their natal river in the fall, with the specific timing of adult runs and spawning correlating to local temperature and streamflow regimes. The duration of incubation varies depending on the location of redds, but is generally completed by the end of February. Young Chinook reside in stream gravels for 2 to 3 weeks after hatching (Wydoski and Whitney 1979) before moving to side channels, sloughs, and pools for refuge and food during their downstream migration. Peak outmigration occurs from March to June. The amount of time juvenile Chinook spend in

estuarine areas depends on their size at downstream migration and rate of growth. Juveniles tend to disperse to deeper marine areas when they reach approximately 65-75 mm in fork length.

The StreamNet (2008) database documents Chinook use of several of the larger East Kitsap streams but Chinook salmon are not known to use streams draining into Rich Passage (StreamNet 2008). Juvenile Chinook salmon may utilize nearshore habitat within the Action Areas and adult fish likely occupy portions of Rich Passage at certain times of year for migration and foraging (WDFW 2008).

3.4 Steelhead Trout

The Puget Sound DPS was listed as threatened on May 11, 2007. Critical habitat designation for this DPS is currently under development as of the date of this evaluation.

Steelhead exhibit complex life history traits as they can be either anadromous (steelhead) or freshwater residents (rainbow or redband trout) and sometimes yield offspring of the opposite life history form. Anadromous fish can spend up to 7 years in fresh water before migrating to salt water, where they spend 3 years.

The East Kitsap winter steelhead stock spawns from February through mid-April in several streams draining into Sinclair and Dyes inlets, including Blackjack, Barker, Chico, and Clear creeks (WDFW 2008). It is likely that adult steelhead use Rich Passage as a migration route to local spawning habitat.

3.5 Leatherback Sea Turtle

The leatherback sea turtle was listed under the ESA as endangered throughout its range on June 2, 1970. Critical habitat for the species was designated on March 23, 1979. The waters adjacent to Sandy Point Beach, St. Croix, U.S. Virgin Islands were designated as critical habitat for the leatherback sea turtle to provide protection for turtles using these waters for courting, breeding, and access to and from their nesting areas on Sandy Point Beach (44 FR 17710). No critical habitat has been designated in the vicinity of the Action Areas.

The leatherback is the largest of the sea turtles and individuals can grow up to 6.5 feet long and weigh up to 1,400 pounds. Leatherbacks are unique among sea turtles in that their primary food is jellyfish. They also will eat finfish, mollusks, squid, sea urchins, and other marine creatures. Adult leatherbacks ply the seas alone, except on occasion gathering to feed in areas with large numbers of jellyfish. They are also remarkable among reptiles in that they can survive in cold waters below 40° F; they have been reported as far north as Norway and south off the coasts of Chile and New Zealand. All other sea turtles are confined to the warmer regions of the world's oceans. The leatherback is the most pelagic of the sea turtles and is often found near the edge of the continental shelf. In northern waters they are reported to sometimes enter shallow estuarine bays.

NOAA Fisheries lists the leatherback sea turtle as a species that "may occur in Puget Sound." However, no known documented sightings or strandings of leatherbacks have occurred in Puget Sound (Norberg 2002). Leatherbacks do occur on the outer coast of Washington and dead specimens occasionally wash ashore on the outer coast during the summer (Norberg 2002). It is possible that leatherbacks could enter the inland Puget Sound waters if there are large jellyfish aggregations, but their presence in Rich Passage is considered unlikely.

3.6 Humpback Whale

The humpback whale is listed as endangered under the ESA on June 2, 1970. No critical habitat has been designated for the species.

Humpback whales are wide ranging and can be found virtually worldwide. The whales feed on krill, small shrimp-like crustaceans, and various kinds of small fish. Humpbacks are migratory; they summer in temperate and polar waters for feeding, and winter in tropical waters for mating and calving. Owing to their tendency to aggregate on the tropical breeding grounds and to come close to the shore on the polar feeding grounds, humpback whales were highly vulnerable to whalers. Humpbacks were hunted for their oil, meat and whalebone. It is likely that whalers throughout the modern whaling era killed more than 100,000 humpbacks and, although some stocks seem to be recovering, today's population is still a fraction of its original size. Based on whaling statistics, the pre-1905 population of humpback whales in the North Pacific was estimated to be 15,000 (Rice 1978), but this population was reduced by whaling to approximately 1,200 by 1966 (Johnson and Wolman 1984). The North Pacific total now almost certainly exceeds 6,000 humpback whales (Calambokidis et al. 1997).

The humpback whale does not frequent the inland waters of Puget Sound, but it has in the past. Historically, humpback whales occurred in inland Puget Sound (Calambokidis 2002), but they were hunted to local extinction. In the early part of the 20th century, there was a productive commercial hunt for humpbacks in Georgia Strait that was probably responsible for their disappearance from local waters (Osborne et al. 1988). Currently, individual humpback whales are occasionally seen south of Admiralty Inlet and there have been about 6 sightings in the last 5 years (Calambokidis 2002). There have been no documented sightings of humpback whales in Rich Passage although an individual was sighted in Sinclair Inlet near Bremerton in March 2002 (Calambokidis 2002).

3.7 Steller Sea Lion

The Steller sea lion was listed as threatened under the ESA on November 26, 1990. In 1997, the species was split into two separate stocks on the basis of demographic and genetic dissimilarities; the status of the western stock (west of 144° longitude) was changed to endangered, and the status of the eastern stock (east of 144° longitude) was left unchanged (Bickam et al. 1996, Loughlin 1997). Critical habitat for the Steller sea

lion was designated on August 27, 1993.

The Steller sea lion is distributed around the North Pacific rim from the Channel Islands off southern California northward into the Bering Sea and along the eastern shore of the Kamchatka Peninsula to northern Hokkaido, Japan. The center of the distribution is considered to be in the Gulf of Alaska and the Aleutian Islands. Within this distribution, land sites used by Steller sea lions are referred to as rookeries and haulouts. Rookeries are used during the reproductive season (late May to early July) for mating, pupping, and nursing. Haulouts are generally not areas used for reproduction, but like rookeries they are areas used for protection from marine and terrestrial predators, protection from severe climate or sea surface conditions, and (perhaps most importantly) are near available prey resources. Haulout sites are found on jetties, offshore rocks, and coastal islands. Extensive declines of the Steller sea lion population have occurred within the Alaskan and the Russian portions of their range over the last 30 years. Counts in southeast Alaska, British Columbia, and Oregon have remained stable over the same period, and numbers in California have declined.

The areas designated as critical habitat for the Steller sea lion were determined on the basis of the available information on life history pattern of the species, with particular attention paid to land sites where animals haul out to rest, pup, nurse their pups, mate, and molt, and to marine sites considered to be essential foraging areas. Rookeries in California and Oregon are considered critical habitat, but in Washington there are no rookeries or critical habitat area designations. The nearest rookeries are in southern Oregon and West Vancouver Island. Haulout sites in Washington, Oregon, or California have not been identified as critical habitat although preventing contamination and conserving prey resources and foraging areas appears essential to the recovery of Steller sea lion populations.

The Steller sea lion is the largest of the eared or otariid seals found in Washington waters and uses haulout sites primarily along the outer coast from the Columbia River to Cape Flattery, as well as occasionally on navigation buoys in Puget Sound (Jeffries et al. 2000). This species is also found at numerous haulout sites along the Vancouver Island side of the Strait of Juan de Fuca. Steller sea lion numbers vary seasonally in Washington with peak counts on the outer coast of 1,000 animals present during the fall and winter months (Jeffries et al. 2000). There are around 600 to 700 individuals from Cape Flattery to La Push on the outer coast (Gearin 2002). However, there may be one or two individuals in inland Puget Sound at any time (Gearin 2002). There is a haulout site at Race Rocks and Trial Island in the Strait of Juan de Fuca, near Vancouver Island where a few Steller sea lions have been seen with a large number of California sea lions. The other nearest known haulout site is on the Toliva Shoals Buoy at the south of end of Vashon Island. Foraging by Steller sea lions may occur in Rich Passage as these animals range to find optimal foraging conditions.

3.8 Killer Whale

The southern resident killer whale DPS was listed as endangered on February 16, 2006. Critical habitat was designated for the species on November 28, 2006.

Killer whales can reach 25 feet in length and weigh up to 10,000 pounds. Killer whales have been divided into two life forms, "transient" and "resident" killer whales. Transient whales travel in small pods, or groups, and feed primarily on other marine mammals. Resident killer whales form larger pods and feed mainly on fish, especially salmon.

The critical habitat designation for the southern resident killer whale encompasses parts of Haro Strait and the waters around the San Juan Islands, the Strait of Juan de Fuca and all of Puget Sound. Eighteen military sites covering approximately 112 square miles are excluded from the critical habitat designation. The PCEs for killer whale critical habitat are: (1) water quality to support growth and development, (2) prey species of sufficient quantity, quality, and availability to support individual growth, reproduction and development as well as overall population growth, and (3) passage conditions to allow for migration, resting, and foraging.

The southern resident killer whale DPS resides in Puget Sound during summer and fall months. This population is believed to have historically maintained a modest sized population of 100 to 200 individuals. Census surveys in 2003 identified a southern resident killer whale population totaling 84 individuals (NMFS 2005).

During the time of year southern resident killer whales are present, they spend most of their time in the greater Puget Sound area and in the waters surrounding the San Juan Islands. They typically make only brief forays into the Rich Passage area.

4. ANALYSIS OF EFFECTS

4.1 Assessment of Impacts on Critical Habitat

4.1.1 Marbled Murrelet

Critical habitat for the marbled murrelet includes nesting areas, which have been identified by USFWS as the primary concern in regard to declining marbled murrelet populations. Marine areas, including Puget Sound, are considered important to the life history of the birds, but no specific marine areas essential to the conservation of the species have been identified. The Action Areas do not include designated critical habitat.

4.1.2 Bull Trout

The eight PCEs for bull trout are described above in Section 3.2. The Action Areas contain two PCEs: an abundant food base and permanent water of sufficient quantity and quality such that normal growth and survival are not inhibited.

There will likely be a temporary increase in turbidity during and shortly after placement of the nourishment material. However, it is expected that any decrease in water quality will be minor, localized, and short-term.

Burial of the beach is expected have a temporary and minor impact on benthic and epibenthic organisms because the large majority of the material will be placed at elevations (+6 ft MLLW or higher) where densities of these organisms are naturally low and the distribution of most intertidal species is limited by desiccation. Some organisms at the nourishment sites will be buried, and there may be a minor, short-term decrease in the availability of organisms that could be used as prey by juvenile salmonids. This could result in a very small, temporary reduction in prey for adult bull trout that may forage in the area. However, given the rapid recolonization of sand and gravel substrates by macroinvertebrates (see Section 4.1.3), the effect of any reduction in prey availability for bull trout is likely to be immeasurable.

4.1.3 Chinook Salmon

The six PCEs for Puget Sound Chinook salmon are described above in Section 3.3. The Action Areas contain one of these PCEs: nearshore marine areas. Rich Passage contains estuarine areas at Olney Creek and locations where unnamed streams enter the Passage. These streams are not identified as utilized by Chinook salmon for spawning, rearing or migration and therefore these streams are not considered critical habitat for this ESU. The Action Areas contain nearshore marine habitat suitable for Chinook salmon refuge and foraging.

The overall effect of the proposed beach nourishment, using sediments that match native beach material, is likely to be beneficial to nearshore salmonid habitat. Because the test sites exhibit erosion under both existing conditions and during previous POFF operations, it is possible that some of the placed material will be eroded away within several months. In that case, any beneficial effects will be temporary. It is also possible, however, that beach nourishment will reduce the rate and extent of erosion in these areas; indeed, the purpose of the beach nourishment demonstration program is to test the longevity of the placement and its effectiveness in enhancing the resiliency of the beaches to stresses from storm waves and vessel wakes.

As described in Section 4.1.2, there will likely be a temporary increase in turbidity during and shortly after placement of the nourishment material. However, it is expected that any decrease in water quality will be minor, localized, and short-term.

Also as described in Section 4.1.2, burial of the beach is expected have a temporary and minor impact on benthic and epibenthic organisms and there may be a small, short-term decrease in the availability of organisms that could be used as prey by juvenile Chinook. However, numerous studies at sites in Puget Sound and other locations have examined recolonization of intertidal and shallow subtidal substrate on nourished beaches (e.g., Jones & Stokes Associates 1990a, 1990b, 1995; Hiss et al. 1990; Simenstad et al. 1991 as cited in Mason County Department of Community Development 1992; Thom et al. 1994;

Thompson 1995; Williams and Thom 2001). The results of these studies indicate that recolonization of sand and gravel substrates by macroinvertebrates is rapid and that substantial population densities are attained within a short period. In most high-energy coastal environments where beach nourishment is conducted, highly mobile fauna are adapted to heavy disturbance regimes and recolonize these areas quickly (Williams and Thom 2001). Therefore, any reduction in the availability of prey for Chinook is likely to be insignificant.

4.1.4 Steller Sea Lion and Leatherback Sea Turtle

Critical habitat for the Steller sea lion includes marine waters of Alaska, Oregon and California. The waters of Washington State, including the Puget Sound and Rich Passage have not been designated as critical habitat for the species. Leatherback sea turtle critical habitat has been designated for the waters adjacent to Sandy Point Beach, St. Croix, U.S. Virgin Islands. There is no critical habitat for leatherback sea turtles in Rich Passage.

4.1.5 Killer Whale

The PCEs for killer whale critical habitat are described in Section 3.8. The Action Areas contain all three of these PCEs: water quality to support growth and development; prey species of sufficient quantity, quality, and availability to support individual growth, reproduction and development as well as overall population growth; and passage conditions to allow for migration, resting, and foraging.

As noted in previous sections, there will likely be a temporary increase in turbidity during and shortly after placement of the nourishment material. However, it is expected that any decrease in water quality will be minor, localized, and short-term, and this is not expected to have any discernable effect on killer whale critical habitat.

Fish may avoid the project sites during placement of the nourishment material, resulting in a very localized and short-term decrease in the availability of these prey for killer whales, but this would not be expected to affect killer whales as prey are abundant and readily available in adjacent areas.

The beach nourishment study is not expected to have any effect on passage conditions for killer whales.

4.2 Direct and Indirect Effects

4.2.1 Marbled Murrelet

The proposed beach nourishment study will have no effect on marbled murrelet nesting habitat and virtually no likelihood of direct mortality of birds. If murrelets were present in the Action Areas during placement of the nourishment materials, they could be disturbed by the presence of humans and construction equipment and temporarily avoid the sites. However, any disturbance would be minor and effects on marbled murrelets insignificant.

There could be a minor and temporary reduction in the availability of sand lance and other fish used as prey by marbled murrelets, as these fish could be disturbed by construction and avoid the project sites during placement of the nourishment material. Forage fish spawning has not been identified within the Action Areas, and spawning grounds in Rich Passage are not expected to be affected by the study. Prey are abundant in adjacent areas and any reduction in prey availability for marbled murrelets are expected to be insignificant.

4.2.2 Bull Trout

The proposed beach nourishment study will have little likelihood of direct mortality of bull trout. Placement of the material will occur during the approved in-water work window, a time of year when bull trout are less likely to be present. Bull trout that may be present in the Action Areas during placement of the material would be highly mobile foraging adults, easily able to avoid areas where nourishment activities are occurring. If bull trout were present in the Action Areas during materials placement, they could be disturbed by the presence of construction activities and temporarily avoid the sites. However, any disturbance would be minor and effects on bull trout insignificant.

There will likely be a temporary increase in turbidity during and shortly after placement of the nourishment material. However, it is expected that any decrease in water quality will be minor, localized, and short-term, and suspended sediment concentrations resulting from placement of the nourishment material will be well below thresholds that could harm bull trout.

As discussed in Section 4.1.2, there may be a minor, short-term reduction in the availability of prey for bull trout, but any effects are expected to be insignificant.

4.2.3 Chinook Salmon

The proposed beach nourishment study will have little likelihood of direct mortality of Chinook salmon. Placement of the material will occur during the approved in-water work window, a time of year when Chinook salmon are not likely to be present in large numbers. Chinook salmon that may be present in the Action Areas during placement of the material would be highly mobile adults or sub-adults, easily able to avoid areas where nourishment activities are occurring. If Chinook salmon were present in the Action Areas during materials placement, they could be disturbed by the presence of construction activities and temporarily avoid the sites. However, any disturbance would be minor and effects on Chinook salmon insignificant.

There will likely be a temporary increase in turbidity during and shortly after placement of the nourishment material. However, it is expected that any decrease in water quality will be minor, localized, and short-term, and suspended sediment concentrations resulting from placement of the nourishment material will be well below thresholds that could harm Chinook salmon.

As discussed in Section 4.1.3, there may be a minor, short-term reduction in the availability of prey for Chinook salmon, but any effects are expected to be insignificant.

4.2.4 Steelhead Trout

The proposed beach nourishment study will have little likelihood of direct mortality of steelhead trout. Placement of the material will occur during the approved in-water work window, a time of year when steelhead are not likely to be present in large numbers. Steelhead trout that may be present in the Action Areas during placement of the material would be highly mobile adults or sub-adults, easily able to avoid areas where nourishment activities are occurring. If steelhead were present in the Action Areas during materials placement, they could be disturbed by construction activities and temporarily avoid the sites. However, any disturbance would be minor and effects on steelhead trout insignificant.

There will likely be a temporary increase in turbidity during and shortly after placement of the nourishment material. However, it is expected that any decrease in water quality will be minor, localized, and short-term, and suspended sediment concentrations resulting from placement of the nourishment material will be well below thresholds that could harm steelhead trout.

As discussed in Section 4.1.3, there may be minor, short-term effects on aquatic macroinvertebrates. This could cause a temporary reduction in the availability of prey for steelhead, but this effect is not expected to be significant.

4.2.5 Leatherback Sea Turtle

Because it is unlikely that leatherback sea turtles would be present in Rich Passage at any time, no direct or indirect impacts on the turtles are expected as a result of the beach nourishment study.

4.2.6 Humpback Whale

It is unlikely that humpback whales would be present in Rich Passage at any time. However, in the event whales were present during placement of the material, the project would not be expected to have any adverse effects. Maneuvering of the barge within the Action Areas would not be expected to cause injury or mortality to humpback whales, as it will not be operated at high speeds and any whales that were present could easily avoid it. Rich Passage experiences a high level of vessel traffic and the presence of the barge is not expected to increase the potential that whales would be disturbed. The study is not expected to have any effect on prey species used by humpback whales.

4.2.7 Steller Sea Lion

Although it is unlikely that Steller sea lions would be present in Rich Passage at any time, this possibility cannot be discounted. However, the project is not expected to have any adverse effects on Steller sea lions that may be present. Maneuvering of the barge within

the Action Areas would not be expected to cause injury or mortality to Steller sea lions, as it will not be operated at high speeds and any sea lions that were present could easily avoid it. Rich Passage experiences a high level of vessel traffic and the presence of the barge is not expected to increase the potential that sea lions would be disturbed.

There may be a small, temporary reduction in the presence of salmon and forage fish within the Action Areas during and shortly after placement of the nourishment materials. It is not expected that this would have any effect on Steller sea lions, because prey are abundant in adjacent areas and readily available to these highly mobile animals.

4.2.8 Killer Whale

Although it is not likely that killer whales would be present in Rich Passage, this possibility cannot be discounted as they are known to make brief forays into the area. However, the project is not expected to have any adverse effects on killer whales that may be present. Maneuvering of the barge within the Action Areas would not be expected to cause injury or mortality to killer whales, as it will not be operated at high speeds and any killer whales that were present could easily avoid it. Rich Passage experiences a high level of vessel traffic and the presence of the barge is not expected to increase the potential that killer whales would be disturbed.

There may be a small, temporary reduction in the presence of salmon and forage fish within the Action Areas during and shortly after placement of the nourishment materials. It is not expected that this would have any effect on killer whales, because prey are abundant in adjacent areas and readily available to these highly mobile animals.

4.3 Interdependent and Interrelated Actions

Interdependent actions are those that have no independent utility apart from the action under consideration (50 CFR 402-02). There are no actions that are interdependent with the beach nourishment study.

Interrelated actions are those that are part of a larger action and depend on the larger action for their justification (50 CFR 402-02). Interrelated actions are typically "associated with" the proposed action. Other elements of the larger POFF Study are interrelated with the beach nourishment study. These elements include: development of numerical models for assessing the performance and effects of potential candidate POFF vessels; collection of physical data, including beach profiles, wind and wave data, and sediment characterization; and testing of prototype POFF vessels in Rich Passage.

The development and use of numerical models and collection of physical environmental data are expected to have no effect on listed species or their critical habitats.

The vessel trials will be conducted using a research vessel that is currently under development. The research vessel is a state-of-the-art foil-assisted catamaran optimized to minimize wake generation. The vessel is equipped with a waterjet propulsion system

that does not involve an exposed propeller. The vessel trials are expected to begin in May, 2009 and continue through November, 2009. These trials will consist of four round trips, seven days per week, between Seattle and Bremerton. The new research vessel is being designed for an optimal operating sped of 37 knots, and it will be tested at a range of speeds between 25 and 39 knots to verify that it meets the design criteria. These long-term trials will allow data on vessel performance and wake and shore conditions along Rich Passage to be gathered during a wide range of weather and tide conditions.

The vessel trials are not expected to affect the marbled murrelet, Chinook salmon, bull trout, or steelhead trout or designated critical habitats for these species.

Given the low likelihood that leatherback sea turtles would be present along the ferry route and the absence of critical habitat for this species in Puget Sound, the vessel trials are not expected to have any effect on the leatherback sea turtle.

Steller sea lions are not common in Puget Sound and it is unlikely that sea lions would be present during the vessel trials. However, if Steller sea lions were present, they would be expected to avoid the vessel and could easily swim outside the area of disturbance.

It is considered unlikely that humpback whales would be present during the vessel trials. If a humpback whale were present, avoidance behavior would be expected while vessel trials are underway. In the event that any whales are sighted during the trials, the following adaptive management protocols will be implemented as conservation measures:

- Slow vessel speed: The test vessel speed will be reduced to less than 7 knots within 400 meters of any whale.
- Avoid contact: The vessel will remain more than 100 meters from any observed whale. If the vessel unintentionally comes within 100 meters of a whale, it will stop immediately until the whale is a safe distance away.
- Keep clear of whales' path: The vessel will attempt to stay on the offshore side of any observed whale and stay clear of its immediate path.
- Notify authorities: In accordance with NOAA Fisheries whale watching guidelines, a designated crew member will immediately notify the Whale Museum Hotline (1-800-562-8832) of any whale sightings.

Killer whales could occur in the area while the vessel trials are underway. In the event that any killer whales are sighted during the trials, the adaptive management protocols listed above will be implemented immediately.

4.4 Determination of Effects

The Action Areas do not include designated critical habitat and the project will have **no effect** on critical habitat for the marbled murrelet. Based on the absence of effects on nesting habitat, the low likelihood of direct mortality, and the insignificant effects on

prey availability, the study **may affect, but is not likely to adversely affect** the marbled murrelet.

Based on the localized, minor, and short-term nature of effects from the placement of beach nourishment materials, the **project may affect, but is unlikely to adversely affect** critical habitat for bull trout. Based on the low likelihood that bull trout would be present in the Action Areas during placement of nourishment material, and the small, short-term effects on water quality and prey, the project **may affect, but is not likely to adversely affect** the bull trout.

The study **may affect, but is not likely to adversely affect** critical habitat for the Puget Sound Chinook salmon for the reasons cited above for bull trout. Based on the low likelihood that Chinook salmon would be abundant in the Action Areas during placement of nourishment material, and the small, short-term effects on water quality and prey, the project **may affect, but is not likely to adversely affect** the Chinook salmon.

Based on the low likelihood that steelhead would be abundant in the Action Areas during placement of nourishment material, and the small, short-term effects on water quality and prey, the project **may affect, but is not likely to adversely affect** the steelhead trout.

The study will have **no effect** on critical habitat for the leatherback sea turtle. Because it is unlikely that leatherback sea turtles would be present in the area at any time, no direct or indirect impacts on the turtles are expected. Therefore, the project is expected to have **no effect** on the leatherback sea turtle.

Based on the low probability that humpback whales would be present and the conservation measures that would be implemented if a whale were sighted, the project is expected to have **no effect** on the humpback whale.

The study will have **no effect** on critical habitat for the Steller sea lion. Based on the low probability that Steller sea lions would be present, and the absence of potential impacts, the project is expected to have **no effect** on the Steller sea lion.

Overall, the study **may affect, but is not likely to adversely affect** critical habitat for the killer whale. Because of the conservation measures that would be implemented if killer whales are sighted, the project **may affect, but is not likely to adversely affect** the Southern resident killer whale.

5. EFH ASSESSMENT

Pursuant to the MSFCMA and SFA, an evaluation of potential impacts on EFH is required for actions associated with the proposed beach nourishment demonstration project. EFH is defined by the MSFCMA as “those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity” (50 CFR 600.905-930).

Estuaries of Washington State, including Puget Sound and the Pacific Ocean off the mouth of these estuaries, are designated as EFH for various groundfish, coastal pelagic and salmonid species (NMFS 1998; PFMC 1998a, 1998b, 1999).

Based on the available life history information, important elements of salmon marine EFH are (1) estuarine rearing, (2) early ocean rearing, and (3) juvenile and adult migration and feeding (Roni et al. 1999). Important features of estuarine and marine habitat are (1) adequate water quality, (2) adequate temperature, (3) adequate prey species and forage base (food), and (4) adequate depth, cover, and marine vegetation in estuarine and nearshore habitats (Roni et al. 1999).

Potential threats to these habitat features and life history components include (1) direct (hydrologic modifications); (2) indirect (loss of prey or reduction of species diversity); (3) site-specific; or (4) habitat-wide impacts that are chemical, biological, and physical in nature and may result in individual, cumulative, or synergistic consequences (Wilbur & Pentony 1999).

The Puget Sound HUC is designated EFH for chinook and coho salmon as well as bottomfish and coastal pelagic species. Table 4 lists the species of fishes and life-history stages with designated EFH in Puget Sound.

Table 4. Species of fishes and life-history stages with designated EFH in Puget Sound

Species	Scientific Name	Adult	Spawn/ mate	Juvenile	Larvae	Eggs/ parturition
Bottomfish Species						
Spiny Dogfish	*Squalus acanthias*	X	X	X		X
Big Skate	*Raja binoculata*	X	X	X		X
California Skate	*R. inornata*	X				
Longnose Skate	*R. rhina*	X				X
Ratfish	*Hydrolagus colliei*	X				X
Lingcod	*Ophiodon elongatus*	X	X	X	X	X
Cabezon	*Scorpaenichthys marmoratus*	X	X	X	?	X
Kelp Greenling	*Hexagrammos decagrammus*	X	X	X	X	X
Pacific Cod	*Gadus macrocephalus*	X	X	X	X	X
Pacific Whiting (Hake)	*Merluccius productus*	X		X		
Sablefish	*Anoplopoma fimbria*	X		X		
Black Rockfish	*Sebastes melanops*	X		X		
Bocaccio	*S. paucispinis*	X	?	X	X	
Brown Rockfish	*S. auriculatus*	X	?	?	X	
Canary Rockfish	*S. pinnige*	?		X		
China Rockfish	*S. nebulosus*	X		X		
Copper Rockfish	*S. caurinus*	X		X	?	
Darkblotched Rockfish	*S. crameri*	X		X		
Pacific Ocean Perch	*S. alutus*	X		X		
Quillback Rockfish	*S. malinger*	X		X	?	
Redbanded Rockfish	*S. babcocki*	X				
Redstripe Rockfish	*S. proriger*	?				
Rosethorn Rockfish	*S. helvomaculatus*	X		X		
Rosy Rockfish	*S. rosaceus*	?				
Rougheye Rockfish	*S. zacentrus*	X		?		
Sharpchin Rockfish	*S. zacentrus*	X		?		
Shortspine Thornyhead	*Sebastolobus alascanus*	X		X		
Splitnose Rockfish	*S. diploproa*	X		X		
Stripetail Rockfish	*S. saxicola*	X				
Tiger Rockfish	*S. nigrocinctus*	X		X		
Vermilion Rockfish	*S.miniatus*	X	?	X		
Yelloweye Rockfish	*S. ruberrimus*	X				
Yellowtail Rockfish	*S. flavidus*	X	?	X		

Table 4. Species of fishes and life-history stages with designated EFH in Puget Sound (continued)

Species	Scientific Name	Adult	Spawn/ mate	Juvenile	Larvae	Eggs/ parturition
Arrowtooth Flounder	*Atheresthes stomias*	X	X	X		
Butter Sole	*Pleuronectes isolepis*	X	X	X		
Curlfin Sole	*Pleuronichthys decurrens*	X				
Dover Sole	*Microstomus pacificus*	X	X	X		
English Sole	*Parophrys vetulus*	X	X	X	X	X
Flathead Sole	*Hippoglossoides elassodon*	X	X	X		
Pacific Sanddab	*Citharichthys sordidus*	X		X	X	X
Petrale Sole	*Eopsetta jordani*	X		X		
Rex Sole	*Glyptocephalus zachirus*	X	X	X		X
Rock Sole	*Pleuronectes bilineatus*	X	X	X		
Sand Sole	*Psettichthys melanostictus*	X	X	X		
Starry Flounder	*Platichthys stellatus*	X	X	X	X	X
Pacific Salmon Species						
Chinook Salmon	*O. tshawytscha*	X		X		
Coho Salmon	*O. kisutch*	X		X		
Pink Salmon	*Oncorhynchus gorbuscha*	X		X		
Coastal Pelagic Species						
Northern Anchovy	*Engraulis mordax*	X	X	X	X	X
Pacific Sardine	*Sardinops sagax*	X				
Pacific Mackerel	*Scomber japonicus*	X				
Market Squid	*Loligo opalescens*	X				

5.1 Potential Effects of the Proposed Project on EFH

The definition of "adverse effect" is "any impact that reduces quality and/or quantity of EFH, including direct (e.g., contamination or physical disruption), indirect (e.g., loss of prey or reduction in species fecundity), site-specific or habitat-wide impacts, including individual, cumulative, or synergistic consequences of actions" (50 CFR 600.810).

The following measures will be adopted as part of the project and are applicable to conservation of EFH:

1. Compliance with applicable State water quality standards (WAC 173-201A-030 through –140).

2. Compliance with WDFW HPA conditions to ensure that fish and aquatic life are protected to the extent feasible and practicable.

3. Adherence to timing restrictions specifying that in-water work must occur when juvenile salmonids are absent or present in very low numbers.

5. Development of and strict adherence to a spill response and hazardous material control plan.

6. Use of beach nourishment materials that are compatible with existing sediments in the upper intertidal zone of the beaches to be nourished.

7. Placement of beach nourishment material from the waterward side during high tide to minimize habitat disturbance.

There will be a minor, temporary reduction in primary productivity and food resources resulting from the disturbance of macroinvertebrates within the existing beach sediment. However, these organisms are will rapidly recolonize the new substrate. Depending on the behavior of the material following placement, there may be a net improvement in productivity of the nourished beaches.

Spills from construction equipment associated with the placement of nourishment materials could temporarily adversely affect water column EFH. Conservation measures, including adherence to a spill response and hazardous material control plan, will avoid or minimize such impacts.

Placement of the nourishment material will result in a small, short-term increase in turbidity, but there will be no long-term effect on turbidity in the vicinity of the project. Based on experience with similar beach nourishment projects in the Puget Sound region, materials placement is expected to generate turbidity only in a localized area.

Historic and current shoreline conditions are discussed Section 1.4. The proposed project will not cause cumulative adverse effects on EFH. The project is intended to investigate whether beach nourishment may improve the health and resiliency of shorelines in Rich Passage. Therefore, the project will not contribute to adverse cumulative effects and will be consistent with ongoing efforts to improve general ecological functions in Puget Sound.

Based on the minor, short-term, and localized effects of the project, it is expected that the project will have no long-term or significant adverse effects on the EFH for groundfish, pelagic and salmonid species.

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