UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Northwest Region
7600 Sand Point Way N.E., Bldg. 1
BIN C15700
Seattle, WA 98115-0070

NMFS Tracking No.
2003/00756 March 25, 2004

Daniel M. Mathis
Division Administrator
Federal Highway Administration
711 S. Capitol Way, Suite 501
Olympia, Washington 98501

Re: Endangered Species Act Section 7 Formal Consultation and Magnuson-Stevens Act Essential Fish Habitat Consultation for the SR 104 Edmonds Ferry Terminal Project (HUC 17110019, Puget Sound)

Dear Mr. Mathis:

The attached document transmits the NOAA's National Marine Fisheries Service's (NOAA Fisheries) Biological Opinion (Opinion) on the proposed SR 104 Edmonds Ferry Terminal Project in accordance with section 7 of the Endangered Species Act (ESA) of 1973, as amended, and the results of our consultation on Essential Fish Habitat (EFH) under the Magnuson-Stevens Fishery Conservation and Management Act. The Federal Highway Administration (FHWA) determined that the proposed action was likely to adversely affect the Puget Sound chinook (*Oncorhynchus tshawytscha*) Evolutionarily Significant Units (ESU). It similarly concluded that EFH would be adversely affected.

This Opinion reflects formal consultation and an analysis of effects covering the Puget Sound chinook in the Puget Sound, Snohomish County, Washington. The Opinion is based on information provided in the biological assessment sent to NOAA Fisheries by the FHWA, as well as subsequent information transmitted by telephone conversations and electronic mail. A complete administrative record of this consultation is on file at the Washington Habitat State Office.

NOAA Fisheries concludes that the implementation of the proposed project is not likely to jeopardize the continued existence of Puget Sound chinook. The project will adversely affect EFH. Please note that the incidental take statement, which includes reasonable and prudent measures and terms and conditions, was designed to minimize take. If you have any questions, please contact Barb Wood of the Washington Habitat State Office at (360) 534-9307 or barb.wood@noaa.gov.

Sincerely,

Russell M Strach for

D. Robert Lohn
Regional Administrator

Attachment

cc: Peter Eun, FHWA

Endangered Species Act - Section 7 Consultation
Biological Opinion
and
Magnuson-Stevens Fisheries Conservation and Management Act
Essential Fish Habitat Consultation

SR 104 Edmonds Crossing Ferry Terminal Project,
Snohomish County

Agency:	U.S. Department of Transportation Federal Highway Administration
Consultation Conducted By:	National Marine Fisheries Service, Northwest Region
Issued by:	Russell M Strach for D. Robert Lohn Regional Administrator
Date:	March 25, 2004
NMFS TrackingNo.	2003/00756

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1.0 INTRODUCTION

This document transmits the NOAA's National Marine Fisheries Services' (NOAA Fisheries) Biological Opinion (Opinion) and Magnuson-Stevens Fisheries Conservation and Management Act (MSA) Essential Fish Habitat (EFH) consultation based on our review of the proposed State Route (SR) 104 Edmonds Crossing Ferry Terminal Project, located in Snohomish County, Washington. The Edmonds Crossing multimodal terminal is a major marine development in Puget Sound with an upland and a minor freshwater component. The project is located at Point Edwards, at the southern boundary of Edmonds, Washington. This area is within the geographic range of the Puget Sound (PS) chinook (*Oncorhynchus tshawytscha*) evolutionarily significant unit (ESU). An ESU is considered a distinct population segment which can be treated as a species under the provisions of the Endangered Species Act (ESA) (16 U.S.C. 1532 (16)). Puget Sound has been designated as EFH for a number of species of groundfishes, coastal pelagics and Pacific salmon.

1.1 Background and Consultation History

The Edmonds Crossing project is intended to provide a long-term solution to current operations and safety conflicts between ferry, rail, automobile, bus, and pedestrian traffic in downtown Edmonds. The Federal Highway Administration (FHWA), the Federal Transit Administration (FTA), the Washington State Department of Transportation (WSDOT), including Washington State Ferries (WSF), and the City of Edmonds, propose to relocate the existing state ferry terminal from milepost 24.45 of State Route (SR) 104 in downtown Edmonds to another site approximately 3,700 feet south and adjacent to the Edmonds Marina. In the process, a multimodal center will be established to integrate the ferry, rail, and transit services into a single complex.

As part of the project, the FHWA proposes to fund the realignment and the construction of a multimodal transportation facility along the shores of Puget Sound in Snohomish County, Washington. The FHWA requested ESA section 7 formal consultation and EFH consultation, and the WSDOT, the designated non-federal representative of the FHWA, has submitted the Biological Assessment (BA) and other related information.

This document is based on information provided through the early coordination efforts of the Signatory Agency Committee, the revised BA, additional information, and the following written correspondence:

- A request for formal ESA consultation and EFH consultation from FHWA received by NOAA Fisheries on April 5, 2001, for actions on the Edmonds Crossing Ferry Terminal. However, unresolved issues regarding tribal treaty rights resulted subsequently in considerable changes to the proposed alignment. Thus, FHWA sent a letter retracting the initiation request on May 29, 2002.

- A revised BA and a letter from FHWA, received on June 13, 2003, requesting formal consultation for the revised project.

On July 31, 2003, NOAA Fisheries sent a letter to the FHWA acknowledging completion of the initiation package.

Additionally, telephone conversations, meetings, electronic mail correspondence, and site visits between staff of NOAA Fisheries, U.S. Fish and Wildlife Service (USFWS), WSDOT, and FHWA are documented in the administrative record.

1.2 Description of the Proposed Action

The FHWA proposes to fund and design, in whole or in part, a project to be constructed by the WSDOT. Figure 1 depicts the project and action area.

The proposed work includes:

- Removal of the Unocal Pier at Point Edwards;
- Construction of a new ferry pier at Point Edwards with an overwater length of 330 feet;
- Construction of a train/ferry/bus terminal and associated parking garage;
- Construction of a new approach roadway through an upland forested hill slope;.
- Replacement of the Pine Street culvert with a bottomless arch culvert;
- Removal of the wooden overwater existing ferry pier, restoration of 2.6 acres of eelgrass bed and 3.0 acres of macroalgae beds;
- Relocation of the lower reach of Willow Creek from a 1,275-foot culvert into an open channel and two culverts (150 feet and 30 feet).

Construction is expected to begin in January 2006 and conclude in just over two years. The schedule is broken into four major elements as follows: Stream Relocation, Upland Roadway and Holding Area, Multimodal Center, and Offshore Structures.

This schedule groups logical work elements together and shows when all elements of the project will be undertaken to achieve completion in about two years. The existing terminal and Unocal Pier will be removed following the commencement of operation of the new terminal. The eel grass restoration will occur following removal of the existing terminal and Unocal facilities.

Inwater construction will be conducted within the limitations of approved work windows. Marine inwater construction will include pile driving, piling demolition, riprap placement, and gravity anchor placement. Freshwater inwater construction will include culvert replacement, culvert removal, steam channel rehabilitation, and the Deer Creek Hatchery weir removal.

1.2.1 Upland Roadway and Holding Area

For the construction of approach roadway (new SR 104 alignment) portion of the project, construction activities will clear approximately 4.6 acres. This will include logging and skidding some trees in the approximate 3.6 acres of forested habitat to be cleared for construction, clearing with bulldozers and excavators, loading and hauling material with front loaders, excavators and dump trucks, and burning wood waste. Tree canopies were interpreted using aerial photos, and it is estimated that WSDOT will remove approximately 150 coniferous and deciduous trees as part of the project. Many trees will be set aside for use in wetland and wildlife mitigation and will be incorporated into a final mitigation plan. No riparian trees will be removed.

Earthwork will include 54,000 cubic yards of excavation and 80,000 cubic yards of fill from a WSDOT-approved source. The fill will be used for construction of the access roadway. No excavation or fill will occur in riparian areas.

The entire project will include approximately 10 acres of new impervious surface, bringing the amount of impervious in the project area to approximately 20 acres. Approximately 3.6 acres of the new impervious surface area occurs west of the railroad tracks and 7.0 acres east of the railroad tracks. The WSDOT's proposed method of stormwater treatment is to construct a stormwater pond or wetland northeast of the multimodal center parking area. As currently planned, WSDOT will discharge all of the outflow from this treatment facility directly to Puget Sound, using the currently abandoned Willow Creek culvert outfall.

Stormwater facilities work will include installation of an underground stormwater conveyance system, which will direct flow into treatment facilities located adjacent to the multimodal center.

1.2.2 Offshore Structures

The offshore structures include specialty structures necessary for safe and efficient ferry operation. The dolphins and wingwalls guide the ferry into position on approach and hold it there while passengers and vehicles load and unload from the ferry. The pedestrian and vehicle transfer spans work together to allow simultaneous unloading and loading of people and vehicles. The floating breakwater and fixed wave barrier provide protection from heavy seas during pedestrian and vehicle transfer. Protective dolphins provide an emergency barrier to prevent ferries from running aground under extreme conditions. The pedestrian walkway is a separate elevated structure over the water that will allow passengers from the multimodal center to board the ferries at the end of the pier. The work necessary to construct these structures will be accomplished with floating derricks. The WSDOT will conduct all inwater work in compliance with the Washington State Department of Fish and Wildlife (WDFW) approved work window for work in marine waters, between July 16 and February 15.

The new structures will be constructed with steel pilings driven by a derrick. The dolphins, wingwalls, and transfer span foundations will be constructed from driven steel pilings. Steel pilings will not be used for the floating breakwater, which will be anchored with gravity and plate anchors, or emergency barricades. The following discussion outlines the construction methods for these structures.

Pile Driving

Approximately 62 steel pipe pilings will be used to construct the dolphins, wingwalls, vehicle and pedestrian transfer span foundations, and the pedestrian walkway. A vibratory hammer will be used to set the pile and drive it as far as possible. A pile-driving hammer will be used to drive the pile to a specified tip elevation or bearing capacity. In addition to pilings, large (cast-in-place) concrete piers will support the ferry pier. Two of these columns will be located in the intertidal zone, and the rest will be located in the upland area of the site.

Floating Concrete Pontoon Breakwater

An approximately 600-foot long floating concrete pontoon breakwater will be constructed off site. The WSDOT will tow the breakwater into position and anchored it to moorings on the offshore substrate as described below. The breakwater will be positioned inwater depths of minus-25 to minus-195 feet mean lower low water (MLLW).

Gravity Anchor Installation

The floating breakwater will be secured by gravity and plate anchors. The WSDOT will use five gravity anchors to hold the position of the breakwater. Each anchor will consist of a large concrete box that is placed on the sea floor and filled with high-density material (rock or steel). Each anchor will measure approximately 46 feet wide by 46 feet deep by 33 feet high. The gravity anchors will be lowered to the bottom using a derrick and filled with rock or heavier material for additional weight. The plate anchors are 8-foot by 6-foot steel plates shaped like arrowheads. The WSDOT will drive the plates to a depth of about 100 feet.

Sheet-pile Cell (Emergency Barricades) Installation

The WSDOT will construct sheet pile cells by driving the steel sheets in a 30 foot-diameter circle and filling the center with sand. The steel sheets are typically vibrated into the sea floor but may be driven with a hammer if resistance exceeds the ability of the vibratory device. The barricades are intended to stop a ferry from drifting or from running into the Edmonds Marina breakwater during an emergency.

Construction of Pier and Landing Facilities

The construction of a unique split pier is designed to facilitate longshore juvenile salmonid migration. The pier will consist of a 66-foot wide westbound loading pier, a 33-foot wide eastbound unloading pier, and a 25-foot wide pedestrian walkway. The two wider piers will have a 15-foot gap between them. The split pier concept is designed to reduce the continuous width of the ferry pier through the use of multiple pier structures overwater; the separations between them is to allow more light under the piers. The underside of the piers will be painted with special reflective paint to help light the under-pier areas. The shoreline bulkhead will be situated above the extreme high-tide mark. All components of the pier design are intended to facilitate the movement of juvenile salmonids along the shoreline, instead of driving them out into deeper water where there is a greater threat of predation.

The new ferry pier and landing facilities will be constructed with steel piling driven by a derrick. The pile driving work will be followed by concrete deck construction. The deck will consist of pre-cast concrete panels, cast-in-place concrete, or post-tensioned construction, depending on final design details. Following construction of the deck, the terminal building and other operational necessary facilities will be constructed.

Approximately 245 steel pilings will be used for the terminal deck and piers. Steel piles will range from 24-inch to 10-foot in diameter. Construction of the dolphin will require 12 steel piles at 72-inch diameter and 50 at 36-inch diameter. Construction of the terminal deck and associated structures will require 126 steel piles at 24-inch diameter, four steel sheet piles constructed at 10-foot diameter, and 100 steel piles at 36-inch diameter. Construction of the piers will require 15 steel piles at 48-inch diameter. Piling driving methods will include vibratory and/or conventional pile-driving hammer. Sediment testing has been performed at both the Unocal and proposed Point Edwards pier locations. The test results indicate that the soils in these areas are considered “clean” by Washington State standards. Piles will be driven open ended into the sea bottom. This is a very clean process as the bottom is virtually undisturbed. A vibratory hammer is used to set the pile and drive it as far as possible, while a pile-driving hammer then drives the pile to a specified tip elevation or bearing capacity.

Removal of Existing Steel and Creosote Pilings

The Unocal Pier and other existing pier and offshore structures will be removed as soon as possible. There are a total of 202 existing steel piles ranging in size from 15-inch to 94-inch in diameter. In addition to removing the steel piles, a total of 705 creosote piles ranging in size from 12-inch to 24-inch in diameter, will also be removed.

1.2.3 Multimodal Center

The multimodal center will consist of four major components: a rail station; a bus plaza; a short-term surface parking lot; and a long-term parking garage. The construction area covered by the multimodal center is currently entirely paved. Methods used to construct the multimodal center will be similar to constructing an office park development.

Site Preparation

The lower yard at the Unocal property where the multimodal center will be constructed is currently old pavement and densely compacted gravel. The area where the multimodal terminal will be built was once the site of an asphalt plant. During plant operations, asphalt tar and other petrochemicals were spilled, contaminating the soils within the footprint of the facility. Unocal is currently cleaning up the site in accordance with the Washington State Department of Ecology (WDOE) and Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) standards.

Culvert Installation

The WSDOT will place two culverts in the vicinity of the multimodal center. Both will be double 6-foot by 8-foot concrete box-type culverts. One culvert will be approximately 150 feet long and the other will be approximately 30 feet long. The longer of the two culverts will be placed under the Burlington Northern Santa Fe (BNSF) railroad tracks. This culvert will be provided by Sound Transit as mitigation for a second track that will be constructed as part of its commuter rail project. It will be plugged and buried for future tie-in with Willow Creek when that element of the Edmonds Crossing is built. The 30-foot long culvert will be installed in front of the multimodal center to provide truck access to the facility by trucks.

1.2.4 Marine and Freshwater Activities

Culvert Removal

The WSDOT will remove two existing culverts. One is the existing Willow Creek culvert under the railroad tracks, which is a double 24-inch diameter concrete pipe. The other culvert, which goes under an abandoned access road, is a double 30-inch diameter and 24-inch diameter corrugated metal pipe (CMP).

Emergency Tide Gate Installation

A manually operated tide gate will be installed at the upstream end of the railroad culvert. This device will prevent tidewater from backing up into Edmonds Marsh and flooding the low-lying commercial district adjacent to the marsh during extreme tidal events. The tide gate will normally be open except during extreme high tides, when the gates will only be closed for a few hours around the peak of the high tide. This is anticipated to occur perhaps one to three times per year. Therefore, the gates may be closed for three to four hours during a few days each year.

Stormwater Facilities

Approximately 1.3 acres of net new impervious surface area will be created by the placement of an underground stormwater conveyance system, and the construction of stormwater treatment facilities. The WSDOT will treat stormwater from this project using either a stormwater wetland, or a wet pond and sand filter combination. The permanent stormwater treatment facility will be installed as a first order of work and will be used during construction, as needed.

The pond located at this site will treat stormwater for the entire project area. A detailed preliminary stormwater analysis is included as Appendix E of the BA. The existing Willow Creek 1,275-foot culvert to Puget Sound will be used as the site's permanent stormwater outfall.

Building Construction

Both the new rail station and multi-level parking garage will be constructed using conventional building construction practices. Foundations will be either spread footing, driven pile, or both. Construction of the parking garage and the rail station will create approximately 1.0 acre of net new impervious surface area.

Willow Creek Relocation

The WSDOT will re-route Willow Creek into a new open channel from the point where it currently enters the long culvert discharging into Puget Sound. The open channel will be rerouted to the southeast, just enough to pass around the proposed new multimodal center building, then travel south in an open channel in front of the terminal, through a 30-foot long box culvert, under the proposed pier, and into a 150-foot long box culvert under the BNSF railroad tracks. No trees need to be removed for the new stream realignment. Both box culverts will be set well below grade to maintain a natural substrate bottom. The channel will then discharge into the intertidal zone just south of the existing Unocal Pier. The total length of new open channel will be about 1,050 feet. The new channel configuration substitutes two small concrete or CMP culverts with two double 6-foot by 8-foot box culverts set below grade, thereby replacing the existing 4-foot wide, 1,275-foot long culvert and two smaller culverts. One of the new culverts will be 30 feet long and the other will be 150 feet long. The replacements will open up approximately 1,156 feet of stream channel.

The Willow Creek culvert located at Pine Street will be removed and replaced in accordance with current fish passage standards. The existing culvert is a complete blockage with an unbaffled round concrete pipe design and a six percent slope. The new culvert will be built using Washington Department of Fish and Wildlife (WDFW) "simulated stream" design criteria (WDFW 2002). The new culvert will be the same length but will have a bottomless arch design. Natural substrate will be used within the newly exposed channel, such as rounded boulder, cobble and gravel materials. The width of the culvert will be increased to allow at all stream flows, wildlife passage.

The existing open channel section of Willow Creek running parallel to the railroad tracks will be enhanced from its present degraded condition, by adding small meanders, large woody debris (LWD), boulders, and overhanging vegetation.

The new channel will be designed to enhance salmonid habitat. It will have a natural meander, contain abundant LWD placements, boulders, a gravel bottom, overhanging vegetation, and a buffer 10 to 20 feet wide densely landscaped with native vegetation. Interpretive signs along the edge of the platform will describe what the habitat features are and how they work to provide habitat for salmon. Construction will be conducted in the dry, isolated from the existing channel by a sheetpile wall. The channel will be allowed to stabilize for a year, allowing rocks and other structures to settle and riparian plantings to take hold. The WSDOT will connect the channel during the summer low flow to avoid impacts to listed fish. The existing 1,275-foot long culvert to Puget Sound will then be used as the site's permanent stormwater outfall.

Removal and Replacement of Marina Breakwater

Constructing the foundations for the holding-lane superstructure and pedestrian walkway will require selective removal and replacement of the riprap that composes the rock jetty. Both the holding area superstructure and overhead walkway will have concrete column foundations that must reach down through the existing rock jetty and into the native soils below. WSDOT will use a trackhoe excavator perched on the rock jetty, or, depending on depth, a floating crane with clamshell bucket to remove select areas of riprap. The rock will be temporarily stockpiled on site during construction of the foundations. After the foundations are constructed, the rock will be replaced around the foundations to match the jetty's original footprint and slope.

1.3 Interrelated and Interdependent Actions

An analysis of an action must include other activities that are interrelated to, or interdependent with the proposed action. An interrelated action is one that is part of the proposed action, or depends on the proposed action for its justification. An interdependent action is one that has no independent utility apart from the proposed action (50 CFR 402.02). The following replacement of an existing railroad culvert; and the salmon habitat rehabilitation project described above are elements interrelated and interdependent with the underlying action.

Sound Transit will be placing a culvert under the railroad tracks in the anticipated position that Willow Creek will have following this project. For the time being, the culvert will be buried and capped until it is needed.

Additionally, a local conservation organization, Brackett's Landing Foundation, plans to do a salmon habitat restoration project above Pine Street on Willow Creek following the proposed fish passage replacement project at Pine Street.

1.4 The Action Area

The action area is defined as all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action (50 CFR 402.02). The action area is defined to mean "all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action."

The project area encompasses portions of the City of Edmonds and the central basin Puget Sound in Snohomish County, Washington. There are freshwater, marine, and terrestrial aspects to this project. The freshwater portion of the project includes Willow Creek and Shellabarger Creek.

The marine portion of the action area covers a larger defined geographic area because the effects of pile driving activities extend well beyond the actual project area. Clearing and grading activities will encompass approximately 24 acres upland, bounded by the Edmonds city limits to the south, the existing SR 104 to the east, the Puget Sound to the west, and the Edmonds Marsh to the north.

The marine extent of the action area is defined by the limits that the sound of driving steel pile will travel. Feist *et al.* (1992) noted that ambient noise levels at the Navy homeport in Everett, Washington were 80-90 dB. Assuming that these levels are representative of those found throughout Puget Sound, the area where noise from the project will be above ambient levels to extend from approximately 24 miles northeast to the Hermosa Point and Mission Beach, and northwest to Marrowstone Point, and approximately 7 miles southwest along the Bainbridge Island shoreline. This is based on the size of the pile, type of substrate, and current Best Management Practices (BMP) for sound attenuation (bubble curtain).

2.0 ENDANGERED SPECIES ACT - BIOLOGICAL OPINION

The purpose of consultation under section 7 of the ESA is to ensure that actions undertaken by a Federal agency are not likely to jeopardize the continued existence of threatened or endangered species, or to destroy or adversely modify their designated critical habitat. Because PS chinook do not have designated critical habitat, that portion of the analysis will not appear below.

2.1 Evaluating the Proposed Action

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

Subsequently, NOAA Fisheries evaluates 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 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 salmon's life stages that occur beyond the action area. If NOAA Fisheries finds that the action is likely to jeopardize, NOAA Fisheries must identify reasonable and prudent alternatives for the action.

NOAA Fisheries' jeopardy analysis considers direct and indirect mortality of fish attributable to the action. NOAA Fisheries' jeopardy analysis also considers the extent to which the proposed action affects the quantity and quality of salmonid habitat by assessing the functions of habitat elements necessary for migration, spawning, and rearing of the listed salmon under the existing environmental baseline.

2.1.1 Biological Requirements

The biological requirements are those conditions necessary for PS chinook to survive and recover to adequate, naturally reproducing, population levels, at which time protection under the ESA will become unnecessary. Adequate population levels must safeguard the genetic diversity of the listed stock, enhance their capacity to adapt to various environmental conditions, and allow them to become self-sustaining in the natural environment.

Biological requirements are the habitat conditions that are relevant to any chinook life stage. Information related to biological requirements for PS chinook can be found in Spence *et al.* 1996. Generally characterized, the biological requirements for PS chinook are adequate: water (volume and velocity); water quality; food; substrate; up and downstream migration; safe passage (refuge); and biotic interactions. The biological requirements affected by this project are access to functioning nearshore habitat and good water quality.

2.1.2 Environmental Baseline

The environmental baseline represents the current set of conditions to which the effects of the proposed action are then added. Environmental baseline is defined as "the past and present impacts of all Federal, state, and 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 informal ESA section 7 consultation, and the impact of state or private actions which are contemporaneous with the consultation process" (50 CFR 402.02).

Anthropogenic activities have blocked or reduced access to historical spawning grounds and altered downstream flow and thermal conditions. In general, upper tributaries have been impacted by forest practices while lower tributaries and mainstem rivers have been impacted by agriculture and/or urbanization. Diking for flood control, draining and filling of freshwater and estuarine wetlands, and sedimentation because of forest practices and urban development are cited as problems throughout the ESU (WDFW *et al.* 1993). Blockages by dams, water diversions, and shifts in flow regime because of hydroelectric development and flood control projects are major habitat problems in several basins.

These impacts on the spawning and rearing environment may in turn impact the expression of many life-history traits and masked or exaggerated the distinctiveness of many stocks. The PS Salmon Stock Review Group (PFMC 1999) concluded that reductions in habitat capacity and quality have contributed to escapement problems for PS chinook salmon. It cited evidence of direct losses of tributary and mainstem habitat due to: (1) dams; (2) loss of slough and side-channel habitat caused by diking, dredging, and hydromodification; and (3) reductions in habitat quality because of land management activities.

Estuaries and marine shorelines provide critical habitat for rearing and outmigrating salmonids.

Recent studies have found that approximately 30% of the shoreline in the state has been armored, with approximately 1.7 miles of Puget Sound shoreline being armored each year (WDNR 2001; Canning and Shipman 1995b).

Marine Environment

This area includes intertidal and shallow subtidal habitats, which are some of the most productive marine areas and are particularly important for early rearing of many species including juvenile salmonids. Deeper areas directly adjacent to the proposed pier are also included in the project area out to a depth of about 200 feet. The following description of the action area is a broad-scale overview:

The project area is situated on the eastern shoreline of the central basin Puget Sound. The three closest major river systems are the Green/Duwamish, Lake Washington, and Snohomish River systems, roughly 16, 9, and 14 miles from Edmonds, respectively. Typical to most areas in Puget Sound, the shoreline is moderately steep, dropping off into waters deeper than 100 feet generally within 100 to 300 yards offshore. Prominent shoreline features in the action area include the Unocal Pier, Edmonds Marina and associated breakwater, the SR 104 stormwater outfall, the Edmonds Underwater park, and the existing ferry terminal. With the exception of the Edmonds Marina and associated breakwater, the shoreline in the vicinity of the project consist of generally fine to coarse sand, mixed with patches of gravels and scattered boulders. Eelgrass beds are present, ranging from sparse and scattered patches south of Point Edwards, to thick continuous beds north of the marina and existing ferry pier.

Prevailing winds are from the south, and the shorelines in the project area are generally oriented north-south with the exception of the cove formed by the Edmonds Marina breakwater. As a result, stormwaves hit the shoreline at a shallow angle most of the time, at least in the winter when waves are largest. Because of this, net longshore drift is in a northerly direction (Johannessen 1992) and should be fairly strong, considering the vectors. The Edmonds Marina breakwater forms the northern terminus of a drift cell (SN-3) starting adjacent to Seattle.

The Unocal Pier is a tall, very narrow pier. It was used for conveying oil and asphalt. The area surrounding the Unocal Pier includes a broad shallow bench that is intertidal to about two-thirds of the distance out to the end of the pier. Water depths drop off rapidly at that point (at minus 10 feet mean lower low water (MLLW)).

The marina breakwater consists of rock riprap. A public fishing pier built on concrete piles extends out beyond the breakwater. There is a stormwater outfall extending out from the south end of the marina breakwater that conveys stormwater from SR 104. The outfall is covered by riprap materials in a configuration that looks like a jetty at low tide. Willow Creek once discharged into Puget Sound in a location that is now the middle of the Edmonds Marina. Willow Creek was placed in a 1,275-foot long culvert under Admiral Way and Marina Beach Park when the marina was built.

A fully developed urban setting borders the existing ferry terminal. The Underwater Park, a marine sanctuary, is located on the north side of the existing ferry terminal pier. The Edmonds Marina breakwater lies a short distance to the south.

Eelgrass beds are very small and sparse in the vicinity of the Unocal Pier and are not present in the vicinity of the proposed footprint of the Point Edwards Pier. Most of the patches are on the south side of the pier between the minus10- and minus 20-foot MLLW contours. No eelgrass is present in the proposed pier alignment. Macroalgae, primarily *Ulva* and *Entermorpha*, are abundant in large patches adjacent to both sides of the Unocal Pier including the proposed pier alignment. Patches directly adjacent to the pier are in rocky/mixed sand-gravel depressions separated from deeper water by sand bars. The *Ulva* beds provide good cover for young-of-year Dungeness crabs and other intertidal fauna. Most of the macroalgae bands exist in the 0- to minus15-foot MLLW strata, but other deeper patches are present along the dropoff at minus 20 to minus 40 feet MLLW to the south side of the Unocal Pier. Algae attached to the breakwater include primarily *Fucus, Laminaria*, and *Nereocystis.*

The area near the existing ferry terminal and Dayton Street has expansive macroalgae and eelgrass beds. Macroalgae, including *Laminaria* and *Nereocystis*, are nearly continuous from the minus 5-foot contour to the minus 60-foot MLLW contour. The area directly offshore of and including the docking area of the existing ferry terminal is conspicuously devoid of eelgrass and macroalgae, probably as a result of propeller-induced turbulence. Macroalgae are mostly attached to tube worm cases in sandy areas, larger gravels in mixed substrate areas, and rocks as they occur. Eelgrass beds are continuous from the marina to the ferry pier, and from the ferry pier north through the underwater park and beyond. Depths range from about minus two feet to minus 20 feet MLLW in this band. Hard substrates in the underwater park provide abundant attachment surfaces for various macroalgaes, such as *Laminaria*, *Nereocystis*, and *Gracilaria*.

The nearshore area in Edmonds is thought to provide habitat during juvenile salmonid outmigration because of its location. Except for the Edmonds Marina, Unocal Pier, and Edmonds ferry pier, the shoreline is unobstructed sand and mixed fine beach for over 10 miles in either direction. This section of Puget Sound shoreline contains a nearly continuous, albeit narrow, eelgrass bed. Within the action area, habitat can only be considered to be fair due to the presence of the marina breakwater and piers. To the south of the marina, and excluding the Unocal Pier, is a broad shelf, and is considered good habitat. North of the marina, Olympic Beach is shallowly sloped and has abundant eelgrass but is lined with a seawall at 14 feet MLLW. The shorelines between Point Wells to the south and Mukilteo to the north represent relatively good habitat for juvenile salmon. The BNSF railroad, built on fill in the intertidal zone, runs along this entire shoreline. The shoreline is relatively impoverished, receiving less eroding bluff materials (sand and gravels), and thus is narrower and rockier than it would be otherwise. In addition to cutting off upland materials from nourishing beaches in the area, the BNSF railroad tracks form a vertical seawall at mid and high tides. This is thought to increase juvenile salmon vulnerability to predation due to their propensity to migrate in shallow water against the shore.

Freshwater Environment

The freshwater environment in the project area consists of two small perennial streams (Willow Creek and Shellabarger Creek) and Edmonds Marsh, a 23-acre wetland system. The marsh is actually a complex of salt marsh and freshwater wetland. An approximate 0.02-acre seep wetland is located on the bluff hillside between the upper and lower Unocal yards and two detention basins associated with the Unocal site.

Willow Creek is a small perennial suburban stream in the southern portion of the project area. It is a second-order perennial stream with salmonid utilization below Pine Street and a perennial stream, without salmonids, above Pine Street. Base flow statistics are not available, but seasonal low flow is estimated to be on the order of about 0.1 to 0.5 cubic feet per second at the mouth. Observed flow in June 1995 was about 1.5 cubic feet per second (CH2M HILL 2003).

Willow Creek historically meandered through Edmonds Marsh, but was relocated to its current channel in the 1950s when the Unocal detention basins were constructed (CH2M HILL and Adolfson 1995a). Willow Creek now discharges from a culvert into Puget Sound at Marina Beach Park.

Shellabarger Creek is a small, perennial urban stream flowing west out of a heavily developed residential area of Edmonds. It is a first-order stream with a moderate-to-high gradient and numerous partial blocks. Shellabarger Creek runs through backyards and between buildings to join with Willow Creek in the middle of Edmonds Marsh. The lower portion of Willow Creek and the associated salt marsh (Edmonds Marsh) is tidally influenced as a result of the removal of the tide gates at the stream's outfall into Puget Sound.

Edmonds Marsh, formerly known as Union Oil Marsh meets the criteria for a Category 1 wetland under the City of Edmonds Sensitive Areas Ordinance. Those regulations currently require a 100-foot-wide buffer for all Category 1 wetlands and a 6 to 1 replacement ratio for loss of Category 1 wetlands.

The marsh is hydrologically supported by Willow and Shellabarger Creeks and stormwater runoff from surrounding properties. A tide gate at the outflow of Willow Creek into Puget Sound is permanently open to allow tidal influence in the western portion of this marsh and to create a brackish environment.

<u>2.1.3 Status of Species</u>

Puget Sound chinook salmon were listed as threatened under the ESA on March 24, 1999 (64 FR 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; 1998b). Critical habitat is not designated for PS chinook.

Chinook salmon are the largest of the Pacific salmon (Netboy 1958), and exhibit the most diverse and complex life history strategies of all salmonids. Healey (1986) described 16 age categories for chinook salmon, seven total ages with three possible freshwater ages. Two generalized freshwater life-history types were initially described by Gilbert (1912): "stream-type" chinook salmon that reside in freshwater for a year or more following emergence; and "ocean-type" chinook salmon that migrate to the ocean within their first year. Healey (1983) has promoted the use of broader definitions for "ocean-type" and "stream-type" to describe two distinct races of chinook salmon. This racial approach incorporates life history traits, geographic distribution, and genetic differentiation and provides a valuable frame of reference for comparisons of chinook salmon populations. The generalized life history of chinook salmon involves incubation, hatching, and emergence in freshwater, migration to the ocean, and subsequent initiation of maturation and return to freshwater for completion of maturation and spawning. Some male chinook salmon mature in freshwater, thereby foregoing emigration to the ocean.

The Puget Sound ESU historically consisted of 31 quasi-independent populations of chinook salmon. Twenty-two historical independent populations are still extant. Thirteen historical spawning aggregations are know to be extirpated (PSTRT 2001 and 2002). The populations that are presumed to be extirpated were mostly of early-returning fish, and most of these were in the mid- to southern parts of Puget Sound, Hood Canal and the Strait of Juan de Fuca. This ESU encompasses all runs of chinook salmon in the Puget Sound region from the North Fork Nooksack River to the Elwha River on the Olympic Peninsula. Chinook salmon are found in most of the rivers in this region. The boundaries of the Puget Sound ESU correspond generally with the boundaries of the Puget Lowland Ecoregion. Despite being in the rainshadow of the Olympic Mountains, the river systems in this area maintain high flow rates because of the melting snowpack in the surrounding mountains.

Chinook salmon in this area all exhibit an ocean-type life history. Although some spring-run chinook salmon populations in the Puget Sound ESU have a high proportion of yearling smolt emigrants, the proportion varies from year to year and appears to be environmentally mediated rather than genetically determined. Puget Sound stocks all tend to mature at ages three and four and exhibit similar, coastally-oriented, ocean migration patterns.

The most recent five-year geometric mean natural spawner numbers in populations of PS chinook ranges from 42 to just over 7,000 fish. Most populations contain natural spawners numbering in the hundreds (median recent natural escapement equals 481); and of the six populations with greater than 1,000 natural spawners, only two are thought to have a low fraction of hatchery fish. Estimates of historical equilibrium abundance from predicted pre-European settlement habitat conditions range from 1,700 to 51,000 potential chinook spawners per population. The historical estimates of spawner capacity are several orders of magnitude higher than realized spawner abundances currently observed throughout the ESU.

Previous assessments of stocks within this ESU have identified several stocks as being at risk or of concern. Long-term trends in abundance and median population growth rates for naturally spawning populations of chinook in Puget Sound both indicate that approximately half of the populations are declining and half are increasing in abundance over the length of available time series. The number of populations with declining abundance over the short term (eight of 22 populations) is similar to long-term trends (12 of 22 populations).

The artificial propagation of fall-run stocks is widespread throughout this region. Summer/fall chinook salmon transfers between watersheds within and outside the region have been commonplace throughout this century; thus, the purity of naturally spawning stocks varies from river to river. Nearly two billion chinook salmon have been released into PS tributaries since the 1950s. The vast majority of these have been derived from local returning fall-run adults. Returns to hatcheries have accounted for 57% of the total spawning escapement, although the hatchery contribution to spawner escapement is probably much higher than that because of hatchery-derived strays on the spawning grounds. The electrophoretic similarity between Green River fall-run chinook salmon and several other fall-run stocks in Puget Sound (Marshall *et al.* 1995) suggests that there may have been a significant and lasting effect from some hatchery transplants. Overall, the pervasive use of Green River stock throughout much of the extensive hatchery network in this ESU, may reduce the genetic diversity and fitness of naturally spawning populations.

Harvest impacts on PS chinook salmon populations averaged 75% (median=85%; range 31-92%) in the earliest five years of data availability and have dropped to an average of 44% (median=45%; range 26-63%) in the most recent five-year period (BRT 2003).

Overall abundance of chinook salmon in this ESU has declined substantially from historical levels, and many populations are small enough that genetic and demographic risks are likely to be relatively high. Both long- and short-term trends in abundance are predominantly downward, and several populations are exhibiting severe short-term declines. Spring-run chinook salmon populations throughout this ESU are all depressed.

Other concerns noted by the Biological Review Team (BRT) are the concentration of the majority of natural production in just two basins, high levels of hatchery production in many areas of the ESU, and widespread loss of estuary and lower floodplain habitat diversity and, likely, associated life history types. Populations in this ESU have not experienced the sharp increases in the late 1990's seen in many other ESUs, although more populations have increased than decreased since the last BRT assessment. After adjusting for changes in harvest rates, however, trends in productivity are less favorable. Most populations are relatively small, and recent abundance within the ESU is only a small fraction of estimated historical run size.

Through the recovery planning process, NOAA Fisheries will define how many and which naturally spawning populations of chinook salmon are necessary for the recovery of the ESU as a whole (McElhany *et al.* 2000).

2.1.4 Factors Affecting Species Environment within Action Area

The action area is defined as all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action (50 CFR 402.02 and 402.14(h)(2)).

The action area provides migration and foraging for PS chinook, and spawning habitat for chinook forage species *i.e*., herring, surf smelt, and sand lance. There are three major river systems within 16 miles of the Edmonds Crossing project. The Green/Duwamish, Lake Washington, and Snohomish River, respectively 16, 9, and 14 miles from the project area.

Physical habitat for the nearshore-oriented juvenile salmonids in estuarine environments such as chinook, pink, and chum salmon is largely a function of substrate composition. Substrate composition, in turn, is strongly influenced by proximity to various sediment inputs, exposure to wind (waves), and other physical processes. In general, sand and gravel come from eroding bluffs in Puget Sound and the finer materials deposited at or near the mouths of rivers. Habitat quality is, to a lesser extent, influenced by the amount of cover for refuge and connectivity between high-quality rearing environments. Substrate composition in Puget Sound has been shifting from sand and gravel shorelines toward gravel and cobble. The decline of bluff erosion in Puget Sound has reduced the input of these materials. Shoreline erosion processes have been altered as a result of shoreline stabilization measures such as bulkheads, leading to the impoverishment of finer grain materials in intertidal and shallow subtidal zones.

In the project area, the Burlington Northern/Santa Fe Railroad track bed has, for the most part, cut off these inputs, although landslide materials upland from the tracks are excavated and side-cast on the shore side of the right-of-way. Fine-grain substrates are habitat for many of the prey organisms that chinook salmon smolts preferentially feed upon during their estuarine rearing period. Eelgrass grows on fine-grain substrates in the action area and is recognized as an important habitat for juvenile salmonids and other organisms.

On an estuary scale, about 45% of central Puget Sound and 33% of all Puget Sound have modified shorelines (Puget Sound Water Quality Action Team [PSWQAT] 1998). At the embayment scale (vicinity within several miles), this factor is also at risk because of the expansive railroad seawall along the shoreline south of the action area (net longshore drift is to the north at the project site).

Beach slopes have been made steeper throughout Puget Sound as a result of nearshore filling and stabilization. This tends to shift substrate toward coarser particle sizes and adversely affects salmonids, as previously discussed. Steeper shoreline also provides less refuge for migrating juvenile salmonids, particularly the smaller smolts such as ocean-type chinook, by increasing their exposure to predation by larger fish. The beach slopes on an estuary scale and at the vicinity scale are not properly functioning because of the breakwater of the marina and the

Burlington Northern Santa Fe Railroad seawall.

Eelgrass and macroalgae provide a refuge function along shorelines in addition to substrate and shoreline slope. Eelgrass beds have been removed or degraded in many areas of Puget Sound because of nearshore filling and shoreline armoring. Vegetation and refuge on the estuary scale and in the project vicinity are functioning at risk because of nearshore fill, the marina, seawalls, and intertidal riprap.

The maintenance of clean, fine-grain substrates in the nearshore environment is conducive to the production of the preferred food used by chinook salmon smolts. Riverine sediment dynamics have been changed by dams and by altered hydraulic and hydrologic processes in many Puget Sound river systems. Many rivers carry substantially increased sediment loads because of urbanization and past forestry practices. The small local drainages deposit fine-grain sediments in the project vicinity. Sediment quality does not appear to be affected by the City's storm drains or from the Unocal property. Sediment inputs to the project vicinity from shoreline sources are impeded by the railroad right-of-way.

Sediment quality within the project vicinity is generally good. A recent sediment quality investigation around the Unocal Pier did not find contamination. However, the Edmonds Marina sediments are likely degraded because of past and present use as a boat moorage facility, and residential stormwater drainage in the area have led to a clam and oyster harvest closure in the vicinity, including Marine Beach Park.

Shoreline vegetation sources include shoreline trees and bushes, eelgrass and macroalgae beds, and salt marshes. Because salt marshes have disappeared from many locations in Puget Sound, eelgrass bed acreage has diminished over the years, and because of the importance of the detritus-based food web to chinook salmon smolts, the environmental baseline is not properly functioning for a number of reasons: (1) eelgrass beds have been reduced; (2) shoreline vegetation has been isolated because of the BNSF railroad right-of-way fill; and (3) much of the salt marsh habitat in Edmonds Marsh was lost when Willow Creek was put in a culvert at its mouth.

Riverine inputs of detritus come in the form of driftwood, decayed vegetation and, historically, salmon carcasses. Upland logging and development has reduced the detritus input to nearshore marine environments. Because of the loss of recruited vegetation that enters from the freshwater environment, the contribution of upland resources to the estuary have been reduced.

Estuarine function-related water quality refers to temperature and salinity parameters. These can be influenced by thermal discharges and by significant freshwater discharges into restricted estuarine systems. Puget Sound is strongly affected by natural freshwater inputs from rivers. The stratification that occurs in spring as a result of high runoff in the absence of strong tides allows plankton blooms to occur in Puget Sound.

Currents, whether tidally driven, wind driven, or from other physical processes, are important because they affect sediment transport, detritus, and flocculated organic material ("marine snow") deposition, and outfall mixing zone dynamics. A number of anthropogenic factors can change currents on a localized scale, such as large-scale tideland filling, jetties, piers, groins, channelization, and the propeller wash of large ships.

Current patterns in Puget Sound have not been altered by man's activities on a large scale. Longshore drift has been cut off by the Edmonds Marina jetty, and breakwater Propeller-wash-induced scour has also removed a substantial amount of eelgrass and macroalgae at the existing ferry terminal.

There are a number of predator/prey relationships modified by urban development. These include man-made structures that can concentrate juvenile salmonids, make them more vulnerable to predation, increase the number of predators, decrease the abundance of alternative prey for opportunistic predators, or cause harassment. A direct loss from fishing is a separate but related factor. Except for fishing, these are difficult topics to address because they are not well understood and are subject to an array of complex interactions.

2.1.5 Status of the Species within the Action Area

Adult chinook salmon are transient residents that are present for a very short time in the action area and are therefore, generally unaffected by the project (CH2M HILL 2003); therefore, they are addressed only briefly in this analysis. However, some individual blackmouth chinook are resident year round in Puget Sound, and therefore will be exposed to action affects. As a population, they can be found in the project area from May through November.

The following descriptions are from the BA (CH2M 2003):

In general, juvenile fall chinook are mostly offshore in Puget Sound by late August. However, recent studies show that at least some of these fish are still present in the nearshore area later in the year and potentially year-round. As a result, inwater work during the approved WDFW work windows does not completely exclude protected fish species from the area of construction activity. The likelihood that the presence of protected juvenile fish and construction activity will coincide, however, is greatly minimized by work window restrictions, which reduces the numbers of fish that may be present, and the vulnerability of the lifestage that will be affected.

Salmon stocks that may be present in the project area for variable lengths of time include runs originating from the Skagit and Stillaguamish. Most fish that could be present will be from the Snohomish, Cedar, Green, Puyallup, Nisqually, and Deschutes rivers and smaller drainage areas in central and southern Puget Sound. This discussion will focus on the salmonids originating in the Green-Duwamish river, Snohomish, and Lake Washington systems because fish from these river systems are likely to form the majority of juvenile salmonids likely to be present in the action area. The timing of the migrations of adult salmon of various species and various stocks through the central Puget Sound and their residence duration in the Edmonds vicinity is not precisely known. However, salmon generally arrive about two weeks to one month before entering natal rivers to spawn.

Certain salmonid species reside as juveniles for varying lengths of time in shallow waters along shorelines in Puget Sound. Species that are relatively large when they smolt and enter saltwater as yearlings, such as steelhead and coho, move offshore quickly. Species that are relatively small at seawater entry (ocean types), such as pink, chum and fall chinook salmon, stay close to shore and move offshore as they grow larger. They migrate along shorelines in central Puget Sound, moving north towards the open ocean as they grow. During this time, they are vulnerable to nearshore activities, construction impacts, and conditions resulting from altered shorelines.

Juvenile salmonids can be expected in nearshore marine waters as soon as their freshwater migration begins. Pink and chum salmon move directly into marine waters following emergence from spawning gravels in spring. Spawning areas for these species are usually low in river systems, so river migrations are usually short. Fall chinook usually take more time to move into nearshore areas and can be found into July and August.

While no specific studies were conducted to establish juvenile chinook occurrence in the action area, there is a high likelihood that they will be present in the action area based on other studies in adjacent shorelines (e.g., Parametrix 1985). During this time, they feed, grow, and migrate down the shoreline. Ultimately, they move offshore and out to sea through the Strait of Juan de Fuca or remain in Puget Sound to grow to adulthood.

Juvenile chinook rearing in estuaries feed on a variety of epibenthic, terrestrial, and pelagic food sources as they move along the shorelines. Generally, they tend to prey mostly on small epibenthic crustaceans, as they first enter the estuaries. However, they are opportunistic and shift to whatever suitable prey is available at the time. Juvenile chinook have been found to feed heavily on insects of terrestrial origin while residing in marine waters. As they quickly grow they tend to shift more to pelagic prey as their food source. Along the Edmonds shoreline, both epibenthic and pelagic prey are likely to be present. Epibenthic prey will be present in the sand and silt habitats, as well as on the algae that attach to cobbles and boulders. Pelagic prey are present in the upper water column along the Edmonds shoreline.

Green-Duwamish River System

Juvenile chinook from the Green/Duwamish system probably migrate along the Edmonds shoreline prior to moving offshore. The probability of this is high given the distance between the two points and the proximity of Edmonds in their presumed migratory route northward. Adult chinook also probably pass through the Edmonds area before they return to the Green-Duwamish River basin to spawn. However, adult chinook do not commonly pass directly along the shorelines in shallow water and are not known to use intertidal habitat.

Lake Washington System

Juvenile chinook from the Lake Washington system probably migrate along the Edmonds shoreline prior to moving offshore. The probability of this is high given the distance between the two points and the proximity of Edmonds in their presumed migratory route northward. Adult chinook also probably pass through the Edmonds area before they return to the Lake Washington system river basin to spawn. However, adult chinook do not commonly pass directly along the shorelines in shallow water and are not known to use intertidal habitat.

Snohomish River System

Juvenile chinook from the Snohomish system are unlikely to reside along the Edmonds shoreline in any numbers. The rationale for this is that their normal migratory path out to sea should, in general, be north and west towards the open sea. A prolonged migration south from Mukilteo would seem maladaptive. Nevertheless, some chinook of Snohomish River origin may spend some time in the project action area, perhaps carried southward with the tide.

Adult chinook destined for the Snohomish River may spend some time in the action area before they return to that river to spawn. Although this is outside their generalized migratory path, fish arriving early to Puget Sound may mill about the general vicinity while waiting for the desired time or conditions to enter the river mouth.

Willow Creek

Chinook do not use Willow Creek, although some have returned to the creek in the past as the result of an accidental release from the Deer Creek Hatchery (Stay, personal communication, as cited in BA). The creek is too small and does not have sufficient holding pools to be considered PS chinook habitat. Since the Deer Creek Hatchery does not currently produce chinook, there is no potential for escapees to attempt to naturalize in the stream.

2.1.6 Relevance of the Environmental Baseline to the Species' Current Status

Presently, because of degraded conditions (described in the preceding section) the environmental baseline does not meet the biological requirements of PS chinook. The status of PS chinook as a threatened species is in part a function of declining conditions in the species' environment. As described above, various anthropogenic features, such as modified floodplain, hardened banks and levees, disruption of hydrological processes, and decreased access to rearing areas have negatively influenced the biotic features necessary to support healthy populations of chinook. While other factors, such as ocean conditions, harvest levels, and natural mortality from predation and disease, influence the current status of this ESU, the baseline conditions contribute to the net effect of depressing the populations' viability. In order to improve the status of this ESU and contribute to the ability for PS chinook to recover, improvement in the habitat conditions over the baseline condition is necessary.

Within the action areas specifically, the biological requirements of chinook salmon are not entirely met, *i.e.*, nearshore habitat conditions overall are impaired. Long-term and recent declines in distribution and abundance of PS chinook may be attributed in part, to substantial fragmentation and simplification of habitat structure and distribution, and altered natural processes that route sediment and organic materials in the action area and throughout the watershed.

One of the factors believed essential to improve the status of chinook salmon is an improvement in habitat conditions. This means providing access to functional conditions necessary to support PS chinook life history expressions that are supported in the marine area, specifically shallow, vegetated intertidal habitat. The action area provides migration and foraging habitat for PS chinook, and spawning areas for chinook forage species, *i.e*., herring, surf smelt, and sand lance. The proposed action will result in short-term negative modification of nearshore habitat, but conditions will eventually improve over the baseline condition, through the WSDOT's removal of existing facilities that currently degrade habitat in the project action area.

2.2 Analysis of Effects

In this analysis, the changes resulting from the proposed action are expressed in terms of whether they are likely to restore, maintain, or degrade an element of functional PS chinook salmon habitat. By examining the effects of the proposed action on the habitat portion of a species biological requirements, NOAA Fisheries can gauge how the action will affect the population variables that constitute the rest of a species' biological requirements and, finally the effect of the action on the species (NMFS 1999).

2.2.1 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 actions that interrelated and interdependent with the action. Future Federal actions that are not a direct effect of the action under consideration (and not included in the environmental baseline or treated as indirect effects) are not evaluated.

Marine Environment

Impact driving of steel piles can produce intense sound pressure waves that can injure and kill fishes (*e.g.*, Longmuir and Lively 2001; Stotz and Colby 2001; Stadler, pers. obs. 2002). The injuries caused by such pressure waves are known as barotraumas, and include hemorrhage and rupture of internal organs, including the swimbladder and kidneys in fish, and damage to the auditory system. Death can be instantaneous, occur within minutes after exposure, or occur several days later. Fishes with swimbladders (which include salmonids) are sensitive to underwater impulsive sounds (sounds with a sharp sound pressure peak occurring in a short interval of time) because of swimbladder resonance, which is believed to occur in the frequency band of most sensitive hearing (usually 200 to 800 Hz) (Caltrans 2002). As the pressure wave passes through a fish, the swimbladder is rapidly squeezed due to the high pressure and then rapidly expanded as the underpressure component of the wave passes through the fish. At the high sound pressure levels (SPL) associated with pile driving, the swimbladder may repeatedly expand and contract, hammering the internal organs that cannot move away since they are bound by the vertebral column above and the abdominal muscles and skin that hold the internal organs in place below the swimbladder (Gaspin 1975). This pneumatic pounding may result in the rupture of capillaries in the internal organs as indicated by observed blood in the abdominal cavity, and maceration of the kidney tissues (Caltrans 2002). Hastings (pers. comm. 2003) also noted the differential vibration of the various tissues when the pressure wave passes through the fish can cause tearing.

Another mechanism of injury and death is "rectified diffusion," which is the formation and growth of bubbles in tissue caused by regions of high SPL. Growth of bubbles in tissue by rectified diffusion can cause inflammation and cellular damage because of increased stress and strain (Vlahakis and Hubmayr 2000; Stroetz, *et al.* 2001), and blockage or rupture of capillaries, arteries and veins (Crum and Mao 1996).

Hastings (2002) expects little to no physical damage to aquatic animals for peak sound pressures below 190 dB (re: 1 µPa), the threshold for rectified diffusion (Crum and Mao 1996) (*note: all decibel levels discussed hereafter will be with a reference pressure of 1 µPa*). Abbott (pers. comm. 2003) suggested that SPLs below 190 dB_{peak} would not kill fishes. However, much uncertainty exists as to the level of adverse effects to fish exposed to sound between 180 and 190 dB_{peak} due to species-specific variables. Turnpenny, *et al.* (1994) reported a mortality rate of 57% for brown trout (*Salmo trutta*), 24 hours after exposure to 90-second bursts of pure tones at 95 Hz at peak pressures below 173 dB. The authors suggested that the threshold for continuous sounds was lower than that for pulsed sounds such as seismic airgun blasts. This difference is thought to be due to the longer duty cycle of the pure tone bursts. The literature also suggests there may be adverse effects stemming from shifts in hearing, physical hearing damage, or equilibrium problems (Turnpenny, *et al.* 1994; Hastings, *et al.* 1996). Based on this information, NOAA Fisheries has established the threshold for physical harm at 180 dB_{peak} for this project.

Sound pressure levels expressed as "root-mean-squared" (rms) values are commonly used in behavioral studies. Sound pressure levels in excess of 150 dB_{rms} are expected to cause temporary behavioral changes such as elicitation of a startle response or behavior associated with stress. These SPLs are not expected to cause direct permanent injury, but, as discussed above, may decrease a fish's ability to avoid predators. Shin (1995) reports that pile driving may result in "agitation" of salmonids indicated by a change in swimming behavior. Observations by Feist, *et al.* (1992) suggest that sound levels in this range may disrupt normal migratory behavior of juvenile salmon. They also noted that when exposed to the sounds from pile driving, juvenile pink and chum salmon were less likely to startle and flee when approached by an observer than were those that were shielded from the sounds. Based on this information, NOAA Fisheries has established the threshold for behavioral disruption at 150 dB_{rms} for this project.

A combination of vibratory and impact driving is proposed for 100 36-inch, and 15 48-inch diameter hollow steel piles. Based on a limited set of hydroacoustic monitoring data for piles in this size range (Reyff 2003), NOAA Fisheries predicts that the highest sound pressures will result from impact driving the 48-inch piles, where pressures of up to 209 dB_{peak} and 195 dB_{rms}, when measured 10 meters from the pile, are expected. These pressures exceed the thresholds for injury and behavioral disruption. Of greatest concern is the peak pressure, which is 29 dB higher than the threshold value for physical injury, and are sufficiently high to present a lethal threat to fishes, as evidenced by the number of species, including salmonids, killed during impact driving of 24- and 36-inch diameter steel piles (*e.g.*, Longmuir and Lively 2001; Stotz and Colby 2001; Stadler, pers. obs. 2002; Blomberg pers. comm. 2003; Carman pers. comm. 2003; Desjardin, pers. comm. 2003). Vibratory hammers produce peak pressures that are approximately 17 dB lower than those from impact hammers, (Nedwell and Edwards 2002), yielding an estimated peak pressure of 192 dB. While these are above the threshold for physical injury (180 dBpeak), no fish-kills have been linked to the use of vibratory hammers. The lack of evidence does not mean that vibratory hammers are harmless, but they are, clearly, less harmful than impact hammers.

The sounds from the two types of hammer differ in not only in intensity, but in frequency and impulse energy (the rate at which the pressure rises) as well. Most of the sound energy of impact hammers is concentrated between 100 and 800 Hz, the frequencies thought to be most harmful to fishes, while the sound energy from the vibratory hammer is concentrated around 20 to 30 Hz. Additionally, during the strike from an impact hammer, the pressure rises much more rapidly than during the use of a vibratory hammer (Carlson, *et al.* 2001; Nedwell and Edwards 2002). Hubbs and Rechnitzer (1952) found that underwater explosions from black powder charges were less lethal to fishes than those from dynamite, even though the peak pressure was approximately twice as high. The difference was determined to be the much higher impulse energy of the dynamite.

Just as these two sounds are different, so are the behavioral responses of fishes to them. Most of the energy in the sounds produced by vibratory hammers is at the frequency of vibration, around 20 to 30 Hz, very near the range of infrasound (less than 20 Hz). Fishes have been shown to avoid infrasound, but not sounds at 150 Hz (Enger, *et al.* 1993; Dolat 1997; Knudsen, *et al.* 1997; Sand, *et al.* 2000), and habituation to the sound does not occur, even after repeated exposure (Dolat 1997; Knudsen, *et al.* 1997). These studies found that the response requires particle accelerations greater than 0.01 m/s^2, that the response to infrasound is limited to the nearfield (less than 1 wavelength), and that the fish must be exposed to the sound for several seconds to elicit the response. Since the sounds from vibratory hammers are very near the frequency of infrasound, and are of long duration, they may elicit an avoidance response (Carlson, *et al.* 2001). The response to impact hammers is, however, quite different. Fishes may react to the first few strikes of an impact hammer with a “startle” response. After these initial strikes, the startle response wanes and the fishes may remain within the field of a potentially harmful sound (Dolat 1997; NOAA Fisheries 2001b). The sounds from impact driving of steel piles have too little energy in the infrasound range and are too brief to elicit the avoidance response (Carlson, *et al.* 2001). Thus, impact hammers may be more harmful than vibratory hammers for two reasons: first they produce pressure waves with greater potential to harm fishes and second, the sounds produced do not elicit an avoidance response in fishes, which will expose them for longer periods to those harmful pressures.

Most reports of fish-kills associated with pile driving are limited to those fishes that were immediately killed and floated to the surface. However, physical harm to juvenile salmonids is not always expected to result in immediate, mortal injury – death may occur several hours or days later, while other injuries may be sublethal. Necropsy results from Sacramento blackfish exposed to high SPLs showed fish with extensive internal bleeding and a ruptured heart chamber were still capable of swimming for several hours (Abbott and Bing-Sawyer 2002). Sublethal injuries can interfere with the ability to carry out essential life-functions, such as feeding and avoiding predators.

Small fishes that are subjected to high SPLs may also be more vulnerable to predation, and the predators themselves may be drawn into the potentially harmful field of sound by following injured prey. The California Department of Transportation (cited in NOAA Fisheries 2003) reported that the stomach of a striped bass killed by pile driving contained several freshly consumed juvenile herring. It appears this striped bass was feeding heavily on killed, injured, or stunned herring as it, too, swam into the zone of lethal sound pressure. Due to their piscivorous nature, adult salmonids may be drawn to an area of dangerously high SPL by the smaller fishes that are injured or killed.

Not all fishes killed by pile driving float to the surface. At the Port of Vancouver, BC, divers found a large number of dead fishes, including salmonids, had sunk to the bottom (Desjardin, pers com). Teleki and Chamberlain (1978) found that up to 43% of the fishes killed by underwater explosions sank to the bottom. With few exceptions, fish-kills are reported only when dead and injured fishes are observed at the surface. Thus, the frequency and magnitude of such kills may be underestimated.

The effects to fishes of the high SPLs produced by impact driving of steel piles depend on several factors, including the size and species of fish. At Bremerton, WA, approximately 100 surfperches (*Cymatogaster aggregata, Brachyistius frenatus* and *Embiotoca lateralis*) were killed during impact driving of 30-inch diameter steel pilings (Stadler, pers. obs. 2002). The size of these fish ranged from 70 mm to 175-mm fork length. Dissections revealed that the swimbladders of the smallest of the fishes (80mm FL) were completely destroyed, while those of the largest individual (170mm FL) were nearly intact. Damage to the swimbladder of *C. aggregata* was more was more severe than to similar sized *B. frenatus*. These results indicate size and species-specific differences. These results agree with those of Yelverton, *et al.* (1975) who found size and species differences in injury from underwater explosions. Due to their size, adult salmon can tolerate higher pressure levels (Hubbs and Rechnitzer 1952), and injury rates are expected to be less than that of juvenile fish.

The potential for injury to fishes from pile driving depends on the type and intensity of the sounds produced. These are greatly influenced by a variety of factors, including the type of hammer, the type of substrate and the depth of the water. Firmer substrates require more energy to drive piles into, and produce more intense sound pressures.

To minimize the potential risk to juvenile and adults of PS chinook, the FHWA has agreed to a number of conservation measures, including restricting inwater work to the approved work window, and program of hydroacoustic monitoring of the underwater SPLs for a subset of the piles during impact-driving, and deployment of a bubble curtain if the sound pressures exceed 150 dB_{rms} for more than 50% of the impacts, or ever exceed 180 dB_{peak} during the monitoring phase. Deployment of a bubble curtain is expected to attenuate the peak SPLs by approximately 20 dB (a 90% reduction in sound energy). With a bubble curtain, SPLs are estimated at approximately 189 dBpeak and 175 dBrms. Because these SPLs exceed the established thresholds, some low level of take may still occur, and the distance at which transmission loss (TL) attenuates the pressures to below the thresholds must be estimated. Calculating TL is extremely complicated, and is likely to be site-specific. In shallow water, a cylindrical spreading model of TL (TL = 10*Log ®), where R = range) will be more conservative (for the species) than a spherical model (TL = 20*Log®) (Greene pers. comm. 2003), but will likely give unrealistic ranges for effects. Reyff (2003) provided hydroacoustic monitoring data which suggest that the actual spreading loss may be intermediate between cylindrical and spherical spreading. Therefore, a practical spreading loss model, as described by Davidson (taken from internet, 2004), where TL = 15*Log®), was used to estimate the distances at which injury and behavioral disruption are expected. Using this model, physical injury to sensitive species and life-history stages may occur up to 40 m from the pile driver, and behavioral effects up to 484 m. However, studies on pile driving and underwater explosions suggest that, in addition to attenuating peak pressure, bubble curtains also reduce the impulse energy and the resulting potential for injury (Keevin and Hempen 1997; Desjardin pers. comm. 2003). Additionally, sound pressure attenuates more rapidly in shallow water (Rogers and Cox 1988). As a result, the actual range of deleterious effects may be considerably smaller than estimated.

Although the FHWA has proposed the conservation measures described above, it is likely that the science and technology surrounding this issue will change before pile driving begins. Therefore, NOAA Fisheries expects that the actual measures implemented by the FHWA will be different from those proposed, but will offer the same, or greater, protection for ESA-listed salmonids.

Temporary turbidity will be caused by suspended sediments during pile and pile driving and pile removal activities. Turbidity impacts will be relatively minor and will last only a matter of hours or a few days, because tidal exchange quickly disperses turbid water. The veneer of silt deposition in adjacent areas near these types of activity is typically very thin, perhaps 1/4 inch or less. Studies in Puget Sound have shown that benthic invertebrates and fish are unaffected by rapid sediment deposition of less than a few centimeters (Hirsch *et al.* 1978). Most benthic animals can burrow out of such shallow sediment deposits (Maurer *et al.* 1978).

The direct loss of migration and foraging habitat from piling and associated structures (dolphins, transfer span supports, emergency barricades) was evaluated by calculating the cross-sectional area of new pilings compared with the pilings removed and the Unocal Pier and the existing ferry pier. The new pier and associated structures result in a net permanent loss of 8,893 square feet of bottom.

However, as part of the Unocal Pier removal, the riprap shoreline under the pier will be removed. The shoreline will then be pulled back and restored to match the contours of the adjacent shorelines. And removal of the wooden portion of the existing ferry pier will leave a portion of the structure (the part with a concrete and earthen fill foundation) for the future construction of a marine interpretive center. Removal of the wooden pier will also eliminate the potential offshore diversion of juvenile salmonid at this location.

In addition, the shoreline and shallow subtidal areas out to minus 30 feet MLLW will be restored to their natural slope and contours with clean fine sand suitable for eelgrass. Eelgrass will be planted through this area for a net increase of 2.6 acres of eelgrass meadow. The probability for reestablishment success at this location is high. This action also increases habitat connectivity between two eelgrass beds divided by the ferry terminal and shallow sub-tidal propeller-wash-induced scouring action of the ferries. Macroalgae beds will be reestablished in the nearshore area currently barren due to propeller-wash scour at depths below those of the eelgrass plantings. This will start at the minus 30 feet MLLW contour and extend out to minus 50 feet MLLW covering an area of approximately 164,201 square feet or 3.8 acres. A method that could be used is to scatter six to eight-inch rock at a density of two or three pieces per square meter. This will greatly improve the process of initial colonization of macroalgae.

Lastly, minimization of effects to migrating salmon include an unique, split ferry pier at Point Edwards that is specifically designed to facilitate unobstructed under-pier passage for migrating juvenile salmonids without offshore diversion. The pier will be split into three parallel elements, with gaps between them to allow for light to penetrate between the decks. The underside of the decks will be painted with reflective paint to take full advantage of light reflected upwards from the water at the underside of the decks. The wide spacing of pilings allows for better light penetration and provides less obstruction to longshore drift. The WSF's expect shoreline migrating juvenile salmon to pass under rather than around the pier as a result of lighting conditions. The relatively deep water at the end of the pier reduces propeller-wash scour-related effects and reduces the need for armoring the base of the outside pilings.

Freshwater Environment

Short-term construction impacts to Willow Creek will be primarily water-quality related. Turbidity-related impacts might affect coho spawning or rearing habitat downstream of the Pine Street culvert as a result of culvert upgrades. Stormwater runoff from construction areas will be contained and managed according to Temporary Erosion and Sediment Control (TESC), and Spill Prevention, Containment and Countermeasures Plan (SPSCC) management plans, approved by WDOE through the issuance of the Federal Clean Water Act section 401 permit. However, because construction will span up to three years, there is a risk of a breach of containment. Sedimentation is the primary risk; some temporary elevated sediment loading might occur at times because the amount of earthwork involved. However, most of the earthwork is downstream of the areas of good habitat (around the Deer Creek Fish Hatchery). The only construction activity upstream of the Deer Creek Fish Hatchery will be the road-widening and culvert replacement at Pine Street. Because of the proximity of the water supply intake of the

Deer Creek Fish Hatchery, a temporary collection and conveyance system might be required during construction to maintain a constant flow of sediment-free water to the hatchery. The solution to the hatchery water supply issue is relatively simple and does not constitute an impact. The areas of the creek having the most risk of sediment-related impacts are adjacent to the existing Unocal detention pond and downstream. This reach is of very poor habitat quality for salmonids and other fish species. The bottom materials in this reach are already 100% silt and sand, which are relatively unproductive for salmonids in stream systems. All appropriate BMPs will be implemented to preclude sedimentation impacts and are listed in the project description.

Temporary sediment-related impacts might occur in the lower reach of Willow Creek during transition to the new channel. The new channel section will be allowed to stabilize for roughly one year prior to its connection with Willow Creek and subsequent conveyance of stream flows (at first during low flow conditions). All earthen areas will be stabilized with either vegetation, jute mat, mulch, or other erosion control measure, before this time. Adding meanders and LWD to the channel reach upstream of the terminal and parallel to the BNSF will require streambank alteration and stabilization measures. Some sediment input is unavoidable. The end result will be an improvement in habitat quality. Since this is a migratory corridor and virtually no salmonid spawning or rearing occurs in this reach, the impact is expected to be minimal to PS chinook.

Some oils, grease, and related materials may enter Willow Creek at elevated loading rates during construction if stormwater control facilities fail. A SPCC plan, fully implemented, will minimize the risk of fuel, oil, or lubricants entering the stream and adjacent wetland.

The relocation of Willow Creek will result in a net increase in open channel (1,150 feet) and loss of culvert length (1,125 feet). All appropriate channel habitat enhancement features such as large woody debris, boulder placements, and riparian vegetation planting will be incorporated into the newly built stream channel. Riparian plantings will utilize native species and maintained, promoting overwater cover. Spanning logs will also help to achieve this function.

The lower Willow Creek reach will be rehabilitated from its present highly degraded condition. This reach is essentially a channelized ditch with no riparian vegetation other than grasses. The channel will be modified so it will meander slightly and will receive the complexity in the form of gravels, LWD, and boulders.

Two partial salmon passage blocks will be removed. The 1,275-foot-long outlet culvert will be abandoned as the outlet for Willow Creek and subsequently used as the terminal's stormwater outfall. The creek will discharge to the sound from an open channel below 6.0 feet MLLW, above which will be a large box culvert set deep into grade extending for 150 feet under the BNSF Railroad tracks.

Salt marsh function will be restored to the Edmonds Marsh by opening up the restrictive culvert. Substantially more saltwater will flow upstream and into the marsh each day with the tides. Salt marshes are one of the most productive estuarine environments and have suffered the greatest losses from development over the years. Salt marshes are very limited in central Puget Sound and thus highly desirable to restore or enhance.

The WSDOT's proposed project will cause the permanent loss of approximately 6.3 acres of upland forest consisting primarily of mixed deciduous coniferous forest dominated by Douglas fir, bigleaf maple, western red cedar, red alder, and grand fir. Approximately 800 square feet of the riparian corridor of Willow Creek, above the Deer Creek Fish Hatchery, will be lost through realignment of the SR 104/Pine Street intersection. However, this project will reduce the amount of Willow Creek that is confined to culverts as a result of this project. Consequently, there will be a net gain in riparian habitat following construction.

The project will plant native shrubs and trees along the margins of the realigned SR 104 to offset for the loss of forested habitat associated with construction and to buffer surrounding habitats from human activity and glare associated with operation of the new multimodal center facility.

The project will replace snags and other woody debris within the wetland to enhance the vegetative complexity of the habitat as soon as possible following construction and enhanced vegetated wetland buffer will be established along Edmonds Marsh by planting desirable native species, removing non-native invasive species, and replacing snags and large woody debris. These measures will enhance water quality and sediment trapping functions of the wetland and buffer area.

2.2.2 Indirect Effects

Indirect effects are those effects that are caused by or will result from the proposed action and are later in time, but are still reasonably certain to occur (50 CFR 402.02). Indirect effects might occur outside of the area directly affected by the action. These actions must be reasonably certain to occur, or be a logical extension of the proposed action.

For this project the indirect effects include changes in future food resources, foraging areas, refuge, and other factors impacting habitat quality, including increased human activity from greater opportunity for human access to the streams.

Marine Environment

The suspension and the deposition of sediments from pile driving, pile removal, and replacement of the marina breakwater, will impact the area under the new ferry pier. The area of disturbance will be approximately the same as the surface area of the new pier. Substrate materials may be mixed somewhat under the pier and may shift in composition temporarily to mixed substrate, then settle back to sand if the existing underlying substrate includes coarse materials. The WSDOT's removal of pilings at the existing terminal and the Unocal Pier will also mix and disturb substrates. The exact surface area cannot be determined but is likely to be on the order perhaps a third, to a half, of the surface area of the two piers (about 16,000 to 24,000 square feet). The disturbed area, most of which is composed of shell hash, will stabilize over a period of one to three years (depending on seasonal storm severity), eventually returning to the same character as the adjacent habitat.

The primary biological impact of replacing the existing Unocal Pier with the proposed pier will be that a greater area of the seafloor will be shaded. It is assumed for this analysis that all areas that will be shaded currently support eelgrass or macroalgae, and that shading will cause the complete loss of those resources within that footprint. Eelgrass beds are very sparse in the vicinity of the Unocal Pier; none will be lost as a result of construction of the new Point Edwards ferry pier.

Macroalgae losses at Point Edwards from shading will be 17,992 square feet. Considering only shading effects, the proposed habitat restoration of removing the existing ferry pier results in potential net gain of 11,928 square feet of eelgrass and a net loss of 17,173 square feet of macroalgae (mostly *Ulva*).

However, shading is not the exclusive source of impacts to eelgrass at the Edmonds ferry terminal. Propeller-wash from the ferries, rather than shading, is the primary factor for eelgrass and macroalgae losses at the Edmonds Ferry Terminal. Shifting propeller scour impacts from the existing ferry terminal to the proposed Point Edwards site will provide net benefits to marine habitat. The size of the area affected by the existing Edmonds ferry terminal is readily apparent in Figures 15 and 16 of the BA by examining the shape of the eelgrass and macroalgae beds. By ending operations at the existing terminal and restoring bottom contours with appropriately sized materials and planted with eelgrass out to a depth of -30 feet MLLW, about 232,662 square feet or 5.3 acres of ocean bottom could be restored with eelgrass and macroalgae. Since almost all of the seafloor at Point Edwards is too deep for propeller scouring, propeller-wash impacts at the new terminal will be minimized.

The planned eelgrass enhancement will result in a net gain of 112,033 square feet or 2.6 acres, assuming 100% successful restoration. Although eelgrass restoration projects are not always successful, the likelihood of success is very high at the existing ferry dock because this location was once part of a continuous bed, indicating that conditions would support efforts to re-establish eelgrass plantings. Prior to construction, an eelgrass planting and monitoring plan will be prepared in accordance with the WDFW Hydraulic Permit Approval (HPA) requirements. Monitoring will be conducted for at least four years.

The combined increase in macroalgae habitat assumes that this habitat can be reestablished at the existing ferry terminal to create a continuous bed that joins the two beds present on each side of the dock. The net increase will be 130,051 square feet or 3.0 acres, or approximately a ratio of five to one.

Together, eelgrass and macroalgae restoration amounts to a net gain of approximately 242,084 square feet or 5.6 acres of vegetated subtidal habitat due to the proposed project. This is a replacement ratio of seven to one for macroalgae and eelgrass combined. This benefit is further amplified because two disconnected eelgrass/macroalgae beds will be rejoined, reestablishing habitat connectivity.

The wood pilings of the Unocal and existing ferry piers are heavily encrusted with barnacles and mussels. Barnacle/mussel clusters, which can be 8 inches thick, form a substrate supporting a rich community of organisms including amphipods, various worms, and crustaceans, and ultimately support larger shrimp, crabs, and fish living among the piles. This will be removed when the two piers are removed. However, a comparable community will become established on the piles of the new ferry pier within one year, with full recovery within a period of five to ten years.

The Point Edwards Pier will provide 16,324 square feet of new surface for this type of community, in a 6-foot vertical band on each piling within the intertidal zone. However, the proposed conservation measure of removing the two existing piers will remove 26,732 square feet. As a result, there will be a net loss of 10,408 square feet of barnacle/mussel community. The significance of this loss is unknown, however, as this type of habitat is not generally thought of as being used by juvenile salmonids. In addition, some biologists have suggested that piling communities support predators (e.g., stoutfish) that may then forage in adjacent eelgrass communities in greater numbers (CH2M HILL 2003).

Another issue related to benthic community alteration is the substrate changes that result from barnacle shell fall-out from the pilings. Barnacle and mussel shells (sometimes called shell hash) accumulate around the base of pilings in a "halo"or ring. This alters the biological community's character in this localized area. Whether or not this constitutes an impact is debatable, however, because there is also a "rain" of biological materials from above, feeding the benthic community below. The surface area of "halos" was estimated for the Unocal and existing ferry piers and predicted for the proposed new pier at Point Edwards. The project will result in less barnacle debris impact (9,439 square feet less).

As part of this project, WSDOT will remove 834 creosote-treated wood pilings and replace them with 288 steel pilings. The long-term consequence of this action cannot be quantified but can be viewed as beneficial by improving sediment and water quality.

There is some concern among biologists that piers may cause higher predation mortality rates in juvenile salmonids by diverting them away from shoreline shallows into deeper waters along pier perimeters. Tall narrow piers, such as the existing Unocal Pier, may either create a partial seaward diversion of juvenile salmonids, principally fall chinook, pink, and chum salmon migrating along the shoreline, or not affect them at all. Research at the Manchester Navy fuel pier, a pier similar in construction to the Unocal Pier, indicated that about one-half of the juvenile salmon (chum) swam under the pier and one-half swam around the end of the pier (Dames and Moore 1994). Larger, wider piers that are darker underneath tend to discourage under-pier passage and tend to guide small juvenile salmon around the periphery of the pier where predators may have more opportunity to feed on them. The dynamics of shading and migratory avoidance by juvenile salmonids are poorly understood, and the significance of a brief diversion offshore along a pier apron is unknown. A pair of studies (a literature study and a field study) were conducted on behalf of WSF to elucidate the issue and perhaps end the controversy (Simenstad *et al.* 1999; Shreffler and Moursund 1999). The literature study found no documentation of impacts but warned that this did not provide the basis for conclusions. The field study was compromised by the premature loss of 98% of the test fish. No observations of the remaining 1,300 fish indicated that fish were put at risk from coming into contact with a pier structure. The conclusion made was that "the fundamental question of whether ferry terminals are a 'barrier' to juvenile salmon migration remains unanswered" (Sheffler and Moursund 1999).

In response to this unknown factor and the recent listing of PS chinook, WSDOT redesigned the ferry pier at Point Edwards to facilitate under-pier and longshore passage. The principal design element of the ferry dock will be three separate parallel piers instead of one continuous pier. This design will leave gaps between piers for lighting purposes. Reflective paint will be painted on the underside of the pier to further maximize light under the pier.

Juvenile salmon are known to migrate along shore in relatively shallow water, usually two to 10 feet deep. The gap in the pier has been situated to accommodate the longshore migratory corridor as it changes with the tide. In other words, the length of the gap in the pier provides a 5-foot deep migratory corridor from minus 5 feet MLLW to plus 11 feet MLLW.

Impact analysis on fish passage is difficult because the presumption of negative impact is based largely on conjecture and because the proposed design to alleviate this condition is unprecedented. If the assumption is made that many of the juvenile salmon, including chinook, will pass under the pier, then impacts can be expected to be negligible. If some or all of the juvenile salmon traveling along the shoreline are diverted around the pier despite the design changes, minor impacts are possible, although unknown.

As additional habitat restoration, the existing ferry pier will be dismantled and removed. This will restore the longshore migratory corridor at the existing ferry terminal.

Freshwater Environment

The Point Edwards alternative proposed by the WSDOT will reconfigure and relocate the lower 1,360 feet of Willow Creek. At different stretches, this section of creek is now either a mud-bottomed ditch of very low habitat quality or in a 1,275-foot-long culvert. This section of stream has almost no habitat value for salmonids other than as a migratory corridor. The existing 1,275-foot-long culvert is considered to be a partial block to migrating adult salmon due to its length and because the outlet frequently becomes blocked by sand. Gradient is not a factor here because the slope of the culvert is very gradual.

The new configuration for Willow Creek will significantly improve salmon passage and improvement in habitat quality for salmonids. The new configuration replaces the 1,275-foot long culvert with a 150-foot long culvert. A 40-foot long culvert (corrugated metal pipe) will be removed and a 30-foot long culvert will be installed (bottomless arch or box) for service access to the terminal. Also, two 20-foot wide footbridges will be placed in front of the terminal. None of these will pose any impediment for salmon passage. Aquatic insect (food) production will increase because more of the channel will be open and will have riparian vegetation.

By replacing the current culvert outlet to Puget Sound with an open channel in the intertidal zone, the periodic blockage problem will be solved. The enlarged culvert size will allow for a freer exchange of saltwater into the salt marsh. This will enhance the ecological functions of this environment and probably enlarge the size of the salt marsh as well. A tide gate will be installed at the railroad culvert, but will generally be left open at all times. The only condition under which the tide gate will be closed will be during extreme high tides that would otherwise flood the low-lying commercial area just to the north of the salt marsh. This will amount to a closure for 3 to 4 hours during a few days per year or less.

During the past year, Unocal has undertaken remedial actions to clean up polynuclear-aromatic-hydrocarbon (PAH) contamination in the lower yard, where the stream relocation will. This area has been undergoing cleanup by Unocal for a number of years and will be "clean" before stream relocation construction will begin. However, it is recognized that there are varying levels of "clean" and the final level of cleanup (to commercial/industrial) levels may not be viewed as clean enough to come in contact with an open stream-channel. Of course, the contaminated groundwater has contact with the stream, and has for many decades. Depending on how WDOE and other state resource agencies view the situation, a backup plan has been proposed for isolating the stream channel from groundwater in this new lower reach. If determined necessary during consultation, a 30-mil PVC liner in conjunction with a concrete channel could be placed under a normal earth/rock/gravel inset channel and still support normal biological processes such as riparian community growth. Because it is uncertain at this time as to whether or not a liner will be needed, a detailed design has not been prepared. A containment feature such as a liner will have a significant influence on design.

Currently, the culvert at Pine Street partially blocks salmon migration due to its steep gradient. The Deer Creek Hatchery water intake weir also blocks passage at this location. The new culvert at Pine Street will be a significant improvement with its bottomless arch design and simulated stream channel form. The design will follow WDFW's simulated stream channel design guidance given in their culvert design manual (WDFW 2002).

Long-term water quality impacts to Willow Creek will be offset by first treating the stormwater prior to discharging directly to Puget Sound. Stormwater from the facility will be detained and treated. The oil, grease, and heavy metals will be removed using approved water quality BMPs prior to discharge. The system will use the existing Willow Creek outfall following abandonment, thus eliminating the need to construct a new conveyance system.

Harassment of fish and wildlife is an issue because of the large number of people coming in close proximity to Willow Creek. The creek will be running through the area out in front of the terminal. The harassment will be kept to a minimum by the establishment of a riparian buffer, which will be approximately 10 to 20 feet wide. The riparian buffer will be irrigated and managed as both a visual amenity and as shade/overhead cover for the creek. The channel will have numerous in-channel vertical and horizontal surfaces for fish to hide up against and under in the form of inwater LWD and large boulders. There will also be numerous channel-spanning logs for overhead cover. As a result, there should be ample cover to allow fish to avoid human disturbance.

Willow Creek does not support a consistent run of coho, other than hatchery origin. The proposed project will improve the possibility of sustaining a small naturalized run by opening up the outlet and restoring passage at Pine Street. This rehabilitation will assist in a meaningful recovery effort in Willow Creek.

The project will have approximately 20.0 acres of impervious area in the built condition, of which 10.6 acres will be new. Approximately 3.6 acres of the net new impervious surface area occurs west of the railroad tracks and approximately 7.0 acres east of the railroad tracks. The proposed method of stormwater treatment will be to construct a stormwater pond or wetland northeast of the multimodal center parking area. As currently planned, all of the outflow from this treatment facility will discharge directly to Puget Sound using the abandoned Willow Creek culvert outfall.

As more native vegetation is removed and natural landscape is converted to impervious surface, changes in water quality and hydrology become more apparent on habitat. Stormwater treatment facilities, in addition to other minimization measures, can reduce those changes in water quality and quantity if they are designed and implemented properly. In addition to proper design, all stormwater BMPs and facilities must be regularly maintained to assure proper operation to avoid and minimize impacts to receiving waters that provide habitat for salmonids.

The extent to which chinook experience adverse effects from impervious surfaces depends on several factors, *e.g*., the amount and location of land conversion, the vegetative condition of riparian or shoreline, and the BMPs implemented to offset any new impervious surface. To offset potential effects of land clearing and new impervious surface, the stormwater treatment system was designed to minimize water quality impacts of the facility. Stormwater treatment will be provided for runoff from all of the new pollution-generating impervious surfaces created by project construction and will be accomplished using facilities designed to an equivalent standard of the 2001 WDOE Stormwater Manual. The new impervious surface areas will effectively replace existing impervious surface areas on the Unocal site. All treated stormwater will be discharged directly into Puget Sound.

The WSDOT will incorporate into the project measures to minimize changes in hydrology caused by the new impervious surface built under the proposed action. These measures provide for both stormwater quality treatment and infiltration following quality treatment. These measures include creating stormwater treatment facilities designed to detain and treat stormwater transmitted from the road improvement project prior to discharge into marine waters. Detention basins will provide some infiltration where precipitation will percolate stormwater to groundwater. On balance, there are few expected effects of added impervious surface and stormwater treatment to fish habitat in the action area because WSDOT will re-vegetate with native plants where feasible, and use permanent stormwater BMPs.

Overall, beneficial effects of the project include the removal of creosote pilings and the removal of the existing Unocal Pier. Creosote contains polyaromatic hydrocarbons (PAHs) which have properties toxic to fish and other marine life. Removal of creosote-treated pilings would eliminate a potential source of water and sediment contamination in the nearshore environment, which will benefit listed marine mammals and their prey species within the action area. In addition, removal of the existing ferry terminal will reduce shading within the area and improve habitat conditions for eelgrass and macroalgae growth. Improvements in this nearshore habitat may augment fish use, thereby enhancing the available prey base for bald eagle and marine mammals within the area. Improvement to Willow Creek may potentially increase salmon and other fish presence within the system.

It is expected that development within and near the City of Edmonds will increase as a result of the proposed project. Future plans call for further development of the Unocal property after the proposed project. The development is expected to include construction of a 90-room hotel and approximately 120 condominium residences on the slopes above the proposed multimodal center. Development of the Unocal property would likely remove the majority of the upland deciduous forest, and parts of the upland mixed forest on the slopes above the lower portion of the property. The currently undeveloped areas surrounding the project would eventually be developed regardless of the proposed project; however, the Edmonds Crossing project is expected to facilitate and perhaps accelerate the rate of ongoing private development in the project vicinity. Much of this development could be single-family residential development and therefore may not be subject to the same level of water quality and detention requirements for runoff as the project is. Therefore, it is expected that additional impervious surface will increase within the Willow Creek drainage basin, both as direct and indirect effects of the project. To avoid any potential water quality effects of new impervious surface, all new development would be required to contain and treat stormwater to the local government's minimun water quality and quantity standards adopted at the time of development.

2.3 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 CFR 402.02). Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the ESA.

Two major projects are likely to occur in the action area. One is the cleanup and eventual sale of the Unocal property. The lower property will be purchased by the City of Edmonds for the Edmonds Crossing project to occur. The upper lot is likely to be sold by Unocal for commercial or high-density residential development, much of which could proceed without Federal nexus, and thus be considered as causing cumulative effects.

The BNSF Railroad is planning to add a second track through Edmonds, which would require filling of portions of Edmonds Marsh. Filling of wetlands is regulated by the United States Army Corps of Engineers (COE) and would require a separate section 7 review process under ESA. As a result, this project could not be considered a cumulative effect.

It is likely that development within and near the City of Edmonds will continue to increase regardless of the completion of the proposed project. Traffic volumes on the Edmonds-Kingston ferry route doubled from 1980 to 1990. Ridership increased appreciably during the 1990s, growing by more than 40% to over 6,750 vehicles and 13,000 persons daily during 2000. Currently, about 30 to 35 trains per day pass through Edmonds. By 2020, the number of trains will increase to about 70 trains per day. By 2030, the projection is 104 trains per day. As a result, pollution from motorized traffic will increase regardless of project implementation.

2.4 Conclusion

The proposed action is not likely to jeopardize the continued existence of PS chinook. The determination of no jeopardy is based on the following:

- Pile-driving activities will occur when only a small number of chinook salmon are likely to be present. The use of vibratory devises for the initial piling placement will minimize the use of hammer-type drivers. For final proofing of the pile, a bubble curtain, or other BMP to attenuate noise at, or below, the 180 dB will be used. Also, inwater work will be conducted within WDFW approved work windows to minimize the number of salmonids from coming into contact with effects of construction activities.

- Temporary and permanent changes will be made to enhance habitats through placement of pilings at the proposed ferry pier and removal of pilings at the Unocal Pier and the existing ferry pier.

- The effects of shading and potential diversion of migrating salmonids have been minimized with a new split pier design that allows light to penetrate under the pier. The design is intended to facilitate salmon migration under the pier, along the shallow nearshore, rather than around it.

- Changes in water quality because of instream construction and new impervious surface will been minimized by working within the approved work window, the development and implementation erosion and spill response plans, as well as permanent stormwater facilities designed to treat to the minimum standards described in the 2001 WDOE stormwater manual.

2.5 Reinitiation of Consultation

Consultation must be reinitiated if the amount or extent of taking specified in the Incidental Take Statement is exceeded, or is expected to be exceeded; new information reveals effects of the action may affect listed species in a way not previously considered; the action is modified in a way that causes an effect on listed species that was not previously considered; or, a new species is listed or habitat is designated that may be affected by the action (50 CFR 402.16).

2.6 Incidental Take Statement

The ESA at section 9 (16 U.S.C. 1538) prohibits take of endangered species. The prohibition of take is extended to threatened anadromous salmonids by section 4(d) rule (50 CFR 223.203) Take is defined by the statute as "to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct." (16 U.S.C. 1532(19)) Harm is defined by regulation as "an act which actually kills or injures fish or wildlife. Such an act may include significant habitat modification or degradation which actually kills or injures fish or wildlife by significantly impairing essential behavior patterns, including, breeding, spawning, rearing, migrating, feeding or sheltering." (50 CFR 222.102) Harass is defined as "an intentional or negligent act or omission which creates the likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding, or sheltering." (50 CFR 17.3) Incidental take is defined as "takings that result from, but are not the purpose of, carrying out an otherwise lawful activity conducted by the Federal agency or applicant." (50 CFR 402.02) The ESA at section 7(o)(2) removes the prohibition from any incidental taking that is in compliance with the terms and conditions specified in a section 7(b)(4) incidental take statement (16 U.S.C. 1536).

An incidental take statement specifies the effects of any incidental taking of endangered or threatened species. It also provides reasonable and prudent measures that are necessary to minimize take and sets forth terms and conditions with which the action agency must comply to implement the reasonable and prudent measures. The terms and conditions included below restate elements of the proposed action that are intended to minimize or avoid effects on listed fish. They are restated to ensure the action agency understands they are mandatory components of the project necessary to limit the potential extent of take.

2.6.1 Amount or Extent of Take Anticipated

As stated above, PS chinook use the action area for migration and foraging and are therefore likely to be present in the action area such that they would encounter the effects of the proposed action. Therefore, incidental take of PS chinook is reasonably certain to occur. The proposed action includes measures to reduce the likelihood and amount of incidental take.

Take caused by the proposed action is likely to be in the form of harm, where habitat modification will impair normal behavioral patterns of listed salmonids. Here, the ability of Puget Sound chinook to use the area to forage will be diminished by the extent to which production of forage species is affected. The amount of take from this diminution is difficult, if not impossible to estimate. In instances where the number of individual animals to be taken cannot be reasonably estimated, NOAA Fisheries characterizes the amount as "unquantifiable" and uses a habitat surrogate to assess the extent of take. The surrogate provides an obvious, quantifiable threshold which, if exceeded, provides a basis for reinitiating consultation.

This Opinion analyzes the extent of effects that would result from loss or decreased function of nearshore that produce migration and foraging opportunities for PS chinook. The extent of take NOAA Fisheries anticipates in this statement is that reduction in fish viability that would result from the temporal loss of habitat caused by the installation of piers (temporal loss of nearshore vegetation). This would include approximately 1.8 acre of nearshore habitat which provides migration and forage for PS chinook. Injury or death could result because of pile driving, which is limited to the driving of 151 hollow steel piles. Should either the area of habitat loss or the number of pilings to be driven be exceeded during construction, the reinitiation provisions of the Opinion shall apply.

2.6.2 Reasonable and Prudent Measures

NOAA Fisheries believes that the following reasonable and prudent measures (RPM) are necessary and appropriate to minimize incidental take of PS chinook:

- RPM No. 1. The FHWA shall minimize take from water quality degradation.
- RPM No. 2. The FHWA shall minimize take from inwater sound during pile driving.
- RPM No. 3. The FHWA shall minimize take from stormwater runoff caused by additional impervious surface.
- RPM No. 4. The FHWA shall minimize take from disturbance of marine nearshore vegetation caused by the construction activities of the pier, removal of the Unocal Pier, removal of the existing ferry infrastructure, and rehabilitation of nearshore areas.

2.6.3 Terms and Conditions

To comply with ESA section 7 and be exempt from the take prohibition of ESA section 9, the FHWA, WSDOT, or both, must comply with the terms and conditions that implement the reasonable and prudent measures. Those conservation measures described in the BA, and summarized in this Opinion are incorporated here by reference as terms and conditions of this Incidental Take Statement. The terms and conditions are non-discretionary.

To implement RPM No. 1 above;

- The contractor will implement the Temporary Erosion and Sediment Control (TESC) plan as shown in the contract documents and construction drawings. The plan will be implemented before the start of any ground-disturbing activities. The plan will be based on the proponents' current BMP plans and will include appropriate measures such as silt fences, straw bale dikes, mulching, water bars, slope breakers, and/or the construction of detention and retention facilities to prevent erosion and the discharge of sediment. A plan will also include arrangements for cleaning the treatment facilities during the construction period should a large spill occur.

- For the period from November 1 through March 1, disturbed ground areas greater than 5,000 square feet that are left undisturbed for longer than 12 hours will be covered with mulch, sodding, or plastic sheeting. A construction phasing plan will be provided to ensure that control measures are installed prior to clearing and grading. Clearing limits will be delineated, staked, and flagged. Disturbed areas along the roadway will be hydroseeded as soon as practical after construction has been completed.

- To minimize the potential for accidents that may result in direct effects to Puget Sound, the proponents or their agent will inform and educate all crew members and all onsite personnel to implement environmental precautions. The contractor will develop and adopt a spill prevention plan. These precautions must include clearly marking the work area and following all applicable laws and permit conditions. To minimize the potential for accidents resulting in direct effects to surface-water quality, construction equipment will be fitted with emergency spill kits and construction crews will be trained in their proper use.

- Prior to operating near the shoreline, all heavy equipment operating within 300 feet of any open water shall be checked on a daily basis for potential hydraulic leaks or other mechanical problems that could result in the accidental discharge of toxic materials. Any necessary repairs will avoid delivery of material to waters. A daily inspection log/checklist shall be maintained by the contractor.

To implement RPM No. 2 above;

- Inwater work will be conducted within approved work windows to protect salmonids from coming into contact with construction activities. Marine inwater work will be restricted to the period between July 16 and February 15. Inwater work in Willow Creek will be restricted to the period between July 1 and September 30.

- The FHWA shall ensure that a plan is developed and implemented for hydroacoustic monitoring of the peak and rms sound pressure levels generated during impact-driving of steel piles. The plan shall be reviewed and approved by NOAA Fisheries. No monitoring or sound attenuation measures will be required for piles driven in the dry beach at low tide, vibratory driving of any type of pile, or impact driving of wood or concrete piles. During hydroacoustic monitoring, the hydrophone shall be positioned at mid-depths, 10 meters distant from the pile being driven.

    - If sound pressure levels exceed 150 dBrms (re: 1 μPa)(0.032 KPa) for fewer than 50% of the impacts and never exceed 180 dBpeak (re: 1 μPa)(1 KPa), pile driving may proceed without further restriction; or

    - If rms sound pressure levels exceed 150 dB for 50% or more of the impacts, or peak pressures ever exceed 180 dB, pile driving may continue, but only with the use of a bubble curtain. The design of the bubble curtain shall be approved in advance by NOAA Fisheries.

  - The initial hydroacoustic monitoring to establish the sound pressure levels being produced will not be required if a bubble curtain is used for all piles.

  - If a bubble curtain is deployed, the level of sound attenuation will be determined through hydroacoustic monitoring according to a plan to be developed by the FHWA and submitted for approval by NOAA Fisheries.

- Within 60 days of completing the hydroacoustic monitoring at any site, a report shall be submitted to NOAA Fisheries, Washington Habitat Branch, Lacey, Washington. The report shall include a description of the monitoring equipment and for each pile monitored, the peak and rms sound pressure levels with and without a bubble curtain, the size of pile, the size of hammer and the impact force used to drive the pile, the depth the pile was driven, the depth of the water, the distance between hydrophone and pile, and the depth of the hydrophone.

To implement RPM No. 3 above;

- Design criteria for temporary and permanent stormwater treatment facilities shall meet or exceed current design standards in the Washington Department of Ecology Stormwater Manual for Western Washington (2001) for the treatment of stormwater quality and quantity.

- Construction runoff from disturbed areas will be transported to sediment ponds; interception ditches will be required along the base of all fills; and erosion control fences will be installed at the base of all disturbed areas.

To implement RPM No. 4 above;

- The shoreline and shallow sub-tidal areas out to minus30 feet MLLW will be restored to their natural slope and contours with clean fine sand suitable for eelgrass. Eelgrass will be planted through this area for a net increase of 2.6 acres of eelgrass meadow. The probability for reestablishment success at this location is high. This action also increases habitat connectivity between two eelgrass beds divided by the ferry terminal and shallow subtidal propeller-wash-induced scouring action of the ferries.

- Macroalgae beds will be reestablished in the nearshore area currently barren due to propeller-wash scour at depths below those of the eelgrass plantings. This will start at the minus 30 feet MLLW contour and extend out to minus 50 feet MLLW covering an area of approximately 164,201 square feet or 3.8 acres. A method that could be used is to scatter 6- to 8-inch rock at a density of two or three pieces per square meter. This will greatly improve the process of initial colonization of macroalgae.

- Continue a long-term monitoring program to track the effects, if any, of ferry operations on marine resources near the new terminal and recovery at the old terminal. This program will be established through consensus with the jurisdictional agencies. This information will serve to evaluate future and cumulative impacts for other new projects of the Washington State Ferry System, regionwide. Specifically, the pier design will provide opportunities to study the behavior of juvenile salmonids at piers, particularly the threshold level of illumination needed for passage under piers. The triangular shape of this central pier structure in the upper intertidal zone coupled with the 33-foot wide pier to the south (all juvenile salmonids in south and central Puget Sound migrate north) gives a range of pier width and associated illumination conditions to incorporate into an experimental design. This is a crucial study need for Puget Sound chinook salmon.

3.0 MAGNUSON-STEVENS FISHERY CONSERVATION AND MANAGEMENT ACT

3.1 Background

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

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

- NOAA Fisheries must provide conservation recommendations for any Federal or state activity that may adversely affect EFH (section 305(b)(4)(A));
- Federal agencies must provide a detailed response in writing to NOAA Fisheries 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 the conservation recommendations of NOAA Fisheries, the Federal agency shall explain its reasons for not following the recommendations (section 305(b)(4)(B)).

Essential Fish Habitat means those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity (MSA section 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 CFR

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 impacts, including individual, cumulative, or synergistic consequences of actions (50 CFR 600.810).

Essential Fish Habitat consultation with NOAA Fisheries is required regarding any Federal agency action that may adversely affect EFH, including actions that occur outside EFH, such as certain upstream and upslope activities.

The objectives of this EFH consultation are to determine whether the proposed action will adversely affect designated EFH and to recommend conservation measures to avoid, minimize, or otherwise offset potential adverse effects to EFH.

3.2 Identification of Essential Fish Habitat

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. 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 1999), 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 (PFMC 1999).

3.3 Proposed Actions

The proposed action is detailed above in Section 1 of this document. The project includes habitats that have been designated as EFH for various life-history stages of 47 species of groundfish, four coastal pelagic species and three species of Pacific salmon.

3.4 Effects of Proposed Actions

As described in detail in Section 2.2 of this document, the proposed action may result in detrimental short-term impacts to a variety of habitat parameters. These adverse effects are:

- Short-term degradation of habitat because of land clearing and new impervious surface.

- Short-term disturbance of nearshore vegetation.

3.5 Conclusion

NOAA Fisheries believes that the proposed actions might adversely affect EFH for chinook salmon, coho salmon, and pink salmon.

3.6 Essential Fish Habitat Conservation Recommendations

Pursuant to section 305(b)(4)(A) of the MSA, NOAA Fisheries is required to provide EFH conservation recommendations to Federal agencies regarding actions which may adversely affect EFH. While the proposed action may adversely affect EFH as described above, NOAA Fisheries believes that the conservation measures incorporated into the project by the FHWA are sufficient to conserve EFH. Therefore, conservation recommendations are not required.

3.7 Statutory Response Requirement

Since NOAA Fisheries is not providing conservation recommendations at this time, no 30-day response from the FHWA is required (MSA) section 305(b)(4)(B)).

3.8 Supplemental Consultation

The FHWA must reinitiate EFH consultation with NOAA Fisheries 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 NOAA Fisheries' EFH conservation recommendations (50 CFR 600.920(l)).

Fish species with designated EFH in Puget Sound

Groundfish Species	redstripe rockfish *S. proriger*	Dover sole *Microstomus pacificus*
spiny dogfish *Squalus acanthias*	rosethorn rockfish *S. helvomaculatus*	English sole *Parophrys vetulus*
big skate *Raja binoculata*	rosy rockfish *S. rosaceus*	flathead sole *Hippoglossoides elassodon*
California skate *Raja inornata*	rougheye rockfish *S. aleutianus*	petrale sole *Eopsetta jordani*
longnose skate *Raja rhina*	sharpchin rockfish *S. zacentrus*	rex sole *Glyptocephalus zachirus*
ratfish *Hydrolagus colliei*	splitnose rockfish *S. diploproa*	rock sole *Lepidopsetta bilineata*
Pacific cod *Gadus macrocephalus*	striptail rockfish *S. saxicola*	sand sole *Psettichthys melanostictus*
Pacific whiting (hake) *Merluccius productus*	tiger rockfish *S. nigrocinctus*	starry flounder *Platichthys stellatus*
black rockfish *Sebastes melanops*	vermilion rockfish *S. miniatus*	arrowtooth flounder *Atheresthes stomias*
bocaccio *S. paucispinis*	yelloweye rockfish *S. ruberrimus*	
brown rockfish *S. auriculatus*	yellowtail rockfish *S. flavidus*	Coastal Pelagic Species
canary rockfish *S. pinniger*	shortspine thornyhead *Sebastolobus alascanus*	anchovy *Engraulis mordax*
China rockfish *S. nebulosus*	cabezon *Scorpaenichthys marmoratus*	Pacific sardine *Sardinops sagax*
copper rockfish *S. caurinus*	lingcod *Ophiodon elongatus*	Pacific mackerel *Scomber japonicus*
darkblotch rockfish *S. crameri*	kelp greenling *Hexagrammos decagrammus*	market squid Loligo opalescens
greenstriped rockfish *S. elongatus*	sablefish *Anoplopoma fimbria*	Pacific Salmon Species
Pacific ocean perch *S. alutus*	Pacific sanddab *Citharichthys sordidus*	chinook salmon *Oncorhychus tshawytscha*
quillback rockfish *S. maliger*	butter sole *Isopsetta isolepis*	coho salmon *O. kisutch*
redbanded rockfish *S. babcocki*	curlfin sole *Pleuronichthys decurrens*	Puget Sound pink salmon *O. gorbuscha*

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