FINAL ENVIRONMENTAL ASSESSMENT

Issuance of Marine Mammal Incidental Take Authorizations
to the Washington State Department of Transportation to Take Marine Mammals
by Harassment Incidental to Mukilteo Multimodal Project
in Mukilteo, Washington

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LOCATION:	Mukilteo, Washington

ABSTRACT:

The National Marine Fisheries Service proposes to issue Marine Mammal Incidental Authorizations to the Washington State Department of Transportation (WSDOT) Washington Ferries Division (WSF) for the taking, by Level B harassment, of small numbers of marine mammals incidental to Mukilteo Multimodal Project at the Mukilteo Ferry Terminal in the State of Washington. A series of incidental take authorizations would be issued valid between April 2014 and 2018 for WSDOT's proposed construction period.

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List of Acronyms, Abbreviations, and Initialisms

CFR	Code of Federal Regulations
CEQ	President's Council on Environmental Quality
cm	centimeter
Commission	Marine Mammal Commission
CZMA	Coastal Zone Management Act
CZMP	Coastal Zone Management Program
dB	decibel
DPS	Distinct Population Segment
EA	Environmental Assessment
EFH	Essential Fish Habitat
EIS	Environmental Impact Statement
ESA	Endangered Species Act
ESU	Evolutionarily Significant Unit
ft	foot/feet
ft^2	square foot/feet
ft^3	cubit foot/feet
FR	*Federal Register*
hr	hour
hrs	hours
Hz	hertz
IHA	Incidental Harassment Authorization
in	inch
kHz	kilohertz
km	kilometer
kPa	kilopascal
m	meter
m^2	square meter
m^3	cubic meter
mi	mile
MHHW	mean higher high water
MLLW	mean lower low water
MMPA	Marine Mammal Protection Act
MMO	marine mammal observer
MSFCMA	Magnuson-Stevens Fishery Conservation and Management Act
NAO	NOAA Administrative Order
NEPA	National Environmental Policy Act
NMFS	National Marine Fisheries Service
NOAA	National Oceanographic and Atmospheric Administration
NWRO	NMFS Northwest Regional Office
OMB	Office of Management and Budget
OPR	Office of Protected Resources
p-p	peak-to-peak
Pa	pascal
PR1	NMFS OPR Permits, Conservation, and Education Division
PRD	Southwest Regional Office Protected Resources Division
psi	pound(s) per square inch
PTS	permanent threshold shift

rms	root-mean-square
SEL	Sound exposure level
SPL	Sound pressure level
SRKW	Southern Resident killer whale
TL	transmission loss
TS	threshold shift
TTS	temporary threshold shift
U.S.C.	United States Code
WDFW	Washington State Department of Fish and Wildlife
WDOT	Washington State Department of Ecology
WSDOT	Washington State Department of Transportation
ZOI	zone of influence
μPa	microPascal

CHAPTER 1 INTRODUCTION/DESCRIPTION OF ACTION AND BACKGROUND

1.1 INTRODUCTION/DESCRIPTION OF ACTION

In response to a receipt of a request from the Washington State Department of Transportation (WSDOT) Ferries Division (WSF), the National Marine Fisheries Service (NMFS) proposes to issue an Incidental Harassment Authorization (IHA) that authorizes takes by level B harassment of marine mammals incidental to the WSF's proposed pile removal activities at the Mukilteo Ferry Terminal in 2014 and 2015, pursuant to section 101(a)(5)(D) of the Marine Mammal Protection Act of 1972, as amended (MMPA; 16 U.S.C. §§ 1631 *et seq.*), and the regulations governing the taking and importing of marine mammals (50 Code of Federal Regulations (CFR) Part 216). NMFS is also considering potential additional IHAs or proceeding with rulemaking for future years the WSF's construction activities at the Mukilteo Ferry Terminal.

This Environmental Assessment (EA) (hereinafter, the Mukilteo EA) addresses the impacts on the human environment that would result from the issuance of a series of marine mammal incidental take authorizations between 2014 and 2018.

1.2 BACKGROUND

On August 30, 2013, WSF requested that NMFS authorize the take, by Level B harassment of small numbers of eight marine mammal species incidental to construction work associated with the Mukilteo Ferry Terminal replacement project in Mukilteo, Snohomish County, Washington. WSF submitted a revised IHA application on October 17, 2013, in response to NMFS' comments on its application.

WSF proposes to replace the existing Mukilteo Ferry Terminal with a new terminal. Completion of the entire project will occur over 4 consecutive years. WSF plans to submit an IHA request for each year of construction. The current IHA request for Year One of construction is limited to beginning removal of the Tank Farm Pier. Additional proposed construction activities after the first year include channel dredging, installing building foundation/trestle piles and stone columns, installing transfer span drilled shafts, wingwalls, fixed dolphins, passenger overhead loading drilled shafts and fishing pier piles, constructing passenger building, and removing current terminal and existing fishing pier when new terminal is operations.

The purpose of the Mukilteo Multimodal Project is to provide safe, reliable, and efficient service and connections for general-purpose transportation, transit, high-occupancy vehicles, pedestrians, and bicyclists traveling between Island County and the Seattle/Everett metropolitan area and beyond. The project is intended to: (1) reduce conflicts, congestion, and safety concerns for pedestrians, bicyclists, and motorists by improving local traffic and safety at the terminal and the surrounding area; (2) provide a terminal and supporting facilities with the infrastructure and operating characteristics needed to improve the safety, security, quality, reliability, and efficiency of multimodal transportation; and (3) accommodate future demand projected for transit, HOV, pedestrian, bicycle, and general purpose traffic.

The existing facility is deficient in a number of aspects, including safety, multimodal connectivity, capacity, and the ability to support the goals of local and regional long-range transportation and comprehensive plans, including future growth in travel demand. These factors demonstrate the need for an improved multimodal facility.

Since underwater construction noise from these activities and the increase of human activities and vessel traffic could adversely affect marine mammal species and stocks in the proposed action area, WSF is seeking an IHA that would allow the incidental, but not intentional, take of marine mammals by Level B behavioral harassment during the construction activities at the Mukilteo Ferry Terminal. The WSF states that small numbers of eight species of marine mammals could potentially be taken by vibratory pile removal activities associated with the proposed construction work. The marine mammals that could be affected are: Pacific harbor seal (*Phoca vitulina richardsi*), California sea lion (*Zalophus californianus*), Steller sea lion (*Eumetopias jubatus*), harbor porpoise (*Phocoena phocoena*), Dall's porpoise (*Phocoenoides dalli*), killer whale (*Orcinus orca*), gray whale (*Eschrichtius robustus*), and humpback whale (*Megaptera novaeangliae*).

Marine mammal incidental take authorization (ITA) issuance criteria require that the take of marine mammals authorized by an IHA or Letter of Authorization (LOA) will have a negligible impact on the species or stock(s); and will not have an unmitigable adverse impact on the availability of the species or stock(s) for subsistence uses. In addition, the IHA or LOA must, where applicable, set forth the permissible methods of taking, other means of effecting the least practicable adverse impact on the species or stock and its habitat, and requirements for monitoring and reporting of such takings.

Issuance of a marine mammal ITA is a federal agency action. For purposes of section 7 of the Endangered Species Act of 1973 (ESA; 16 U.S.C. 1531 *et. seq*), NMFS must consult with itself to ensure that its action is not likely to jeopardize the continued existence of any federally-listed species or result in the destruction or adverse modification of critical habitat.

In addition, this EA is prepared in accordance with the National Environmental Policy Act of 1969 (NEPA; 42 U.S.C. 4321 *et seq*.) for the analysis of the potential environmental impacts as the result of the NMFS proposed issuance of the ITAs.

1.2.1 PURPOSE AND NEED

The primary purpose of NMFS's proposed action—the issuance of an Authorization to the WSF—is to authorize (pursuant to the MMPA) the WSF's request for the take of marine mammals incidental to the WSF's proposed activities.

WSF proposes to replace the existing Mukilteo Ferry Terminal with a new terminal, which will be located to the east of the existing location at the site of the former U.S. Department of Defense Fuel Supply Point facility, known as the Tank Farm property. In response to WSF's IHA application, NMFS proposes to issue an IHA pursuant to §101(a)(5)(D) of the MMPA. The IHA will exempt WSF from the take prohibitions under the MMPA and thus authorize the incidental takes that may occur as a result of construction work at the Mukilteo Ferry Terminal in Mukilteo, Washington (Figure 1-1). WSF has informed NMFS that it will request additional IHAs in future years for the remaining construction phases.

NMFS' issuance of an ITA (IHA or rulemaking) is necessary for the construction work at the Mukilteo Ferry Terminal to comply with the MMPA.

Figure 1-1. WSF's proposed project area at the Mukilteo Ferry Terminal in Mukilteo, Washington.

1.2.2 Scoping Summary

The purpose of scoping is to identify the significant issues related to the proposed action, as well as identify and eliminate from detailed study the issues that are not significant or that have been covered by prior environmental review. An additional purpose of the scoping process is to identify the concerns of the affected public and Federal agencies, states, and Indian tribes.

The MMPA and its implementing regulations governing issuance of an ITA require that upon receipt of a valid and complete application for an ITA, NMFS publish a proposed IHA or proposed rule in the *Federal Register* (*FR*). The notice summarizes the purpose of the requested ITA, includes a statement about whether an EA or an Environmental Impact Statement (EIS) was prepared, and invites interested parties to submit written comments concerning the proposal to issue the ITA.

1.2.3 Comments On Application and EA

On December 3, 2013, NMFS published a notice of a proposed IHA in the *Federal Register* (78 FR 72643), which announced the availability of the application for public comment for 30 days. The public comment period for the proposed IHA afforded the public the opportunity to provide input on environmental impacts. In addition, NMFS will post the final Mukilteo EA on http://www.nmfs.noaa.gov/pr/permits/incidental.htm#applications.

NMFS only received comments from the Marine Mammal Commission (Commission). The Commission recommends that NMFS issue the IHA, subject to inclusion of the proposed mitigation and monitoring measures described in the *Federal Register* notice for the issuance of the IHA.

1.2.4 Issues Within The Scope Of This EA

This EA contains an analysis of NMFS' proposal to authorize the take of marine mammals incidental to WSF's construction activities at the Mukilteo Ferry Terminal in 2014 and a range of other reasonable alternatives. If issued, the 2014 IHA would allow the take, by Level B harassment, of eight species of marine mammals. NMFS has also been advised by WSF that it intends to apply for additional ITAs related to future construction activities at the Mukilteo Ferry Terminal (e.g., 2015-2018). While our proposed action is the issuance of an IHA for 2014 construction activities, we have, nevertheless, considered all potential marine mammals impacts associated with each construction phase of the Mukilteo Ferry Terminal. NMFS anticipates that it would rely upon this EA for future ITA requests related to the Mukilteo Ferry Terminal.

Because the in-water construction activities associated with the proposed Mukilteo Multimodal Project will produce loud noises, NMFS expects that marine mammals in the vicinity of the project area could be affected. This EA provides detailed analyses and evaluation of the potential noise impacts to the affected environment that would result from the proposed construction work at the Mukilteo Ferry Terminal.

1.2.5 Applicable Laws And Necessary Federal Permits, Licenses, And Entitlements

This section summarizes five of the federal laws that are triggered by WSF's Mukilteo Multimodal project. This section is not meant to be comprehensive.

1.2.5.1 National Environmental Policy Act

The NEPA, enacted in 1969, is applicable to all "major" federal actions significantly affecting the quality of the human environment. A major federal action is an activity that is fully or partially funded, regulated, conducted, or approved by a federal agency. NMFS' issuance of an ITA for incidental harassment of marine mammals represents approval and regulation of the applicant's activities. While NEPA does not dictate substantive requirements for an ITA, it requires consideration of environmental issues in federal agency planning and decision making. The procedural provisions outlining federal agency responsibilities under NEPA are provided in the CEQ's implementing regulations (40 CFR Parts 1500-1508).

The National Oceanic and Atmospheric Administration (NOAA) has, through NAO 216-6, established agency procedures for complying with NEPA and the implementing regulations issued by the CEQ. NAO 216-6 specifies that issuance of an ITA under the MMPA and ESA is among a category of actions that require further environmental review. This EA is prepared in accordance with NEPA, its implementing regulations, and NAO 216-6.

1.2.5.2 Endangered Species Act

Section 7 of the ESA requires consultation with the appropriate federal agency (either NMFS or the USFWS) for federal actions that "may affect" a listed species or critical habitat. NMFS' issuance of an ITA affecting ESA-listed species or designated critical habitat, directly or indirectly, is a federal action subject to these section 7 consultation requirements. Accordingly, NMFS is required to ensure that its action is not likely to jeopardize the continued existence of any threatened or endangered species or result in destruction or adverse modification of critical habitat for such species. Regulations specify the requirements for these consultations (50 CFR Part 402).

The NMFS Office of Protected Resources (OPR) Permits and Conservation Division (PR1) is required to consult with the NMFS Northwest Regional Office (NWRO) Protected Resources Division (PRD) on the issuance of an ITA under Section 101(a)(5)(D) of the MMPA. PR1 is required to consult with PRD because the action of issuing an ITA may affect threatened and endangered species under NMFS' jurisdiction.

As the effects of the activities on listed marine mammals and salmonids were analyzed during a formal consultation between the Federal Highway Administration (FHWA) and NMFS, and as the underlying action has not changed from that considered in the consultation, the discussion of effects contained in the Biological Opinion and accompanying memo issued to the FHWA on July 31, 2013. Therefore, NMFS has determined that issuance of an IHA for this activity would not lead to any effects to listed marine mammal species beyond those that were considered in the consultation on FHWA's action. The U.S. Department of Transportation prepared an Environment Impact Statement for the Mukilteo Ferry Terminal construction project (USDOT 2013).

1.2.5.3 MARINE MAMMAL PROTECTION ACT

Section 101(a)(5)(D) of the MMPA directs the Secretary of Commerce (Secretary) to authorize, upon request, the incidental, but not intentional, taking by harassment of small numbers of marine mammals of a species or population stock, for periods of not more than one year, by United States citizens who engage in a specified activity (other than commercial fishing) within a specific geographic region if certain findings are made and notice of a proposed authorization is provided to the public for review.

Authorization for incidental taking of small numbers of marine mammals shall be granted if NMFS finds that the taking will have a negligible impact on the species or stock(s), and will not have an unmitigable adverse impact on the availability of the species or stock(s) for subsistence uses. The authorization must set forth the permissible methods of taking, other means of effecting the least practicable adverse impact on the species or stock and its habitat, and requirements pertaining to the monitoring and reporting of such takings. NMFS has defined "negligible impact" in 50 CFR 216.103 as "an impact resulting from the specified activity that cannot be reasonably expected to, and is not reasonably likely to, adversely affect the species or stock through effects on annual rates of recruitment or survival."

Section 101(a)(5)(D) of the MMPA established an expedited process by which citizens of the United States can apply for an authorization to incidentally take small numbers of marine mammals by harassment. Except with respect to certain activities not pertinent here, the MMPA defines "harassment" as:

> any act of pursuit, torment, or annoyance which (i) has the potential to injure a marine mammal or marine mammal stock in the wild ["Level A harassment"]; or (ii) has the potential to disturb a marine mammal or

> marine mammal stock in the wild by causing disruption of behavioral patterns, including, but not limited to, migration, breathing, nursing, breeding, feeding, or sheltering ["Level B harassment"].

Section 101(a)(5)(D) of the MMPA establishes a 45-day time limit for NMFS' review of an application followed by a 30-day public notice and comment period on any proposed authorizations for the incidental harassment of small numbers of marine mammals. Not later than 45 days after the close of the public comment period, if the Secretary makes the findings set forth in Section 101(a)(5)(D)(i) of the MMPA, the Secretary shall issue the authorization with appropriate conditions to meet the requirements of Section 101(a)(5)(D)(ii) of the MMPA.

NMFS has promulgated regulations to implement the permit provisions of the MMPA (50 CFR Part 216) and has produced Office of Management and Budget (OMB)-approved application instructions (OMB Number 0648-0151) that prescribe the procedures (including the form and manner) necessary to apply for permits. All applicants must comply with these regulations and application instructions in addition to the provisions of the MMPA. Applications for an IHA must be submitted according to regulations at 50 CFR § 216.104.

1.2.5.4 MAGNUSON-STEVENS FISHERY CONSERVATION AND MANAGEMENT ACT

Under the Magnuson-Stevens Fishery Conservation and Management Act (MSFCMA), "Essential Fish Habitat" (EFH) is defined as "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity" (16 U.S.C. § 1802(10)). The EFH provisions of the MSFCMA offer resource managers the means to accomplish the goal of giving heightened consideration to fish habitat in resource management. NMFS, Office of Protected Resources Permits and Conservation Division has determined that issuance of ITAs for the taking of marine mammals incidental to the ferry terminals construction at the Mukilteo Ferry Terminal will not have an adverse impact on EFH; therefore, an EFH consultation is not required.

1.2.5.5 COASTAL ZONE MANAGEMENT ACT

Congress enacted the Coastal Zone Management Act (CZMA) (16 U.S.C. §§ 1451 *et seq.*) to protect the coastal environment from growing demands associated with residential, recreational, commercial, and industrial uses (e.g., State and Federal offshore oil and gas development). Those coastal states with an approved Coastal Zone Management Program, which defines permissible land and water use within the state's coastal zone, can review Federal actions, licenses, or permits for "Federal consistency." "Federal consistency" is the requirement that those Federal permits and licenses likely to affect any land/water use or natural resources of the coastal zone be consistent with the Program's enforceable policies. NMFS consults with States on issuance of permits for activities that fall within the State's Coastal Zone Management Program.

CHAPTER 2 ALTERNATIVES INCLUDING THE PROPOSED ACTION

The NEPA implementing regulations (40 CFR § 1502.14) and NAO 216-6 provide guidance on the consideration of alternatives to a federal proposed action and require rigorous exploration and objective evaluation of all reasonable alternatives. This chapter describes the range of potential actions (alternatives) determined reasonable with respect to achieving the stated objective, as well as alternatives eliminated from detailed study and also summarizes the expected outputs and any related mitigation of each alternative.

This EA evaluates the alternatives to ensure that they would fulfill the purpose and need, namely: (1) the issuance of a series of IHAs for the take of marine mammals by level B behavioral harassment incidental to the Mukilteo Ferry Terminal replacement construction activities in Washington State; and (2) compliance with the MMPA which sets forth specific standards (i.e., no unmitigable adverse impact and negligible impact) that must be met in order for NMFS to issue ITAs.

The Proposed Action (Preferred) alternative represents the activities proposed in the application for an IHA and subsequent IHAs, with standard monitoring and mitigation measures specified by NMFS. In accordance with section 101(a)(5)(D) of the MMPA, NMFS may not issue an ITA if the action will (1) have more than a negligible impact on the species or stocks or (2) have an unmitigable adverse impact on the availability of the species or stock(s) for subsistence uses.

2.1 WSF PROJECT OBJECTIVES

The objective of the project at the Washington State Department of Transportation/Ferries Division Mukilteo Ferry Terminal located in Mukilteo, WA, is to replace the existing Mukilteo Ferry Terminal, with its first year construction activity to remove the existing piles.

2.2 ALTERNATIVE 1: NO ACTION ALTERNATIVE – DENY REQUEST FOR WSF'S IHA

Evaluation of the No Action Alternative is required by the CEQ regulations as a baseline against which the impacts of the Proposed Action are compared.

Under the No Action Alternative, NMFS would not issue the proposed IHA and subsequent IHAs for the WSF's proposed Mukilteo Ferry Terminal replacement construction. The MMPA prohibits all takings of marine mammals unless authorized by a permit or exemption under the MMPA. If an authorization to take marine mammals is denied, the WSF may or may not decide to conduct construction activities at the Mukilteo Ferry Terminal. If WSF conducts the construction without an ITA and incidental take occurs, it will be subject to the MMPA's penalty provisions. For purposes of this analysis we assume that the WSF would not proceed with the proposed action and marine mammals present in the vicinity of these areas would not be harassed by the construction activities.

2.3 ALTERNATIVE 2: ISSUANCE OF AN IHA WITH MITIGATION (PREFERRED ALTERNATIVE)

The Proposed Action is the Preferred Alternative. Under this alternative, NMFS would issue an IHA and subsequent IHAs to the WSF allowing the take, by Level B harassment, of small numbers of eight species of marine mammals incidental to the proposed Mukilteo Ferry Terminal replacement project.

NMFS will incorporate the mitigation and monitoring measures and reporting requirements described in Sections 2.3.4 and 2.3.5 into the ITA. The Preferred Alternative would enable the agency and the WSF to comply with the statutory and regulatory requirements of the MMPA and ESA.

The project at the Mukilteo Ferry Terminal is to replace the existing Mukilteo Ferry Terminal with a new terminal, which will be located to the east of the existing location at the site of the former U.S. Department of Defense Fuel Supply Point facility, known as the Tank Farm property.

The project is designed to improve the operations and facilities serving the mainland terminus of the Mukilteo-Clinton ferry route in Washington State. The ferry route is part of State Route (SR) 525, the major transportation corridor crossing Possession Sound, which separates Island County (Whidbey Island) from the central Puget Sound mainland. The route connects to local and regional transportation systems serving many modes of travel, including bus and rail transit, freight, and vehicles, as well as bicycle and pedestrian use.

WSDOT will develop the project on the western portion of the Mukilteo Tank Farm, a 20-acre area previously used by the U.S. Air Force, and featuring lands, buildings, and a large pier formerly used for fuel storage and loading.

The project will include the following elements:

- The Tank Farm Pier, which includes approximately 3,900 piles, will be removed.
- The project will construct in-water facilities that include the features needed for the ferry berth, including wingwalls and fixed dolphins.
- A floating dolphin will be relocated from the existing ferry terminal.
- The project will construct a new transfer span, including hydraulic-lifting mechanisms and structures and a bridge seat foundation, as well as a new concrete trestle and bulkhead.
- A channel, about 500 feet wide by 100 feet long, will be dredged through part of the area currently occupied by the pier to provide a navigation depth of about 28 feet at an average lowest tide, which will require dredging to a depth of about 30 feet.
- The existing ferry berth and all of its marine structures will be removed, including the Port of Everett fishing pier and day moorage. The project will reconstruct the fishing pier and day moorage as part of the new multimodal facility.
- A new passenger building and a maintenance building will be combined as a two-story building and aligned parallel to the shoreline.
- Parking, street and pedestrian path elements will improve public access to transit and the shoreline.

2.3.1 Construction Sequence and Timing

Beginning in 2014, the construction of the new terminal will take place over four consecutive in-water work seasons. Table 2-1 shows project activities for each year of construction. The subject of the current WSF IHA application is the pier removal work to be completed in Year One. WSF states that new ITA applications would be submitted for each year of construction.

Due to NMFS and U.S. Fish and Wildlife Service (USFWS) in-water work timing restrictions to protect salmonids listed under the Endangered Species Act (ESA), planned WSF in-water construction is limited each year to July 15 through February 15.

Table 2-1. In-water Construction Schedule

Construction Year	Duration (months)	Work Tasks
One (2014 – 2015)	7	Tank Farm Pier removal
Two (2015 – 2016)	7	Complete Tank Farm Pier removal, dredge channel. Install building foundation/trestle piles and stone columns.
Three (2016 – 2017)	7	Install transfer span drilled shafts, wingwalls, fixed dophins, passenger overhead loading drilled shafts and fishing pier piles. Construct passenger building.
Four (2017 – 2018)	1	Relocate existing floating dolphin from current terminal, remove current terminal and existing fishing pier when new terminal is operational.

2.3.2 In-water Noise Generation

The proposed project has three types of in-water noise production that may disturb marine mammals: vibratory hammer pile removal and driving, vibratory probe, and impact pile driving.

2.3.2.1 Vibratory Hammer Pile Removal

Vibratory hammer extraction is a common method for removing timber piles. A vibratory hammer is a large mechanical device mostly constructed of steel (weighing 5 to 16 tons) that is suspended from a crane by a cable. It is attached to a derrick and positioned on the top of a pile. The pile is then unseated from the sediments by engaging the hammer, creating a vibration that loosens the sediments binding the pile, and then slowly lifting up on the hammer with the aid of the crane.

Once unseated, the crane will continue to raise the hammer and pull the pile from the sediment. When the pile is released from the sediment, the vibratory hammer is disengaged and the pile is pulled from the water and placed on a barge for transfer upland. Vibratory removal will take approximately 10 to 15 minutes per pile, depending on sediment conditions.

2.3.2.2 Direct Pull and Clamshell Removal

Older timber piles are particularly prone to breaking at the mud-line because of damage from marine borers and vessel impacts, and must be removed because they can interfere with the installation of new piles. In some cases, removal with a vibratory hammer is not possible if the pile is too fragile to withstand the hammer force. Broken or damaged piles may be removed by wrapping the piles with a cable and pulling them directly from the sediment with a crane. If the piles break below the waterline, the pile stubs will be removed with a clamshell bucket, a hinged steel apparatus that operates like a set of steel jaws. The bucket will be lowered from a crane and the jaws will grasp the pile stub as the crane pulled up. The broken piles and stubs will be loaded onto the barge for off-site disposal. Clamshell removal will be used only if necessary. Direct pull and clamshell removal do not produce noise that could impact marine mammals.

The piles will be loaded onto the barge or into a container and disposed of offsite in accordance with State of Washington Administrative Code (WAC) 173-304 Minimum Functional Standards for Solid Waste Handling.

2.3.2.3 Vibratory Hammer Installation

Vibratory hammers are commonly used in steel pile installation where sediments allow and involve the same vibratory hammer used in pile extraction. The pile is placed into position using a choker and crane, and then vibrated between 1,200 and 2,400 vibrations per minute. The vibrations liquefy the sediment surrounding the pile allowing it to penetrate to the required seating depth. The type of vibratory hammer that will be used for the project will likely be an APE 400 King Kong (or equivalent) with a drive force of 361 tons.

2.3.2.4 Stone Column Vibratory Probe Installation

Stone columns are a ground improvement technique consisting of installing aggregate columns in the subsurface to reinforce, densify, and provide drainage of potentially liquefiable soils. The columns are constructed using a down-hole vibratory probe. The probe penetrates to the design depth by means of the probe's weight and the vibrations. Stones (such as crushed gravel) are fed into the soil at the vibrator tip through a feed pipe attached to the vibrator. Compressed air or water is used to push the gravel through the feeder tube and into the subsurface. The gravel creates a stiff column that reinforces the treatment zone and densifies the surrounding soils.

For the Mukilteo project, approximately 200 3-ft. diameter columns will be installed in a grid pattern, with row spacing ranging from five to 10. Columns will extend 60 ft. below ground surface. Approximately 3,142 cubic yards of material will be used for stone column construction. Construction of the columns will take approximately four weeks.

2.3.2.5 Impact Hammer Installation

Impact hammers are used to install plastic/steel core, wood, concrete, or steel piles. An impact hammer is a steel device that works like a piston. Impact hammers are usually large, though small impact hammers are used to install small diameter plastic/steel core piles. Impact hammers have guides (called a lead) that hold the hammer in alignment with the pile while a heavy piston moves up and down, striking the top of the pile, and drives it into the substrate from the downward force of the hammer on the top of the pile.

To drive the pile, the pile is first moved into position and set in the proper location using a choker cable or vibratory hammer. Once the pile is set in place, pile installation with an impact hammer can take less than 15 minutes under good conditions, to over an hour under poor conditions (such as glacial till and bedrock, or exceptionally loose material in which the pile repeatedly moves out of position).

Only concrete piles will be impact driven during this project. A pile cushion will be used to protect the impact hammer and the pile top. The pile cushion can also attenuate impact noise from 11-26 dB (wood pile cushion) (WSDOT 2006).

Table 2-2. Estimated Underwater Noise Level and Distances to Exclusion Zones and Zones of Influence

			Year One		
Project component	Pile type	Extraction method	Estimated noise level (dB_{rms} re 1 µPa @ 1 m)	ZOI	Exclusion zone
Removal of Tank Farm pier	12-inch timber	Vibratory hammer	152	1 mile/1.6 km	N/A
			Year Two		
Project component	Pile type	Installation / Extraction method	Estimated noise level (dB_{rms} re 1 µPa @ 1 m)	ZOI	Exclusion zone
Removal of Tank Farm pier	12-inch timber	Vibratory hammer	152	1 mile/1.6 km	N/A
Trestle construction	24-inch concrete	Impact hammer	170	152 ft/46 m	180 dB: 7 ft/2 m 190 dB: 2 ft/0.6 m
Stone column	N/A	Vibratory prob	166	5.3 mi/8.7 km	N/A
New terminal building foundation	24-inch concrete	Impact hammer	170	152 ft/46 m	180 dB: 7 ft/2 m 190 dB: 2 ft/0.6 m
			Year Three		
Project component	Pile type	Installation / Extraction method	Estimated noise level (dB_{rms} re 1 µPa @ 1 m)	ZOI	Exclusion zone
Transfer span drilled shaft casings	60-inch steel	Vibratory hammer	166	5.3 mi/8.7 km	N/A
OHL drilled shaft casing	131-inch steel	Vibratory hammer	166	5.3 mi/8.7 km	N/A
Wingwalls	36-inch steel	Vibratory hammer	177	12.7 mi/20.4 km	N/A
	18-inch steel	Vibratory hammer	162	2.9 mi/4.7 km	N/A
Fixed dolphins	30-inch steel	Vibratory hammer	176	12.7 mi/20.4 km	N/A
Relocated fishing pier	24-inch concrete	Impact hammer	170	152 ft/46 m	180 dB: 7 ft/2 m 190 dB: 2 ft/0.6 m
	12-inch steel	Vibratory hammer	162	2.9 mi/4.7 km	N/A
			Year Four		
Project component	Pile type	Installation / Extraction method	Estimated noise level (dB_{rms} re 1 µPa @ 1 m)	ZOI	Exclusion zone
Removal of existing terminal and fishing pier	12-inch timber	Vibratory hammer	152	1 mile/1.6 km	N/A
Removal of existing terminal steel dolphin piles	30/36-inch steel	Vibratory hammer	171	12.7 mi/20.4 km	N/A

Currently NMFS uses the received underwater noise levels of 180 dB_{rms} re 1 µPa and 190 dB_{rms} re 1 µPa as the onset for Level A harassment for cetaceans and pinnipeds, respectively. For Level B behavioral harassment, NMFS current criteria are 160 dB_{rms} re 1 µPa for impulse sources and 120 dB_{rms} re 1 µPa for non-impulse sources. For WSF's proposed Mukilteo

Ferry Terminal replacement construction project, underwater noise production and attenuation to the above received levels are presented in Table 2-2 and in Figures 2-1 and 202. These values are derived from a series of prior on site measurements and modeling (WSDOT 2007, 2012; Laughlin 2012).

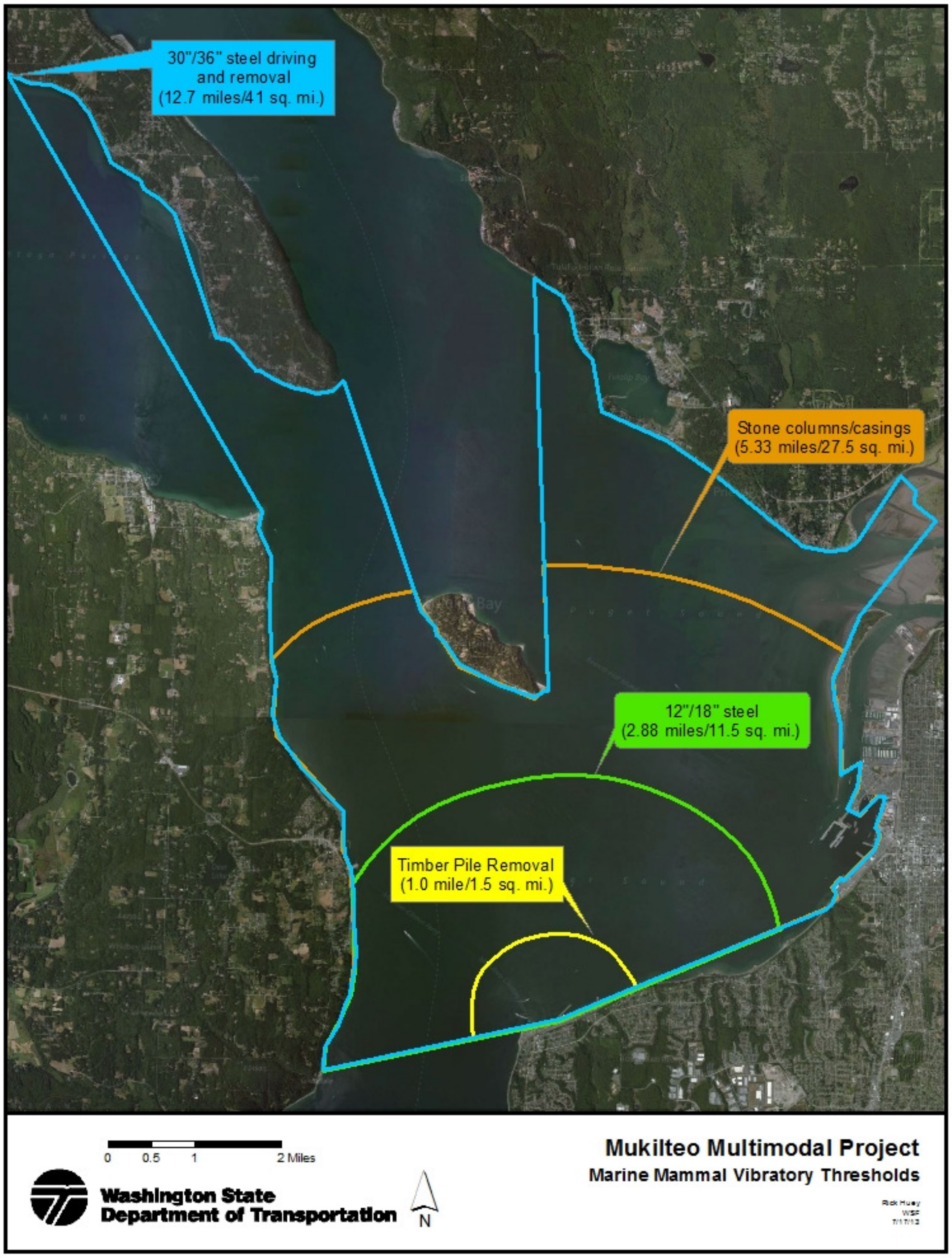

Figure 2-1. ZOIs from vibratory pile driving and pile removal.

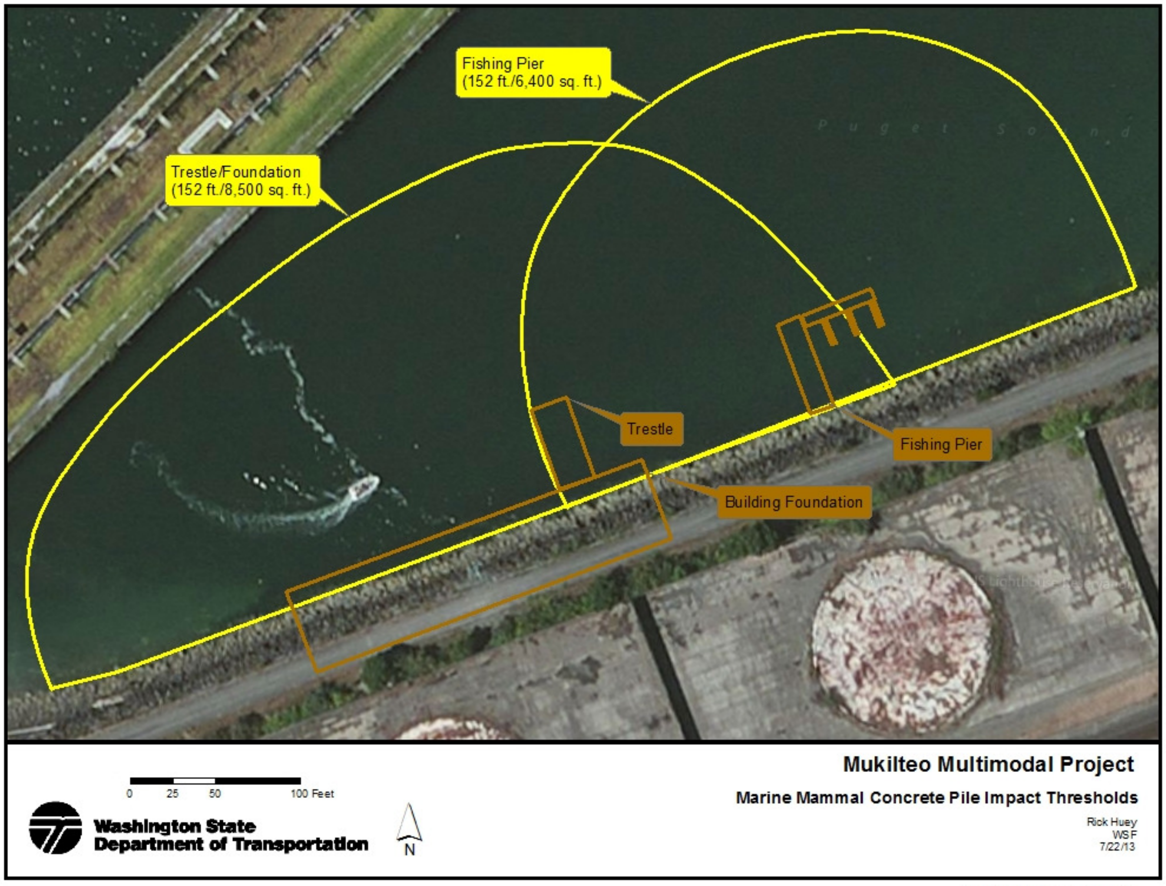

Figure 2-2. ZOIs from impact pile driving.

2.3.3 DURATION

The duration for all underwater noise generating activities for the entire four-year project is provided below (Table 2-3). WSF states that the duration estimates are conservative, and will likely be shorter.

Table 2-3. Duration of Noise Production

			Year One			
Project component	Pile type	Extraction method	Number of piles	Duration per pile (min)	Total noise duration (hrs)	Days
Removal of Tank Farm pier	12-inch timber	Vibratory hammer	1,835	15	516	90
			Year Two			
Project component	Pile type	Installation / Extraction method	Number of piles / columns	Duration per pile / column (min)	Total noise duration (hrs)	Days
Removal of Tank Farm pier	12-inch timber	Vibratory hammer	2,065	15	459	90
Trestle construction	24-inch concrete	Impact hammer	14	120	28	5
Stone column	N/A	Vibratory prob	200	45	150	20
New terminal building foundation	24-inch concrete	Impact hammer	8	120	16	5

Year Three						
Project component	Pile type	Installation / Extraction method	Number of piles	Duration per pile (min)	Total noise duration (hrs)	Days
Transfer span drilled shaft casings	60-inch steel	Vibratory hammer	2	60	2	2
OHL drilled shaft casing	131-inch steel	Vibratory hammer	2	60	2	2
Wingwalls	36-inch steel	Vibratory hammer	14	30	7	2
	18-inch steel	Vibratory hammer	4	30	2	1
Fixed dolphins	30-inch steel	Vibratory hammer	18	30	18	5
Relocated fishing pier	24-inch concrete	Impact hammer	12	120	24	2
	12-inch steel	Vibratory hammer	37	30	18.5	3
Year Four						
Project component	Pile type	Installation / Extraction method	Number of piles	Duration per pile (min)	Total noise duration (hrs)	Days
Removal of existing terminal and fishing pier	12-inch timber	Vibratory hammer	290	15	72.5	14
Removal of existing terminal steel dolphin piles	30/36-inch steel	Vibratory hammer	7	15	1.75	1

2.3.4 MITIGATION MEASURES

As required under the MMPA, NMFS considered mitigation to effect the least practicable adverse impact on marine mammals and has developed a series of mitigation measures, as well as monitoring and reporting procedures (Section 2.3.5) that would be required under the ITAs.

The following measures are designed to eliminate the potential for injury or mortality and to minimize Level B behavioral harassment to marine mammals found in the vicinity of the proposed project area. These measures would be required under Alternative 2 (Preferred Alternative).

For the proposed Mukilteo Ferry Terminal replacement project, the following mitigation measures are required to minimize the potential impacts to marine mammals in the project vicinity. These mitigation measures would be employed during all in-water construction activities at the Mukilteo Ferry Terminal. The mitigation measures would be included in the Contract Plans and Specifications and must be agreed upon by the contractor prior to any construction activities.

Exclusion zones and zones of influence (ZOI) will be established and monitored during all in-water construction activities. For in-water impact pile driving, the exclusion zones correspond to received noise levels at 180 dB_{rms} re 1 μPa and 190 dB_{rms} re 1 μPa for cetaceans and pinnipeds, respectively, and the ZOI corresponds to received level at 160 dB_{rms} re 1 μPa. For vibratory pile driving and pile removal, the measured source levels will not reach 180 dB_{rms} re 1 μPa, therefore, there will be no exclusion zone. However, a ZOI of 122 dB_{rms} re 1 μPa, which corresponds to the median ambient noise levels measured at Mukilteo Ferry Terminal (Laughlin 2012), will be implemented.

For impact pile driving activities, WSF will implement power-down or shutdown measures when a marine mammal is sighted within its respective exclusion zone. A pile cushion will be used to reduce noise from impact pile driving.

In addition, for all pile driving (vibratory and impact) and pile removal activities, WSF will be required to implement a ramp up, or soft start, procedure. The purpose of this procedure is to minimize the likelihood that marine mammals in the vicinity of the proposed construction activity would startle from a sudden loud noise. Soft start requires contractors to initiate the piling hammer at reduced power for 15 seconds with a 1 minute interval, and repeat such procedures for an additional two times.

Furthermore, monitoring for marine mammal presence will take place 30 minutes before, during and 30 minutes after pile driving and pile removal to ensure that marine mammals are not injured by the proposed construction activities (see Proposed Monitoring and Reporting section below).

Additionally, WSF will implement power down or shutdown measures whenever Southern Resident killer whales (SRKWs) are present in the vicinity of the project area.

Finally, if the number of any allotted marine mammal takes reaches the limit under the IHA (if issued), WSF will implement shutdown and power down measures if such species/stock of animal approaches the Level B harassment zones (122 dB for vibratory pile driving/pile removal, 160 dB for impact pile driving).

2.3.5 MONITORING AND REPORTING

Under the Preferred Alternative (Alternative 2), NMFS would require the WSF to undertake the following monitoring activities for the Mukilteo Ferry Terminal replacement construction project. The reporting requirements described in Section 2.3.5.3 would also be implemented under Alternative 2.

2.3.5.1 MARINE MAMMAL SIGHTING NETWORK

Prior to the start of pile driving, WSF will contact the Orca Network and/or Center for Whale Research to ascertain the location of the nearest marine mammal sightings. The Orca Sightings Network consists of a list of over 600 (and growing) residents, scientists, and government agency personnel in the U.S. and Canada. Sightings are called or emailed into the Orca Network and immediately distributed to other sighting networks including: the NMFS Northwest Fisheries Science Center, the Center for Whale Research, Cascadia Research, the Whale Museum Hotline and the British Columbia Sightings Network.

2.3.5.2 PROTECTED SPECIES OBSERVERS

WSF will employ qualified protected species observers (PSOs) to monitor the 120 dB re 1 μPa (rms) for marine mammals. Qualifications for marine mammal observers include:

- Visual acuity in both eyes (correction is permissible) sufficient for discernment of moving targets at the water's surface with ability to estimate target size and distance. Use of binoculars may be necessary to correctly identify the target.

- Experience or training in the field identification of marine mammals (cetaceans and pinnipeds).

- Sufficient training, orientation or experience with the construction operation to provide for personal safety during observations.

- Ability to communicate orally, by radio or in person, with project personnel to provide real time information on marine mammals observed in the area as necessary.

- Experience and ability to conduct field observations and collect data according to assigned protocols (this may include academic experience).

- Writing skills sufficient to prepare a report of observations that would include such information as the number and type of marine mammals observed; the behavior of marine mammals in the project area during construction, dates and times when observations were conducted; dates and times when in-water construction activities were conducted; and dates and times when marine mammals were present at or within the defined ZOIs or exclusion zones.

2.3.5.3 MARINE MAMMAL MONITORING PROTOCOLS

WSF has developed a monitoring plan that will collect sighting data for each distinct marine mammal species observed during pile removal and driving activities. Marine mammal behavior, overall numbers of individuals observed, frequency of observation and the time corresponding to the daily tidal cycle will be included. Qualified PSOs will be present on site at all times during pile removal and driving.

- A range finder or hand-held global positioning system device will be used to ensure that the 120 dB_{rms} re 1 μPa Level B behavioral harassment ZOI is monitored.

- Marine mammal monitoring will occur 30 minutes prior to construction and before the first pile driving or pile removal of the day. Similarly, monitoring will occur 30 minutes past construction after the last pile driving or pile removal of the day. If the construction personnel take a break between subsequent pile driving or pile removal for more than 30 minutes, then additional pre-construction marine mammal monitoring will be required before the next start-up of pile driving or pile removal.

- If marine mammals are observed, the following information will be documented:
  - Species of observed marine mammals;
  - Number of observed marine mammal individuals;
  - Behavioral of observed marine mammals;
  - Location within the ZOI; and
  - Animals' reaction (if any) to pile-driving activities.

- During all pile driving and pile removal, land-based PSOs will monitor the area from the best observation points available. If weather conditions prevent adequate land-based observations, boat-based monitoring may be implemented. All PSOs shall use binoculars to observe the ZOI.

- To verify the required monitoring distance, the Level B acoustical harassment ZOIs will be determined by using a range finder or hand-held global positioning system device.

- During impact pile driving of concrete piles, PSOs will monitor and pause work if a marine mammal enters the 180 dB_{RMS} exclusion zone extending 7 ft/2 m. It is highly unlikely that a cetacean or pinniped will come this close to active pile driving, but monitoring will be done to ensure that no injury takes place.

2.3.5.4 REPORTING REQUIREMENTS

WSF will provide NMFS with a draft monitoring report within 90 days of the conclusion of the proposed construction work. This report will detail the monitoring protocol, summarize the data recorded during monitoring, and estimate the number of marine mammals that may have been harassed.

If comments are received from the NMFS Northwest Regional Administrator or NMFS Office of Protected Resources on the draft report, a final report will be submitted to NMFS within 30 days thereafter. If no comments are received from NMFS, the draft report will be considered to be the final report.

In the unanticipated event that WSF's construction activities clearly cause the take of a marine mammal by injury (Level A harassment), serious injury or mortality (e.g., ship-strike, gear interaction, and/or entanglement), WSDOT shall immediately cease construction operations and immediately report the incident to NMFS OPR and NMFS NWRO.

2.4 ALTERNATIVES CONSIDERED BUT ELIMINATED FROM DETAILED STUDY

NMFS considered an alternative where NMFS would issue an IHA without the mitigation measures described in Alternative 2–Issuance of an IHA with Mitigation (the Preferred Alternative). This alternative, however, failed to meet the statutory and regulatory requirements of the MMPA (e.g., negligible impact, effecting the least practicable adverse impact, and monitoring and reporting of such takings) because the MMPA requires certain monitoring and mitigation measures to be implemented to reduce the effects on marine mammals. Accordingly, NMFS did not consider this alternative further.

CHAPTER 3 AFFECTED ENVIRONMENT

This chapter presents baseline information necessary for consideration of the alternatives, and describes the resources that would be affected by the alternatives, as well as environmental components that would affect the alternatives if they were to be implemented. The effects of the alternatives on the environment are discussed in Chapter 4.

The Mukilteo Multimodal Ferry Terminal project area is located in the northernmost part of the City of Mukilteo in an urbanized area adjacent to Possession Sound, tributary to Puget Sound. The existing ferry terminal is located at the terminus of State Route 525 and Front Street in Mukilteo's waterfront commercial district (Figure 1-1). The marine environment supports concentrations of marine mammals, seabirds, fish and invertebrates occupying in-water and nearshore habitats and beaches.

The following descriptions focus on physical features, major living marine resources—their biology, habitat, and current status of the resource—with special emphasis on the six species of marine mammals that may be present in the in-water marine habitat during project pile removal and driving activities.

3.1 PHYSICAL ENVIRONMENT

3.1.1 MUKILTEO

The population within the existing boundaries of the City of Mukilteo is expected to grow from an estimated population of 19,190 in 2003 to a total of 22,000 by the year 2025 (Moffatt and Nichol 2005). Commercial, residential, public and recreation uses characterize the land use adjacent to the existing ferry terminal and along the Mukilteo waterfront. Specific uses adjacent to the existing ferry terminal include multi-family housing, Mukilteo Lighthouse Park and beach area, a hotel, fishing pier, restaurants and retail uses. Other uses in the vicinity include an artist studio and arts center, office space, several apartments and single-family residence. Most of the buildings in this area range from one to three stories in height. The upland area to the south includes more retail, restaurant and residential uses between Second and Fifth Streets.

The ferry terminal is proposed to be relocated to a property approximately 900 feet east of its current location. The proposed site was previously used for aviation fuel storage and operations, and is referred to as the "Tank Farm" property. Abandoned buildings, pavement, and concrete walls of the former fuel storage operations characterize the Tank Farm property. A pier where fuel was off-loaded from ships extends waterward approximately 1,300 feet from the shoreline.

3.1.2 AMBIENT SOUND

The need to understand the marine acoustic environment is critical when assessing the effects of anthropogenic noise on marine wildlife. Sounds generated by coastal construction such as pile driving and dredging within the marine environment can affect its inhabitants' behavior (e.g., deflection from loud sounds) or ability to effectively live in the marine environment (e.g., masking of sounds that could otherwise be heard). Understanding of the existing environment is necessary to evaluate the potential effects of oil and gas exploration and development.

Ambient sound levels are the result of numerous natural and anthropogenic sounds that can propagate over large distances and vary greatly on a seasonal and spatial scale. These ambient sounds occupy all frequencies and contributions in ocean soundscape from a few hundred Hz to 200 kHz (NRC 2003). In typical urban coastal waters such as the one at the proposed action area, the main sources of underwater ambient sound would be associated with:

- Wind and wave action
- Precipitation
- Vessel and industrial activities
- Biological sounds (fish, snapping shrimp)

The contribution of these sources to the background sound levels differs with their spectral components and local propagation characteristics (e.g., water depth, temperature, salinity, and ocean bottom conditions). In deep water, low-frequency ambient sound from 1–10 Hz mainly comprises turbulent pressure fluctuations from surface waves and the motion of water at the air-water interfaces. At these infrasonic frequencies, sound levels depend only slightly on wind speed. Between 20–300 Hz, distant anthropogenic sound (ship transiting, etc.) dominates wind-related sounds. Above 300 Hz, the ambient sound level depends on weather conditions, with wind- and wave-related effects mostly dominating sounds. Biological sounds arise from a variety of sources (e.g., marine mammals, fish, and shellfish) and range from approximately 12 Hz to over 100 kHz. The relative strength of biological sounds varies greatly; depending on the situation, biological sound can be nearly absent to dominant over narrow or even broad frequency ranges (Richardson *et al.* 1995).

At the vicinity of the Mukilteo Ferry Terminal proposed construction area, the ambient noise levels in the frequency band up to 20 kHz, per guidelines developed by NMFS Northwest Region (NMFS 2012a), measured between 122 and 124 dB re 1 µPa (Laughlin 2012, Table 3-1), depending on marine mammal functional hearing groups (Southall *et al.* 2007).

Table 3-1. Mukilteo Area Underwater Ambient Noise Levels

Frequency Range (Hz)	Functional Hearing Group	Species	Mukilteo 50% CDF (dB re 1 µPa)
7 – 20,000	Low-frequency Cetaceans	Gray whale, humpback whale	124
75 – 20,000	Pinnipeds	Harbor seals, California sea lions, Steller sea lions	122
150 – 20,000	Mid-frequency Cetaceans	Killer whale	122
200 – 20,000	High-frequency Cetaceans	Harbor porpoise, Dall's porpoise	122

3.1.3 ESSENTIAL FISH HABITAT

The action areas includes marine habitat, and is within designated Pacific groundfish, and coastal pelagic and Pacific salmonid EFHs. These three EFHs include habitats for 44 groundfish species, 3 salmon species, and 5 coastal pelagic species. As explained above in Section 1.2.5.4, however, NMFS has determined that issuance of this IHA will not have an adverse impact on any EFH. Therefore, a detailed discussion of the effect of the action EFH is not included.

3.2 Biological Environment

3.2.1 Marine Flora

Marine flora consists of floating algae (phytoplankton) and attached plants which include both algae and vascular plants such as eelgrass. As described by Gustafson *et al.* (2000), phytoplankton productivity in the open waters of the central basin of Puget Sound is dominated by intense blooms of microalgae beginning in late April or May and recurring through the summer. Annual primary productivity in the central basin of the Sound is about 465 grams of carbon per square meter. This high productivity is due to intensive upward transport of nitrate by the estuarine mechanism and tidal mixing.

Substrates for attached plants in the action areas consists of riprap along the shorelines of Port Washington Narrows, Sinclair and Dyes Inlets as well as tide flats, marshes, and a shallow lagoon. The subtidal and intertidal habitat in and around the action area consists mostly of sand with a little mixed mud, clay, and wood substrates. The subtidal and intertidal areas of these waters are dominated by brown and green algae as well as eelgrass beds. Eelgrass grows in the muddy or sandy substrate of the shallow subtidal zone, down to a depth of approximately 7 m (22 ft), and forms a complex and highly productive ecosystem that is an important component of nearshore habitat in estuaries and bays throughout Puget Sound. Eelgrass meadows are biologically rich habitats, sheltering a diverse group of fish and invertebrate species that are dependent on eelgrass beds for food resources and cover (Phillips 1984). Gammarid amphipods are dependent on ingesting eelgrass particles for their growth and development and are preferred prey items of juvenile salmon. Epibenthic harpacticoid copepods are an important food resource for juvenile chum salmon and were reported to be four times more prevalent in a stand of eelgrass compared to a neighboring habitat without eelgrass (Simenstad and Kenney 1978). Pacific herring, another commercially important species, utilize eelgrass beds as a spawning substratum to deposit their eggs and as a nursery ground for young herring. Apart from Pacific herring and juvenile salmon, numerous other commercially and non-commercially important fish are associated with eelgrass meadows. In addition to supporting fish fishery resources, eelgrass beds also support many invertebrate fishery resources like clams, oysters, shrimps, crabs, etc.

3.2.2 Marine Invertebrates

3.2.2.1 Pelagic Invertebrates

Pelagic habitat comprises the water column and is defined by the depth to which light can penetrate, or the photic zone, allowing photosynthesis to occur with existing marine flora. Depth of this layer varies seasonally and locally, generally ranging to depths of 20 to 80 m (66 to 262 ft) (NOAA 1993). Light, temperature, and nutrients all determine the occurrence and succession of zooplankton species (Gustafson *et al.* 2000). Zooplankton exhibit daily vertical migration patterns and will go deeper than the photic zone. However, during the high phytoplankton production months of spring and summer, zooplankton tend to stay near their food source.

Zooplankton such as ciliates, copepods, euphausiids, and pelagic tunicates as well as larval stages of crabs, worms, mollusks, and barnacles occur in the pelagic habitat of the action area in and around the Port Washington Narrows and Sinclair and Dyes Inlets. The most dominant zooplankton species in Puget Sound are calanoid copepods as well as cnidarians and polychaetes that thrive throughout the year (Gustafson *et al.* 2000).

3.2.2.2 SUBTIDAL BENTHIC INVERTEBRATES

Subtidal benthic or bottom habitat is defined as depths not uncovered by the tides (i.e., below the level of the extreme-low-spring tide at a given location). The most abundant (in terms of biomass) bivalve in the subtidal benthic habitat is the Pacific geoduck. Geoducks occur in soft bottom habitat from the intertidal zone to the deep subtidal zone. In Puget Sound they have been found as deep as 110 m (360 ft). Although a highly productive and popular fishery, geoduck associated with eelgrass beds are not harvested out to a 1-m (2-ft) buffer zone around rooted eelgrass to protect the eelgrass beds (Bradbury *et al.* 2000).

Other marine invertebrate species utilizing the sand/mud habitat in and around the Port Washington Narrows action area and surrounding waters include cockles and horse mussel. Other bivalves found in the area include numerous species of hardshell clams such as piddocks, littleneck clam, butter clam, and horse clam (WDFW 2004). Dungeness crab occurs throughout Puget Sound, both intertidally and subtidally on a variety of substrates; juveniles and subadults are often associated with eelgrass (Fisher and Velasquez 2008).

3.2.2.3 INTERTIDAL BENTHIC INVERTEBRATES

In addition to their utilization of subtidal habitat, clams and cockles inhabit the intertidal areas within the vicinity of the action area. Other invertebrates found in the intertidal and subtidal areas include shrimp, tunicates, crab, barnacles, sun star, sea cucumber, and sea anemones. Clams and cockles as well as crab, oyster, sea anemones, and barnacles are most associated with a hard substrate bottom. Sea anemones and barnacles adhere to rocks and other hard structures found in the intertidal areas.

3.2.3 FISH SPECIES

3.2.3.1 NON-ESA-LISTED FISH SPECIES

3.2.3.1A Coastal Pelagic and Forage Fish Species

Pelagic fishes inhabit the open, upper portion of marine waters rather than waters adjacent to land or near the sea floor. Some pelagic fish rear in intertidal or freshwater environments for periods of time, but move into marine waters for two to five years until they are sexually mature. When ready to spawn, these fish move to waters closer to shore. Predominant pelagic fish species found in marine waters adjacent to Washington include: Pacific herring, Pacific sand lance, surf smelt, Pacific sardine, northern anchovy, and eulachon. These species are considered “forage fish” and are important prey for various fish, marine mammals, and seabirds and are also harvested in commercial, recreational, and Tribal usual and accustomed fisheries. Although technically anadromous, eulachon are discussed under the pelagic fish section because of their extensive pelagic life stage and their role as forage fish for other marine animals.

Pacific Herring Most Washington State herring stocks spawn in intertidal and shallow subtidal areas on hard bottom, algae, and other substrates from late January through early April, and hatching of larvae occurs 10 to 14 days later. The larvae become part of the pelagic community and drift with the ocean currents. Puget Sound herring stocks spend their first year in Puget Sound (Bargmann 1998). Some herring stocks spend their entire lives within Puget Sound ("resident stocks") while other stocks ("migratory stocks") summer in the coastal areas of Washington and southern British Columbia (Trumble 1983).

Herring stocks are defined by spawning grounds. At least 18 stocks spawn inside Puget Sound and one stock spawns on the Washington coast in central Willapa Bay. The Washington State Department of Fish and Wildlife's (WDFW's) ongoing annual assessment survey results (which indicate stock specific age structures and strong site specificity, spawn timing, and prespawner holding area characteristics) support the assumption of stock autonomy for Puget Sound herring. Therefore, conservation of herring spawning habitat and minimizing disturbance in the prespawning holding areas is key to the preservation of the herring stocks inside Puget Sound. Herring stock assessment data are very useful for localized habitat management and planning. The Pacific herring is of considerable interest in the Puget Sound region because of the species' value as forage for other fish, seabirds, and marine mammals; its popularity as recreational fishing bait; its significance to local commercial and Tribal usual and accustomed fisheries; and its importance as an indicator of the general "health and productivity" of Puget Sound (WDFW 1997).

Sand Lance The Pacific sand lance is widespread and can be found from California to Alaska and across the Bering Sea to Japan. Sand lance are found from the intertidal zone to approximately 200 m (656 ft) deep and feed in the upper water column during the day and bury in the sand substrate during the night (Hobson 1986). Puget Sound sand lance populations appear to be obligatory upper intertidal spawners, depositing their eggs in sand-gravel substrates between the mean high-tide line and about 2 m (5 ft) in tidal elevation (WDFW 1997). Spawning takes place annually from approximately the beginning of November through mid-February. Individual broods of eggs incubate in the beach substrate for about 1 month, after which time the larvae are a common component of the nearshore plankton in many parts of Puget Sound.

Several spawnings may occur at any given site during the November to February spawning season (Bargmann 1998). Sand lance spawning activity appears to be distributed throughout the shorelines of the Puget Sound basin.

Sand lance are an important part of the trophic link between zooplankton and larger predators in the local marine ecosystem. Like all forage fish, sand lance are a significant component in the diet of many economically important resources in Washington. On average, 35 percent of juvenile salmon diets are composed of sand lance. In particular, 60 percent of the diet of juvenile Chinook are composed of sand lance. Other economically important species, such as Pacific cod, Pacific hake, and dogfish feed heavily on juvenile and adult sand lance (WDFW 1997).

Sand lance populations are widespread within Puget Sound, the Strait of Juan de Fuca, and the coastal estuaries of Washington. They are most commonly noted in more localized areas, such as the eastern Strait and Admiralty Inlet. However, WDFW plankton surveys and ongoing spawning habitat surveys suggest that there are very few if any bays and inlets in the Puget Sound basin that do not support sand lance spawning activity. Sand lance are not regularly harvested for bait or human consumption in

Washington and when harvested are commonly dip netted for salmon sport bait. The stock status of sand lance within Washington is unknown (WDFW 1997).

Surf Smelt Surf smelt occur from Southern California to central Alaska and have an entirely marine/estuarine life history. Surf smelt are very widespread in Washington, occurring in the outer coastal estuaries, the shores of the Olympic Peninsula, and the greater Puget Sound basin from Olympia to the U.S.-Canada border (Bargmann 1998).

Surf smelt within the Puget Sound basin are somewhat unusual in having an extended spawning season, with some areas receiving several months of spawning activity centered in either the summer months or a fall-winter period. Surf smelt deposit adhesive, semitransparent eggs on beaches, which have a specific mixture of coarse sand and pea gravel. Larvae emerge after approximately 11 to 16 days in the summer months and 27 to 56 days in the winter months. After emerging, they are planktonic for a period of time before settling in estuaries and nearshore waters for several months. Juvenile surf smelt rear in the nearshore waters throughout Puget Sound. Spawning maturity may be reached during their first year of life, although the majority reach spawning maturity during their second year. Surf smelt do not die after spawning and may spawn during successive seasons (WDFW 1997).

Surf smelt are harvested in commercial, recreational and Tribal usual and accustomed fisheries in Washington and are currently "passively managed" by the WDFW. Stock status of surf smelt within Washington is unknown (WDFW 1997).

3.2.3.1B Groundfish

Groundfish are marine fish species that live near or on the bottom of marine waters for most of their adult lives. These include groundfish species such as rockfish, flatfish (flounder, sole, halibut), roundfish (greenlings, ling cod, Pacific cod, sablefish, walleye pollock, Pacific hake), sharks, and skates. There are over 90 species of groundfish on the Pacific coast of the U.S. managed under the Pacific Coast Groundfish Fishery Management Plan (PFMC 2004), many of which support important commercial, recreational and Tribal usual and accustomed fisheries. There are at least 150 species of groundfish in Puget Sound (Palsson *et al.* 1998).

While the majority of groundfish on the west coast of Washington are harvested in the commercial trawl fishery, both recreational and Tribal usual and accustomed fisheries also harvest groundfish. Washington coastal treaty Indian tribes (Hoh, Makah, Quileute and the Quinault Indian Nation) hold formal allocations in their usual and accustomed fishing areas for sablefish, Pacific hake, and black rockfish.

A preliminary 2002 assessment of groundfish stocks has shown that over half of key groundfish stocks in South Puget Sound are at or below average abundance (Puget Sound Water Quality Action Team [PSWQAT] 2002). Some of the species that once dominated the catches of recreational and commercial fishers are now at depressed or critical abundances, resulting in historic low catches and reduced fisheries (Palsson *et al.* 1998). Additionally, eight species of West Coast groundfish have recently been declared overfished including widow rockfish, canary rockfish, yelloweye rockfish, darkblotched rockfish, bocaccio, Pacific ocean perch, lingcod, and cowcod.

Cod, Sablefish, and Lingcod Pacific cod are found in continental shelf and upper continental slope waters and are widely distributed in the coastal North Pacific, from the Bering Sea and Alaska south to Santa Monica, California in the east and the Sea of Japan in the west (Hart 1973; Department of Fisheries and Oceans Canada [DFOC] 2001).

Garrison and Miller (1982) reported that all Pacific cod life stages are found in various bays in Puget Sound and in the Strait of Juan de Fuca. Adults occur as deep as 875 m (2,871 ft), but the majority occurs from 50 to 300 m (164 to 984 ft). They are typically associated with mixed-coarse and mixed-fine sand substrata on the bottom of Puget Sound (Matthews 1987). Pacific cod migrate from shallow waters in spring and summer to deeper waters in fall and winter. Sexual maturity is reached by 2 to 3 years of age (DFOC 2001) and spawning occurs at depths of 40 to 265 m (131 to 869 ft) from late fall to early spring in Puget Sound (Garrison and Miller 1982). Eggs and larvae are found over the continental shelf between Washington and central California from winter through summer (Dunn and Matarese 1987; Palsson 1990). Small juveniles usually settle into intertidal and subtidal habitats, commonly associated with sand and eel grass, and gradually move into deeper water with increasing age (Miller *et al.* 1976; NOAA 1990).

The status of Pacific cod in Puget Sound is based primarily on recreational and commercial fishery statistics since 1970 and bottom trawl surveys that were conducted throughout Puget Sound in 1987, 1989, and 1991. A biological review identified several concerns: 1) the apparent loss of the major, known spawning locations in Puget Sound; 2) general synchronicity in declining trends in cod abundance from Puget Sound to Southeast Alaska; and 3) relatively little quantitative information or understanding about the effects of potential risk factors (Gustafson *et al.* 2000).

Sablefish inhabit shelf and slope waters to depths greater than 1,494 m (4,900 ft) from central Baja California to Japan and the Bering Sea. Spawning occurs from January to March along the continental shelf at depths greater than 1,000 m (3,281 ft). Larval sablefish are found in surface waters over the shelf and slope from April to May. Juveniles are commonly encountered in shallower waters, including Puget Sound (Hart 1973).

Lingcod are demersal fish that range from Baja California to Kodiak Island in the Gulf of Alaska (Hart 1973). In Puget Sound, adult lingcod live on and adjacent to rocky bottoms and reefs while juveniles are found on sandy bottom areas adjacent to rocky reefs (Matthews 1987). Spawning occurs between December and March with eggs laid in rocky crevices in shallow areas with strong water motion. After dispersing from their nests, larvae spend two months in pelagic habitat. In late spring-early summer, juveniles move to demersal habitats and settle in shallow-water vegetated habitats (Cass *et al.* 1990; West 1997). It is likely that juveniles use nearshore habitats for shelter and feeding.

Flatfish At least 13 species of flatfish occur in Washington waters and include the Pacific halibut, butter sole, rock sole, curlfin sole, Dover sole, flathead sole, English sole, petrale sole, sand sole, rex sole, starry flounder, and Pacific sanddab. Most flatfish are demersal species associated with shallow, soft-bottom (sand and mud) habitats in Puget Sound and Washington coast waters (Emmett *et al.* 1991). They spawn offshore between September and April (Kruse and Tyler 1983). Larvae are found in nearshore habitats between March and May. Juveniles are found throughout the year in gravel, sand-eelgrass, and mud-eelgrass habitats. English sole is the most numerous flatfish in Puget Sound.

Sharks and Skates Species of sharks and skates that are known to occur in Washington waters include the spiny dogfish, big skate, and longnose skate. The spiny dogfish occurs worldwide in temperate seas and on the Pacific Coast occurs from the Aleutian Islands to central Baja. It is frequently encountered over rocky reefs up to 900 m (2,953 ft) deep and is known to inhabit estuarine, coastal, and offshore waters. Tagging studies have indicated that they are capable of long migrations and have been documented to travel 7,000 km (4,350 mi) from British Columbia to Japan. The spiny dogfish is ovoviviparous (eggs or embryos develop inside the maternal body, but do not receive nutritive or other metabolic aids from the parent; offspring are released as miniature adults). They have a slow maturity rate (around 12 years) which makes them highly vulnerable to overfishing (Elasmodiver 2006).

The big skate is found in temperate waters of the eastern Pacific Ocean including the eastern Bering Sea and Aleutian Islands, west to Unalaska Island and south to Baja, California. It inhabits waters from the intertidal to depths of 120 m (394 ft) and can be found along the coast in estuaries, bays, and over the continental shelf (Florida Museum of Natural History 2006).

The longnose skate was once frequently encountered in British Columbia and Washington but are now uncommon from Alaska to Southern California. The longnose skate is generally found on gently sloping sand and mud bottoms at depths of 20 to 600 m (66 to 1,968 ft) and inhabits coastal areas, estuaries, bays, and continental shelves (Elasmodiver 2006).

Sharks and skates form part of the demersal and near-bottom fish communities in Puget Sound and are not classified as food fish. These species are often caught as bycatch in groundfish fisheries. Stock status of these species in Washington is unknown.

3.2.3.1C Non-ESA-Listed Salmonids

Non ESA-listed salmonid species that are known to inhabit streams flowing into Port Orchard Reach near the action area include chum and Coho salmon (WDFW 2004).

Chum salmon within the vicinity of the action area are considered to be part of the Dyes Inlet/Liberty Bay fall chum stock and are found in Big Scandia, Little Scandia, and Crouch creeks, as well as in an unnamed stream located north of the action area. Other stocks of chum might be present in the action area during their migrations to and from natal streams. The Dyes Inlet/Liberty Bay fall chum stock is considered to be healthy. Escapement estimates based on live spawner counts in Chico, Barker, Dogfish, Clear, Steele, and Scandia creeks have ranged from 5,266 in 1997 to 75,920 in 2003 (WDFW 2003).

Puget Sound fall-run chum enter their natal streams in October and November and spawn from November through January. Out-migrating juvenile fall-run chum are found in nearshore marine waters from January through the end of July. Adult Coho return from the marine environment from early August to the end of December, with spawning occurring from late October to late December. Juvenile Coho out-migration to estuarine areas occurs from mid-February through September, with a few individuals remaining as late as November (Williams *et al.* 1975; WDFW 2003; Dorn and Best 2005; May *et al.* 2005; Fresh *et al.* 2006).

Coho salmon near the action area are considered to be part of the East Kitsap Coho stock due to their distinct spawning distribution and common history of hatchery releases, mainly from Minter Creek Hatchery (WDFW 2003). Coho populations are found in Big Scandia, Little Scandia, and Crouch creeks and in two unnamed streams on Bainbridge Island. Other Coho stocks are also likely to move through the action area. Escapement estimates for the East Kitsap Coho stock have ranged from 800 in 1992 to 18,000 in 2000. This stock is considered to be healthy.

No known populations of anadromous cutthroat or bull trout/Dolly Varden are present within the action area, although resident populations of cutthroat trout are found in two unnamed streams north of the WSF action area (WDFW 2003, 2004; PSMFC 2006).

The status of the East Kitsap winter steelhead stock is unknown (WDFW 2003).

3.2.3.2 ESA-LISTED FISH SPECIES

Two ESA-listed salmonid and three ESA-listed rockfish species potentially occur in the vicinity of the Mukilteo Ferry Terminal action area: Puget Sound Chinook Salmon ESU, Puget Sound Steelhead Trout Distinct Population Segment (DPS), Puget Sound/Georgia Basin yelloweye rockfish DPS, Puget Sound/Georgia Basin canary rockfish DPS, and Puget Sound/Georgia Basin bocaccio DPS.

Puget Sound Chinook Salmon ESU Chinook salmon occur in the action area as both adults and as juveniles. Chinook salmon spawning has been documented in Chico Creek, Clear Creek and other tributary streams to Dyes Inlet, and Blackjack Creek and Gorst Creek, tributaries to Sinclair Inlet (WDFW 2008). These spawning subpopulations are considered part of the South Puget Sound Chinook salmon stock defined by the WDFW and Western Washington Treaty Tribes (Tribes). This stock is classified as being of hatchery origin and not self-sustaining based on the typical habitat conditions present in these tributary habitats (WDFW 2002). It is nonetheless considered part of the ESU because individual spawning populations are supported in part by natural production. Spawning typically occurs from late September through October (WDFW 2002), but staging adult Chinook salmon are likely to be present in the action area as early as the last week of August. The Kitsap Pogie Club hosts an annual salmon fishing derby in mid-August targeting hatchery reared Chinook salmon staging in Sinclair Inlet before returning to spawn in Gorst Creek.

Juvenile Chinook salmon are known to utilize both nearshore and mid-water habitats throughout Sinclair Inlet, Dyes Inlet, and the PWN. Fresh *et al.* (2006) studied marine habitat utilization weekly between February and September in 2001 and 2002 using beach seines, mid-water seines, and mid-water tow nets. They found juvenile Chinook salmon at sampling sites located within the action area as early as March and as late as September, with peak abundance in May and June. The majority of these fish are of hatchery origin from outplants in local streams. However, tagged hatchery origin fish from other rivers in the region including the Nisqually, Puyallup, Skykomish, and Samish River systems, tributaries to the Strait of Juan de Fuca, and even the Fraser River were also captured during sampling. Assuming that wild origin fish display similar habitat use, the action area is likely to be utilized by juvenile Chinook salmon from several populations distributed throughout the ESU.

Puget Sound Steelhead Trout DPS Puget Sound steelhead occur in the action area as adults migrating to spawning habitats and as outmigrant juveniles. Steelhead are known to spawn in several tributary streams in the vicinity, including Gorst, Ross, Anderson, and Blackjack Creeks in Sinclair Inlet; and Chico, Clear, and Barker Creeks in Dyes Inlet. The WDFW considers these discrete spawning subpopulations to be part of the South Sound - East Kitsap Winter Steelhead stock (WDFW 2002). This stock is of native origin and supported entirely by wild production. These populations are not routinely monitored for abundance and productivity and their status is rated as unknown (WDFW 2002). Spawning typically occurs from February through mid-April, meaning that adult fish will be migrating through the action area from late January through early April.

The majority of juvenile Puget Sound steelhead migrate to marine waters from early April through mid-May as two-year old smolts, typically 140 to 160 mm in length (NMFS 2005). The inshore migration patterns of steelhead in Puget Sound are not well understood (NMFS 2005); however, an increasing body of evidence indicates that juveniles migrate rapidly to offshore marine habitats upon exiting freshwater. For example, Welch *et al.* (2004) and Melnychuk *et al.* (2007) found that tagged Keogh River steelhead smolts migrated rapidly from freshwater release areas to open marine waters, the majority moving into open water habitats within one week. Oregon Coast steelhead has also been shown to migrate rapidly to offshore environments (Pearcy 1992).

Studies of Puget Sound steelhead populations have demonstrated similar behavior. Berger and Ladley (2006) studied the migratory patterns of juvenile Puyallup River steelhead using acoustic telemetry. They found that steelhead smolts spent little time in estuarine and nearshore habitats, migrating rapidly towards the open ocean upon leaving their home river. The majority of tagged fish were detected at distant receiver arrays (i.e., West Point, Dalco Passage, Admiralty Inlet, and the Strait of Juan de Fuca) within 6 to 30 days of release near the mouth of the White River. Given the similarity in behavior demonstrated by steelhead populations throughout the Pacific Northwest, it is reasonable to conclude that juvenile steelhead are unlikely to be present in the action area beyond mid-June. Data on juvenile steelhead utilization of nearshore and midwater habitats in Sinclair Inlet are consistent with these observations. Fresh *et al.* (2006) conducted beach and midwater surveys in Sinclair Inlet using a variety of capture techniques. Only four of the over 20,000 juvenile salmonids captured in two years of effort were steelhead, indicating that offshore migration is rapid and nearshore habitat use by this species is limited at best.

Rockfish Rockfish on the Pacific coast typically inhabit the continental shelf and upper slope regions and consequently are sometimes described as nearshore, shelf, or slope rockfish. As adults, rockfish inhabit rocky reef habitats, slopes, pinnacles, pilings, or submerged debris and typically remain within 31 to 50 m (100 to 164 ft) of their preferred habitat (Matthews 1990). Rockfish are long-lived and sexual maturity is attained between 5 and 20 years of age. Spawning for most species generally takes place in the early spring (April) or late fall. Once hatched (late winter to mid-summer) the juvenile larvae form part of the pelagic community for up to 3 years and use nearshore habitats. Due to their long lives and late sexual maturity, rockfish are extremely susceptible to over harvest and stock depletion. The spawning potential of rockfish in

Puget Sound has declined by approximately 75 percent since the historic peak levels observed during the 1970s (PSWQAT 2002).

On April 28, 2010, NMFS listed the Puget Sound/Georgia Basin DPSs of yelloweye rockfish and canary rockfish as threatened, and listed the Puget Sound/Georgia Basin DPS of bocaccio as endangered under the ESA (72 FR 2276; April 28, 2010). The listing of each species will become effective on July 27, 2010. These DPSs include all yelloweye rockfish, canary rockfish, and bocaccio found in waters of the Puget Sound, the Strait of Georgia, and the Strait of Juan de Fuca east of Victoria Sill.

Yelloweye rockfish within the Puget Sound/Georgia Basin (in U.S. waters) are very likely the most abundant within the San Juan Islands region of the DPS. Though there is a lack of a reliable population-census within the regions of Puget Sound Proper, the San Juan region has the most suitable rocky benthic habitat (Palsson *et al.* 2009) and historically was the area of greatest angler catches (Moulton and Miller 1987). Productivity for yelloweye rockfish is influenced by long generation times that reflect intrinsically low annual reproductive success. Natural mortality rates have been estimated from 2 - 4.6% (Yamanaka and Kronlund 1997). Productivity may also be particularly impacted by Allee effects. As adults have been removed by fishing, the density and proximity of mature fish is decreased. Adult yelloweye typically occupy relatively small ranges (Love *et al.* 2002), and may not move to find suitable mates. Maternal effects on yelloweye rockfish productivity within the DPS are similar to those previously described for rockfish generally.

Historically the South Puget Sound was thought to be a population stronghold for the canary rockfish within the DPS, but it appears to be greatly depleted (Drake *et al.* 2010). Natural annual mortality ranges from six to nine percent (Methot and Stewart 2005; Stewart 2007). Life history traits suggest intrinsically slow growth rate and low rates of productivity for this species, specifically its age at maturity, long generation time and its maximum age (84 years) (Love *et al.* 2002). Past commercial and recreational fishing removals may have depressed the DPS to a threshold beyond which optimal productivity is unattainable (Drake *et al.* 2010). Maternal effects on canary rockfish productivity within the DPS are similar to those previously described for rockfish.

Bocaccio within the Puget Sound/Georgia Basin were historically most common within the South Sound and Central Sound regions (Drake *et al.* 2010), with just several documented occurrences within Hood Canal and none within the San Juan region. Though bocaccio were never a predominant segment of the multi-species rockfish population within the Puget Sound/Georgia Basin (Drake *et al.* 2010), their present-day abundance is likely a fraction of their pre-contemporary fishery abundance. Bocaccio may be absent in significant segments of their formerly-occupied habitat; from 1998 to 2008 fish were reported by anglers in only one region of the DPS. Productivity is driven by high fecundity and episodic recruitment events, largely correlated with environmental conditions, thus bocaccio populations do not follow consistent growth trajectories and sporadic recruitment drives population structure (Drake *et al.* 2010). Natural annual mortality is approximately 15% (Tolimeri and Levin 2005). Demographically, this species demonstrates some of the highest recruitment variability among rockfish species, with many years of failed recruitment being the norm (Tolimieri and Levin 2005). Given their severely reduced abundance, Allee effects may be particularly acute for bocaccio, even considering the propensity of some individuals to move long distances and potentially find mates.

Relevance of the Environmental Baseline Condition to Species and Critical Habitat Status

The degraded condition of habitat in the action area undermines function in support of the Puget Sound Chinook salmon or Puget Sound steelhead life histories expressed in the Port Washington Narrows. In general, the status of Puget Sound Chinook salmon and Puget Sound steelhead as threatened species is, in part, a function of declining conditions across the range of key habitats. With regard to nearshore marine habitats, various anthropogenic features, such as modified shorelines, modified bathymetry, overwater structures, disruption of hydrologic and sediment transport processes, habitat fragmentation, and degraded water quality have negatively influenced the biotic features necessary to support healthy populations of these species. While other factors, such as ocean conditions, harvest levels, and natural mortality from predation and disease also influence species status, the baseline conditions within the action area contribute to the net effect of depressing population viability. This effect is primarily realized through depressed juvenile survival during early marine rearing, which in turn is reflected in population productivity.

These factors also contribute to the degraded condition of Puget Sound Chinook salmon PCE 5 in the vicinity of the action area. Specifically, numerous overwater structures and shoreline development have degraded habitat suitability for juvenile Chinook salmon. Shallow water nearshore habitats have been eliminated in many areas, and numerous overwater structures pose a partial migration barrier through physical and shading effects. Shoreline development has resulted in the removal of submerged and overhanging vegetation and woody debris in many areas. Degraded water quality causes behavioral and sublethal injury responses that reduce individual fitness of Chinook salmon for their present and subsequent life histories. Additionally, these conditions effect the productivity of the salmonid prey base, decreasing the availability of food, having further, indirect effects on individual fitness. Despite these limiting factors, the action area and vicinity still provide important habitat functions. The action area is characterized by contiguous shallow water habitat and abundant forage fish and other prey resources, creating important transitional and migratory habitat for juvenile salmonids.

Critical habitat has not yet been designated for the listed yelloweye rockfish, canary rockfish, or bocaccio DPSs.

3.2.4 MARINE MAMMALS

The marine mammal species under NMFS jurisdiction most likely to occur in the proposed construction area include Pacific harbor seal (*Phoca vitulina richardsi*), California sea lion (*Zalophus californianus*), Steller sea lion (*Eumetopias jubatus*), killer whale (*Orcinus orca*), gray whale (*Eschrichtius robustus*), humpback whale (*Megaptera novaeangliae*), harbor porpoise (*Phocoena phocoena*), and Dall's porpoise (*P. dalli*).

General information on the marine mammal species found in Washington inland waters can be found in Caretta *et al.* (2012), which is available at the following URL: http://www.nmfs.noaa.gov/pr/pdfs/sars/po2012.pdf. Refer to that document for information on these species. Specific information concerning these species in the vicinity of the proposed action area is provided below.

3.2.4.1 HARBOR SEAL

Harbor seals are members of the true seal family (Phocidae). For management purposes, differences in mean pupping date (Temte 1986), movement patterns (Jeffries 1985; Brown 1988), pollutant loads (Calambokidis *et al.* 1985), and fishery interactions have led to the recognition of three separate harbor seal stocks along the west coast of the continental U.S. (Boveng 1988). The three distinct stocks are: (1) inland waters of Washington State (including Hood Canal, Puget Sound, Georgia Basin and the Strait of Juan de Fuca out to Cape Flattery), (2) outer coast of Oregon and Washington, and (3) California (Carretta *et al.* 2012).

The Washington Inland Waters stock (which includes Hood Canal, Puget Sound, Georgia Basin and the Strait of Juan de Fuca out to Cape Flattery) may be present near the project site. Pupping seasons vary by geographic region. For the northern Puget Sound region, pups are born from late June through August (WDFW 2012). After October 1 all pups in the inland waters of Washington are weaned. Of the three pinniped species that commonly occur within the region of activity, harbor seals are the most numerous and the only one that breeds in the inland marine waters of Washington (Calambokidis and Baird 1994).

In 1999, Jeffries *et al.* (2003) recorded a mean count of 9,550 harbor seals in Washington's inland marine waters, and estimated the total population to be approximately 14,612 animals (including the Strait of Juan de Fuca). There are an estimated 32,000 harbor seals in Washington today, and their population appears to have stabilized (NMFS 2011a; Jeffries 2013).

Harbor seals are the most numerous marine mammal species in Puget Sound. Harbor seals are non-migratory; their local movements are associated with such factors as tides, weather, season, food availability and reproduction (Scheffer and Slipp 1944; Fisher 1952; Bigg 1969, 1981). They are not known to make extensive pelagic migrations, although some long-distance movements of tagged animals in Alaska (174 km) and along the U.S. west coast (up to 550 km) have been recorded (Pitcher and McAllister 1981; Brown and Mate 1983; Herder 1983).

Harbor seals haul out on rocks, reefs and beaches, and feed in marine, estuarine and occasionally fresh waters. Harbor seals display strong fidelity for haul-out sites (Pitcher and Calkins 1979; Pitcher and McAllister 1981). The closest documented harbor seal haul-out sites to the Mukilteo Ferry Terminal are the Naval Station Everett floating security fence, and the Port Gardner log booms, both approximately 4.5 miles northeast of the project site. Harbor seals may also haul-out on undocumented sites in the area, such as beaches.

Since June 2012, Naval Station Everett personnel have been conducting counts of the number of harbor seals that use the in-water security fence floats as haul-outs. As of April 18, 2013, the highest count was 343 seals observed during one day in October 2012 (U.S. Navy 2013). The average number of seals hauled out for the 8 days of monitoring falling within the project construction window (July 15 - February 15) was 117 (U.S.

Navy 2013). However, given the distance from the haul-out to the Mukilteo Ferry Terminal, the number of affected seals would be less.

Since 2007, the Everett Community College Ocean Research College Academy (ORCA) has conducted quarterly cruises that include monitoring stations within the ZOI. Marine mammal sightings data were collected during these cruises. During 24 cruises within the ZOI falling within the project construction window (July 15 - February 15), the highest count was 13 seals observed during one day in November of 2012. The average number of seals observed during these cruises was 2.4 (ORCA 2013).

According to the NMFS National Stranding Database (2007-2013), there were 7 confirmed harbor seal strandings within 0.5 miles of Mukilteo Ferry Terminal (NMFS 2013b).

3.2.4.2 California Sea Lion

Washington California sea lions are part of the U.S. stock, which begins at the U.S./Mexico border and extends northward into Canada. The U.S. stock was estimated at 296,750 in the 2012 Stock Assessment Report (SAR) and may be at carrying capacity, although more data are needed to verify that determination (Carretta *et al.* 2013). Some 3,000 to 5,000 animals are estimated to move into northwest waters (both Washington and British Columbia) during the fall (September) and remain until the late spring (May) when most return to breeding rookeries in California and Mexico (Jeffries *et al.* 2000). Peak counts of over 1,000 animals have been made in Puget Sound (Jeffries *et al.* 2000).

California sea lions breed on islands off Baja Mexico and southern California with primarily males migrating to feed in the northern waters (Everitt *et al.* 1980). Females remain in the waters near their breeding rookeries off California and Mexico. All age classes of males are seasonally present in Washington waters (WDFW 2000).

California sea lions do not avoid areas with heavy or frequent human activity, but rather may approach certain areas to investigate. This species typically does not flush from a buoy or haulout if approached.

California sea lions were unknown in Puget Sound until approximately 1979 (Steiger and Calambokidis 1986). Everitt *et al.* (1980) reported the initial occurrence of large numbers at Port Gardner, Everett (northern Puget Sound) in the spring of 1979. The number of California sea lions using the Everett haul-out at that time numbered around 1,000. Similar sightings and increases in numbers were documented throughout the region after the initial sighting in 1979 (Steiger and Calambokidis 1986), including urbanized areas such as Elliot Bay near Seattle and heavily used areas of central Puget Sound (Gearin *et al.* 1986). In Washington, California sea lions use haul-out sites within all inland water regions (WDFW 2000). The movement of California sea lions into Puget Sound could be an expansion in range of a growing population (Steiger and Calambokidis 1986).

The closest documented California sea lion haul-out sites to the Mukilteo Ferry Terminal are the Everett Harbor navigation buoys (3.0/3.5 miles NE), and the Naval Station Everett floating security fence and Port Gardner log booms (both 4.5 miles NE).

Since June 2012, Naval Station Everett personnel have been conducting counts of the number of sea lions that use the in-water security fence floats as haul-outs. As of April 18, 2013, the highest count has been 123 California sea lions observed during one day in November 2012. The average number of California sea lions hauled out for the 8 days of monitoring falling within the project construction window (July 15 - February 15) is 43 (U.S. Navy 2013). However, given the distance from the haul-out to the Tank Farm Pier, it is not expected that the same numbers would be present in the ZOI.

Since 2007, the Everett Community College ORCA has conducted quarterly cruises that include monitoring stations within the ZOI. Marine mammal sightings data were collected during these cruises. During 10 cruises within the ZOI falling within the project window (July 15 - February 15), the highest count was 6 California sea lions observed during one day in October of 2008. The average number of sea lions observed during these cruises was 2.8 (ORCA 2013).

According to the NMFS National Stranding Database (2007-2013), there was one confirmed California sea lion stranding within 0.5 miles of the Mukilteo Ferry Terminal (NMFS 2013b).

3.2.4.3 STELLER SEA LION

The Eastern stock of Steller sea lion may be present near the project site. The eastern stock of Steller sea lions is estimated to be 52,847 individuals based on 2001 through 2009 pup counts (Allen and Angliss 2011). For Washington inland waters, Steller sea lion abundances vary seasonally with a minimum estimate of 1,000 to 2000 individuals present or passing through the Strait of Juan de Fuca in fall and winter months (WSDOT 2013).

Steller sea lion numbers in Washington State decline during the summer months, which correspond to the breeding season at Oregon and British Columbia rookeries (approximately late May to early June) and peak during the fall and winter months (WDFW 2000). A few Steller sea lions can be observed year-round in Puget Sound although most of the breeding age animals return to rookeries in the spring and summer (WSDOT 2013).

The Eastern Steller sea lions were listed as threatened under the Endangered Species Act (ESA). On October 23, 2013, NMFS removed the Eastern Steller sea lion from the ESA list as this stock is determined to have been recovered.

Breeding rookeries for the eastern stock are located along the California, Oregon, British Columbia, and southeast Alaska coasts, but not along the Washington coast or in inland Washington waters (Angliss and Outlaw 2007). Adult Steller sea lions congregate at rookeries in Oregon, California, and British Columbia for pupping and breeding from late May to early June (Gisiner 1985).

Steller sea lions primarily use haul-out sites on the outer coast of Washington and in the Strait of Juan de Fuca along Vancouver Island in British Columbia. Only sub-adults or non-breeding adults may be found in the inland waters of Washington (Pitcher *et al.* 2007). However, the number of inland waters haul-out sites has increased in recent years.

Since June 2012, Naval Station Everett personnel have been conducting counts of the number of sea lions that use the in-water security fence floats as haul-outs. No Steller sea lions have been observed using the security barrier floats haul-out to date (U.S. Navy 2013).

Since 2007, the Everett Community College ORCA has conducted quarterly cruises that include monitoring stations within the ZOI. No Steller sea lions have been observed in the ZOI during these cruises (ORCA 2013).

The closest documented Steller Sea lion haul-outs to the Tank Farm Pier are the Orchard Rocks and Rich Passage buoys near S. Bainbridge Island (19 miles SW), and Craven Rock near Marrowstone Island (23 miles NW). Haul-outs are generally occupied from October through May, which overlaps with the in-water work window. Any Steller sea lions near the Tank Farm Pier would be transiting through the area.

There is no data available on the number of Steller sea lions that use the Orchard Rocks. Up to 12 Steller sea lions have been observed using the Craven Rock haul-out off of Marrowstone Island in northern Puget Sound (WSF 2010). However, given the distance from this haul-out to the Mukilteo Ferry Terminal, it is not expected that the same numbers would be present in the ZOI.

According to the NMFS National Stranding Database (2007-2013), there were no Steller sea lion strandings in the area of the Mukilteo Ferry Terminal (NMFS 2013b).

3.2.4.4 HARBOR PORPOISE

The Washington Inland Waters Stock of harbor porpoise may be found near the project site. The Washington Inland Waters Stock occurs in waters east of Cape Flattery (Strait of Juan de Fuca, San Juan Island Region, and Puget Sound).

The Washington Inland Waters Stock mean abundance estimate based on 2002 and 2003 aerial surveys conducted in the Strait of Juan de Fuca, San Juan Islands, Gulf Islands, and Strait of Georgia is 10,682 harbor porpoises (NMFS 2011d).

No harbor porpoises were observed within Puget Sound proper during comprehensive harbor porpoise surveys (Osmek *et al.* 1994) or Puget Sound Ambient Monitoring Program (PSAMP) surveys conducted in the 1990s (WDFW 2008). Declines were attributed to gill-net fishing, increased vessel activity, contaminants, and competition with Dall’s porpoise.

However, populations appear to be rebounding with increased sightings in central Puget Sound (Carretta *et al.* 2007b) and southern Puget Sound (WDFW 2008). Recent systematic boat surveys of the main basin indicate that at least several hundred and possibly as many as low thousands of harbor porpoise are now present. While the reasons for this recolonization are unclear, it is possible that changing conditions outside of Puget Sound, as evidenced by a tripling of the population in the adjacent waters of the Strait of Juan de Fuca and San Juan Islands since the early 1990s, and the recent higher number of harbor porpoise mortalities in coastal waters of Oregon and Washington, may have played a role in encouraging harbor porpoise to explore and shift into areas like Puget Sound (Hanson *et al.* 2011).

Harbor porpoises are common in the Strait of Juan de Fuca and south into Admiralty Inlet, especially during the winter, and are becoming more common south of Admiralty Inlet. Little information exists on harbor porpoise movements and stock structure near the Mukilteo area, although it is suspected that in some areas harbor porpoises migrate (based on seasonal shifts in distribution). For instance Hall (2004) found harbor porpoises off Canada's southern Vancouver Island to peak during late summer, while the Washington State Department of Fish and Wildlife's (WDFW) Puget Sound Ambient Monitoring Program (PSAMP) data show peaks in Washington waters to occur during the winter.

Hall (2004) found that the frequency of sighting of harbor porpoises decreased with increasing depth beyond 150 m with the highest numbers observed at water depths ranging from 61 to 100 m. Although harbor porpoises have been spotted in deep water, they tend to remain in shallower shelf waters (<150 m) where they are most often observed in small groups of one to eight animals (Baird 2003). Water depths within the Tank Farm Pier ZOI range from 0 to 192 m.

Since 2007, the Everett Community College ORCA has conducted quarterly cruises that include monitoring stations within the ZOI. No harbor porpoise have been observed within the ZOI during these cruises (ORCA 2013).

According to the NMFS National Stranding Database, there was one confirmed harbor porpoise stranding within 0.5 miles of the Mukilteo Ferry Terminal from 2007 to 2013 (NMFS 2013b).

3.2.4.5 DALL'S PORPOISE

The California, Oregon, and Washington Stock of Dall's porpoise may be found near the project site. The most recent estimate of Dall's porpoise stock abundance is 42,000, based on 2005 and 2008 summer/autumn vessel-based line transect surveys of California, Oregon, and Washington waters (Carretta *et al.* 2011). Within the inland waters of Washington and British Columbia, this species is most abundant in the Strait of Juan de Fuca east to the San Juan Islands. The most recent Washington's inland waters estimate is 900 animals (Calambokidis *et al.* 1997). Prior to the 1940s, Dall's porpoises were not reported in Puget Sound.

Dall's porpoises are migratory and appear to have predictable seasonal movements driven by changes in oceanographic conditions (Green *et al.* 1992, 1993), and are most abundant in Puget Sound during the winter (Nysewander *et al.* 2005; WDFW 2008). Despite their migrations, Dall's porpoises occur in all areas of inland Washington at all times of year (WSDOT 2013), but with different distributions throughout Puget Sound from winter to summer. The average winter group size is three animals (WDFW 2008).

Since 2007, the Everett Community College ORCA has conducted quarterly cruises that include monitoring stations within the ZOI. No Dall's porpoise have been observed within the ZOI during these cruises (ORCA 2013).

According to the NMFS National Stranding Database (2007-2013), there were no Dall's porpoise strandings in the area of the Mukilteo Ferry Terminal (NMFS 2013b).

3.2.4.6 KILLER WHALE

The Eastern North Pacific Southern Resident (SR) and West Coast Transient stocks of killer whale may be found near the project site.

A. Southern Resident Stock

The Southern Residents live in three family groups known as the J, K and L pods. As of July 1, 2013, the stock collectively numbers 82 individuals: J pod has 26 members, K pod has 19 members, and L pod has 37 members (CWR 2013).

Southern Residents are documented in coastal waters ranging from central California to the Queen Charlotte Islands, British Columbia (NMFS 2008). They occur in all inland marine waters. SR killer whales generally spend more time in deeper water and only occasionally enter water less than 15 feet deep (Baird 2000). Distribution is strongly associated with areas of greatest salmon abundance, with heaviest foraging activity occurring over deep open water and in areas characterized by high-relief underwater topography, such as subsurface canyons, seamounts, ridges, and steep slopes (Wiles 2004).

Sightings compiled by the Orca Network from 1990-2013 show that SR killer whale occurs most frequently in the general area of the Tank Farm Pier in the fall and winter, and are far less common from April through September (Osborne 2008; Orca Network 2013). Since 2007, the Everett Community College ORCA has conducted quarterly cruises that include monitoring stations within the ZOI. No killer whales have been observed within the ZOI during these cruises (ORCA 2013).

Records from 1976 through 2013 document Southern Residents in the inland waters of Washington during the months of March through June and October through December, with the primary area of occurrence in inland waters north of Admiralty Inlet, located in north Puget Sound (Osborne 2008; Orca Network 2013).

Beginning in May or June and through the summer months, all three pods (J, K, and L) of Southern Residents are most often located in the protected inshore waters of Haro Strait (west of San Juan Island), in the Strait of Juan de Fuca, and Georgia Strait near the Fraser River.

Historically, the J pod also occurred intermittently during this time in Puget Sound; however, records from 1997-2007 show that J pod did not enter Puget Sound south of the Strait of Juan de Fuca from approximately June through August (Osborne 2008).
In fall, all three pods occur in areas where migrating salmon are concentrated such as the mouth of the Fraser River. They may also enter areas in Puget Sound where migrating chum and Chinook salmon are concentrated (Osborne 1999). In the winter months, the K and L pods spend progressively less time in inland marine waters and depart for coastal waters in January or February. The J pod is most likely to appear year-round near the San Juan Islands, and in the fall/winter, in the lower Puget Sound and in Georgia Strait at the mouth of the Fraser River.

According to the NMFS National Stranding Database (2007-2013), there were no killer whale strandings in the area of the Mukilteo Ferry Terminal (NMFS 2013b).

The SR killer whale stock was declared "depleted/strategic" under the MMPA in May 2003 (68 FR 31980). On November 18, 2005, the SR stock was listed as "endangered" under the ESA (70 FR 69903). On November 29, 2006, NMFS published a final rule designating critical habitat for the SR killer whale DPS. Both Puget Sound and the San Juan Islands are designated as core areas of critical habitat under the ESA, excluding areas less than 20 feet deep relative to extreme high water are not designated as critical habitat (71 FR 69054). A final recovery plan for Southern Residents was published in January of 2008 (NMFS 2008).

B. West Coast Transient Stock

Transient killer whales generally occur in smaller (less than 10 individuals), less structured pods (NMFS 2013). According to the Center for Whale Research (CWR 2013), they tend to travel in small groups of one to five individuals, staying close to shorelines, often near seal rookeries when pups are being weaned.

The West Coast Transient stock, which includes individuals from California to southeastern Alaska, is estimated to have a minimum number of 354 (NMFS 2012b). The West Coast Transient stock occurs in California, Oregon, Washington, British Columbia, and southeastern Alaskan waters. Within the inland waters, they may frequent areas near seal rookeries when pups are weaned (Baird and Dill 1995).

Sightings compiled by the Orca Network from 1990-2013 show that transient killer whale occurs most frequently in the general area of the Mukilteo Tank Farm Pier in the spring and summer, and are far less common from September through February (Orca Network 2013). However, transient killer whale occurrence is less predictable than SR killer whale occurrence, and they may be present at any time of the year. Since 2007, the Everett Community College ORCA has conducted quarterly cruises that include monitoring stations within the ZOI. No killer whales have been observed within the ZOI during these cruises (ORCA 2013).

3.2.4.7 GRAY WHALE

The Eastern North Pacific stock of gray whale may be found near the project site. The minimum population estimate of the Eastern North Pacific stock is 18,017 (Carretta *et al.* 2011).

Within Washington waters, gray whale sightings reported to Cascadia Research and the Whale Museum between 1990 and 1993 totaled over 1,100 (Calambokidis *et al.* 1994). Abundance estimates calculated for the small regional area between Oregon and southern Vancouver Island, including the San Juan Area and Puget Sound, suggest there were 137 to 153 individual gray whales from 2001 through 2003 (Calambokidis *et al.* 2004). Forty-eight individual gray whales were observed in Puget Sound and Hood Canal in 2004 and 2005 (Calambokidis 2007).

Although typically seen during their annual migrations on the outer coast, a regular group of gray whales annually comes into the inland waters at Saratoga Passage and Port Susan (7.5 miles north) from March through May to feed on ghost shrimp (Weitkamp *et al.* 1992). During this time frame they are also seen in the Strait of Juan de Fuca, the San Juan Islands, and areas of Puget Sound, although the observations in Puget Sound are highly variable between years (Calambokidis *et al.* 1994). The average tenure within Washington inland waters is 47 days and the longest stay was 112 days (WSDOT 2013). Sightings compiled by the Orca Network from 1990-2013 show that gray whales are most frequently in the general area of the Mukilteo Tank Farm Pier from January through May, and are far less common from June through September (Orca Network 2013). Since 2007, the Everett Community College ORCA has conducted quarterly cruises that include monitoring stations within the ZOI. No gray whales have been observed within the ZOI during these cruises (ORCA 2013).

According to the NMFS National Stranding Database (2007-2013), there were no gray whale strandings in the area of the Mukilteo Ferry Terminal (NMFS 2013b).

3.2.4.8 HUMPBACK WHALE

The California-Oregon-Washington (CA-OR-WA) stock of humpback whale may be found near the project site. The 2007/2008 estimate of 2,043 humpback whales is the best estimate for abundance for this stock (Carretta *et al.* 2013).

Historically, humpback whales were common in inland waters of Puget Sound and the San Juan Islands (Calambokidis *et al.* 2004b). In the early part of this century, there was a productive commercial hunt for humpbacks in Georgia Strait that was probably responsible for their long disappearance from local waters (Osborne *et al.* 1988). Commercial hunts ended in the 1960’s. Since the mid-1990s, sightings in Puget Sound have increased.

This stock calves and mates in coastal Central America and Mexico and migrates up the coast from California to southern British Columbia in the summer and fall to feed (NMFS 1991; Marine Mammal Commission 2003; Carretta *et al.* 2007). Few humpback whales are seen in Puget Sound, but more frequent sightings occur in the Strait of Juan de Fuca and near the San Juan Islands. Most sightings are in spring and summer.

Sightings compiled by the Orca Network from 1990-2013 show that humpback whales are most frequently in the general area of the Tank Farm Pier from April through June, and are far less common from July to March (Orca Network 2013). Since 2007, the Everett Community College ORCA has conducted quarterly cruises that include monitoring stations within the ZOI. No humpback whales have been observed within the ZOI during these cruises (ORCA 2013).

According to the NMFS National Stranding Database (2007-2013), there were no humpback whale strandings in the area of the Mukilteo Ferry Terminal (NMFS 2013b).

Table 3-2. List of marine mammals species in the proposed action area

Common Name	Scientific Name	ESA and MMPA Status
Pacific harbor seal	*Phoca vitulina richardsi*	Not ESA-listed, non-depleted
California sea lion	*Zalophus californianus*	Not ESA-listed, non-depleted
Steller sea lion	*Eumetopias jubatus*	Not ESA-listed, non-depleted
Harbor porpoise	*Phocoena phocoena*	Not ESA-listed, non-depleted
Dall’s porpoise	*P. dalli*	Not ESA-listed, non-depleted
Killer whale	*Orcinus orca*	Only Southern Resident killer whale stock listed under ESA and depleted under MMPA.

		Other stocks are not ESA-listed and non-depleted
Gray whale (Eastern North Pacific stock)	*Eschrichtius robustus*	Not ESA-listed, non-depleted
Humpback whale	*Megaptera novaeangliae*	ESA-listed and depleted

3.3 SOCIAL AND ECONOMIC ENVIRONMENT

3.3.1 LAND USE

The City of Mukilteo is located in the southwest portion of Snohomish County, which is one of the fastest growing counties in Washington State. It is bordered by the City of Everett on the east, Possession Sound on the west and north, and unincorporated Snohomish County on the south.

Most of the development within this study area has occurred east of SR 525 due to geographic constraints. Housing exists on both sides of SR 525 from Second Street to Ninth Street, but south of Ninth Street a steep bluff limits development west of SR 525. Two other neighborhoods are located west of SR 525 in the study area, one at Horizon Heights Drive (approximately 19th Street), and the other between 80th Street SW and 84th Street SW.

Commercial development in the study area is concentrated in the old downtown area and along SR 525. The old downtown area is located east of SR 525, approximately from Sixth Street to the waterfront. As with residential development, nearly all of the commercial development has occurred east of SR 525. Exceptions are the waterfront sub-area and the intersection of SR 525 and 84th Street SW, each of which has a small number of businesses west of SR 525.

Within the old downtown area the waterfront sub-area is separated from the rest of downtown by the Burlington Northern Santa Fe (BNSF) railroad tracks and the bluff above the tracks. The tracks run on an alignment parallel to the shoreline through the project area. The primary access between downtown and the waterfront is via SR 525. A secondary access route uses the Mount Baker Boulevard railroad crossing, which crosses the railroad tracks at grade approximately 0.5 mile east of SR 525. The Mount Baker Boulevard route is not suitable for high traffic volumes.

The waterfront sub-area currently has only a small amount of commercial and residential development. Residential development is limited to one 30-unit condominium building immediately west of the existing ferry terminal, and one residential property with approximately five units for rent. Commercial development includes one hotel, three restaurants, a small store, and a building with a number of office and art-related uses, in addition, to a government laboratory (NOAA) and a number of commercial parking lots.

The east end of the waterfront sub-area was used for decades as a military fuel tank farm. This facility consumed the largest share of land in the waterfront sub-area, limiting the amount of land available for development. This property was surplused by the military and is the proposed site for the project, as well as a Sound Transit commuter rail station and a Port of Everett Rail/Barge Transfer Facility. The remainder of the Tank Farm property will be conveyed to the Port of Everett, which is in the process of planning future development.

Preliminary plans call for a mix of housing and commercial uses, but the proposed development has not received approval from the City as of the date of this document.

To the west of SR 525, most of the land in the waterfront sub-area is part of Mukilteo Lighthouse Park, which was recently transferred from Washington State Parks to the City of Mukilteo. Mukilteo Lighthouse Park is located at Elliott Point, where the shoreline changes from an east-west alignment to a north-south alignment. Two of the main features of the park are the lighthouse and a boat ramp. The City is currently finalizing plans for substantial upgrades to this facility. South of the park the shoreline becomes too steep for development, and the BNSF rail line is located at the base of the bluff.

3.3.2 DEMOGRAPHY, INCOME AND AGE CHARACTERISTICS

The project area population has a lower share of minority residents than either Snohomish County or Mukilteo. According to the Census data, the non-white portion of the population was 12.1 percent, which is lower than in Mukilteo as a whole (19.4 percent non-white). The non-white portion in the study area was also lower than in Snohomish County, where the non-white share of the population was 14.5 percent.

The project area has a median household income level that is higher than in Snohomish County as a whole, but is slightly lower than in the City of Mukilteo. The average household income in the project area was $63,548 in the 2000 Census, while that for Snohomish County was $53,060 and for Mukilteo was $67,323.

The share of the population whose incomes are below the poverty level is about the same in the project area as it is in the whole city, but lower than in Snohomish County. According to the Census data 3.6 percent of the study area population and 3.4 percent of the Mukilteo population had incomes below the poverty level, while 6.9 percent of Snohomish County had low income.

The project area has a larger share of population 65 years or older than either Mukilteo or Snohomish County. Nearly 11 percent of the project area population falls into this age range, as compared with 6.5 percent of the Mukilteo population. The portion of the Snohomish County population 65 years or older is 9.1 percent (Moffatt & Nichol, 2005).

CHAPTER 4 ENVIRONMENTAL CONSEQUENCES

This chapter represents the scientific and analytic basis for comparison of the direct, indirect, and cumulative effects of the alternatives. Regulations for implementing the provisions of NEPA require consideration of both the context and intensity of a proposed action (40 CFR Parts 1500-1508).

4.1 EFFECTS OF ALTERNATIVE 1: DENY WSF'S REQUEST FOR AN IHA (NO ACTION)

Under the No Action Alternative, NMFS would not issue the ITAs for the activities proposed by the WSF. Accordingly, should WSF proceed without an IHA, any takes of marine mammals resulting from the proposed Mukilteo Ferry Terminal replacement construction work would not be authorized and any incidental take of marine mammals would be a violation of the MMPA. If the WSF decides not to proceed with the proposed ferry terminal replacement project at the Mukilteo Ferry Terminal, the impacts to the human environment at the proposed action area would remain the status quo, which is described in detail in Chapter 3 Affected Environment.

4.1.1 IMPACTS ON THE PHYSICAL ENVIRONMENT

Under the No Action alternative, it is likely that WSF would not proceed and thus that no construction work would occur at the Mukilteo Ferry Terminal. The only effects to the physical environment would be from existing ferry and ferry terminal operations. There would be no additional effects to the physical environment, including the turbidity and elevated ambient noise from construction activities.

4.1.2 IMPACTS ON THE BIOLOGICAL ENVIRONMENT

Under the No Action alternative, it is likely that WSF would not proceed and thus that there would be no effects on the biological environment as there would be no construction activities at the Mukilteo Ferry Terminal. Any effects to marine mammals, marine flora, invertebrates, or fish species in the proposed action area would be from existing ferry and ferry terminal operations. No Level B behavioral harassment would result from vibratory pile driving and pile removal.

4.1.3 SOCIAL AND ECONOMIC ENVIRONMENT

Under the No Action Alternative, it is likely that WSF would not proceed and thus that there would be no effects to the social and economic environment. The only effects to the social and economic environment would be from existing ferry and ferry terminal operations.

4.2 EFFECTS OF ALTERNATIVE 2: ISSUANCE OF AN IHA WITH MITIGATION (PREFERRED)

4.2.1 IMPACTS ON THE PHYSICAL ENVIRONMENT

Water and Sediment Quality: Short-term turbidity is a water quality effect of most in-water work, including removing and installing piles. Roni and Weitkamp (1996) monitored water quality parameters during a pier replacement project in Manchester, Washington. The study measured water quality before, during, and after pile removal and pile replacement. The study found that construction activity at the site had "little or no effect on dissolved oxygen, water temperature, and salinity", and turbidity (measured in nephelometric turbidity units [NTU]) at all depths nearest the construction activity was typically less than 1 NTU higher than stations farther from the construction area throughout construction.

Similar results were recorded during pile removal operations at two WSF ferry facilities. At the Friday Harbor terminal, localized turbidity levels (from three timber pile removal events) were generally less than 0.5 NTU higher than background levels and never exceeded 1 NTU. At the Eagle Harbor maintenance facility, local turbidity levels (from removal of timber and steel piles) did not exceed 0.2 NTU above background levels. In general, turbidity associated with pile installation is localized to about a 25-foot radius around the pile (Everitt *et al.* 1980).

Cetaceans are not expected to be close enough to the Mukilteo Ferry Terminal to experience effects of turbidity, and any pinnipeds will be transiting the terminal area and could avoid localized areas of turbidity. Therefore, the impact to marine mammals from increased turbidity levels is expected to be insignificant.

Acoustical Environment*:* The pile removal and installation work associated with Mukilteo Ferry Terminal replacement is expected to raise the overall ambient noise at the proposed action area. The level of increase would depend largely on the piling hammer and the distance from the noise source(s). However, WSF would only use vibratory pile hammer for steel pile removal and installation, which generates significantly less noise compared to an impact pile hammer. Impact pile driving would only be used to drive concrete piles with pile cushions to reduce noise production.

Measured underwater noise source levels for vibratory pile driving and pile removal range between 152 dB_{rms} re 1 µPa and 177 dB_{rms} re 1 µPa, depending on the types and sizes of piles. However, under the worst case scenario, the landmass intercepts the noise propagation at 12.7 miles (20.4 km) from the source for source levels above 171 dB_{rms} re 1 µPa. For impact pile driving of concrete piles, the 160 dB ZOI is expected to be only 152 feet (46 m) from the source.

For airborne noise, currently NMFS uses an in-air noise disturbance threshold of 90 dB_{rms} re 20 µPa (unweighted) for harbor seals, and 100 dB_{rms} re 20 µPa (unweighted) for all other pinnipeds. Using the above aforementioned measurement of 97.8 dB_{rms} re 20 µPa @ 50 ft, and attenuating at 6 dBA per doubling distance, in-air noise from vibratory pile removal and driving will attenuate to the 90 dB_{rms} re 20 µPa within approximately 37 m, and the 100 B_{rms} re 20 µPa within approximately 12 m.

4.2.2 IMPACTS ON THE BIOLOGICAL ENVIRONMENT

4.2.2.1 MARINE MAMMALS

WSF and NMFS determined that open-water pile driving and pile removal associated with the construction activities at Mukilteo Ferry Terminal has the potential to result in (1) hearing threshold shifts (TS), (2) masking, and (3) behavioral disturbance of marine mammal species and stocks in the vicinity of the proposed activity.

Exposure of marine mammals to certain sounds could lead to behavioral disturbance (Richardson *et al.* 1995), such as: changing durations of surfacing and dives, number of blows per surfacing, or moving direction and/or speed; reduced/increased vocal activities, changing/cessation of certain behavioral activities (such as socializing or feeding); visible startle response or aggressive behavior (such as tail/fluke slapping or jaw clapping), avoidance of areas where noise sources are located, and/or flight responses (e.g., pinnipeds flushing into water from haulouts or rookeries).

In addition, marine mammals exposed to high intensity sound repeatedly or for prolonged periods can experience TS, which is the loss of hearing sensitivity at certain frequency ranges (Kastak *et al.* 1999; Schlundt *et al.* 2000; Finneran *et al.* 2002; 2005). TS can be permanent (PTS), in which case the loss of hearing sensitivity is unrecoverable, or temporary (TTS), in which case the animal's hearing threshold will recover over time (Southall *et al.* 2007). Because marine mammals depend on acoustic cues for vital biological functions, such as orientation, communication, finding prey, and avoiding predators, marine mammals that suffer from PTS or TTS will have reduced fitness in survival and reproduction, either permanently or temporarily. Repeated noise exposure that leads to TTS could cause PTS. As explained below, it is very unlikely that any marine mammals would experience TTS or PTS as a result of noise exposure to WSDOT's proposed construction activities at Mukilteo Ferry Terminal.

Experiments on a bottlenose dolphin (*Tursiops truncates*) and beluga whale (*Delphinapterus leucas*) showed that exposure to a single watergun impulse at a received level of 207 kPa (or 30 psi) peak-to-peak (p-p), which is equivalent to 228 dB (p-p) re 1 μPa, resulted in a 7 and 6 dB TTS in the beluga whale at 0.4 and 30 kHz, respectively. Thresholds returned to within 2 dB of the pre-exposure level within 4 minutes of the exposure (Finneran *et al.* 2002). No TTS was observed in the bottlenose dolphin. Although the source level of pile driving from one hammer strike is expected to be much lower than the single watergun impulse cited here, animals being exposed for a prolonged period to repeated hammer strikes could receive more noise exposure in terms of SEL than from the single watergun impulse (estimated at 188 dB re 1 μPa^2-s) in the aforementioned experiment (Finneran *et al.* 2002).

Currently, NMFS considers that repeated exposure to received noise levels at 180 dB and 190 dB_{rms} re 1 μPa could lead to TTS in cetaceans and pinnipeds, respectively. For the proposed construction work at Mukilteo Ferry Terminal, only vibratory pile driving would be used. Noise levels measured near the source of vibratory hammers (10 m and 16 m from the source, see above) are much lower than the 180 dB_{rms} re 1 μPa.

Chronic exposure to excessive, though not high-intensity, noise could cause masking at particular frequencies for marine mammals that utilize sound for vital biological functions (Clark *et al.* 2009). Masking can interfere with detection of acoustic signals such as communication calls, echolocation sounds, and environmental sounds important to marine mammals. Therefore, under certain circumstances, marine mammals whose acoustical sensors or environment are being severely masked could also be impaired from maximizing their performance fitness in survival and reproduction.

Masking occurs at the frequency band which the animals utilize. Therefore, since noise generated from in-water vibratory pile driving and removal is mostly concentrated at low frequency ranges, it may have less effect on high frequency echolocation sounds by odontocetes (toothed whales). However, lower frequency man-made noises are more likely to affect detection of communication calls and other potentially important natural sounds such as surf and prey noise. It may also affect communication signals when they occur near the noise band and thus reduce the communication space of animals (e.g., Clark *et al.* 2009) and cause increased stress levels (e.g., Foote *et al.* 2004; Holt *et al.* 2009).

Unlike TS, masking can potentially impact the species at population, community, or even ecosystem levels, as well as individual levels. Masking affects both senders and receivers of the signals and could have long-term chronic effects on marine mammal species and populations. Recent science suggests that low frequency ambient sound levels have increased by as much as 20 dB (more than 3 times in terms of SPL) in the world's ocean from pre-industrial periods, and most of these increases are from distant shipping (Hildebrand 2009). All anthropogenic noise sources, such as those from vessels traffic, pile driving, dredging, and dismantling existing bridge by mechanic means, contribute to the elevated ambient noise levels, thus intensify masking.

Nevertheless, the sum of noise from the proposed WSF construction activities is confined to an area that is bounded by landmass, therefore, the noise generated is not expected to contribute to increased ocean ambient noise. Due to shallow water depth near the ferry terminals, underwater sound propagation for low-frequency sound (which is the major noise source from pile driving) is expected to be poor.

Based on the estimated take, which is described in detail below, the percentage of take of marine mammals by Level B harassment would be under 13% for any species in any given year on a four-year basis, which has little, if any, biological significance. At most, we expect animals to experience temporary behavioral modifications (such as startle reaction) or temporary avoidance of the project area due to the elevated received noise levels. In-water pile driving and pile removal will only occur during the daytime period, and will not be conducted on a daily basis throughout the four-year construction period (please see Table 2-3 for the estimated duration for pile driving and/or pile removal for each of the construction phases: the days that pile driving and/or pile removal range from 15 to 120 days per year). In addition, even for a day when pile driving or pile removal would occur, the driving hammer will not be on continuously throughout the driving period. Instead, it will be on and off intermittently until the pile is settled into the sediment (for pile driving), or the pile is pulled out from the sediment (for pile removal). The entire duration of pile driving or removal lasts between 15 and 120 minutes, depending on the size of the pile (Table 2-3). Therefore, the noise exposure is not expected to have cumulative effects over time.

In sum, any adverse effects on marine mammals from the WSF construction activities, are expected to be minor or insignificant because the effects would be temporary and limited to behavioral disturbance. Marine mammals being disturbed from the elevated noise levels are expected to exhibit only minor and brief behavioral modification. Furthermore, injury or TS is not expected due to the lower level of noises from the construction activities.

Moreover, the proposed project area is not believed to be a prime habitat for marine mammals, and it is not considered an area frequented by marine mammals. Therefore, behavioral disturbances that could result from anthropogenic noise associated with Mukilteo Ferry Terminal construction activities are expected to affect only a small number of marine mammals on an infrequent basis. Therefore, the expected direct and indirect environmental impact will be minor.

4.2.2.1.1 REQUESTED NUMBER OF TAKES

WSF requests an IHA to incidentally take by Level B acoustical harassment small numbers of harbor seals, California sea lions, Steller sea lions, harbor porpoises, Dall's porpoises, killer whales, gray whales, and humpback whales.

For all species except the SRKW, incidental take is estimated for each species by estimating the likelihood of a marine mammal being present within a ZOI during the construction period. Expected marine mammal presence is determined by past observations and general abundance near the Mukilteo Ferry Terminal during the construction window. Typically, potential take is estimated by multiplying the area of the ZOI by the local animal density. This provides an estimate of the number of animals that might occupy the ZOI at any given moment. However, there are no density estimates for any Puget Sound population of marine mammal. As a result, the take requests were estimated using local marine mammal data sets (e.g., Orca Network, state and federal agencies), opinions from state and federal agencies, and incidental observations from WSF biologists. In the case of SRKW, WSF states that it will use its best efforts to avoid the take of SRKW by powering down or shutting down the vibratory pile hammer when the animals are sighted in the vicinity of the project area. However, WSF requested incidental take of 4 individuals (5% of the total population) of SRKW should individual undetected animals enter the ZOI. Requested numbers of takes are summarized in Table 4-1.

Table 4-1. Requested number of level B Behavioral Harassment Takes

Species	Estimated marine mammal takes	Percentage
Year One		
Pacific harbor seal	1,170	4.0%
California sea lion	540	0.2%
Steller sea lion	180	0.3%
Harbor porpoise	720	7.0%
Dall's porpoise	270	0.6%
Killer whale, transient	35	9.8%
Killer whale, Southern Resident	4	5.0%
Gray whale	70	0.4%
Humpback whale	28	2.0%
Year Two		
Pacific harbor seal	3,720	11.6%
California sea lion	1,400	0.5%
Steller sea lion	220	0.4%
Harbor porpoise	1,060	10
Dall's porpoise	510	1.2%
Killer whale, transient	45	12.7%
Killer whale, Southern Resident	4	5.0%
Gray whale	110	0.6%
Humpback whale	68	3.3%
Year Three		
Pacific harbor seal	1,345	4.2%
California sea lion	503	0.2%
Steller sea lion	30	0.1%
Harbor porpoise	255	2.4%
Dall's porpoise	144	0.3%
Killer whale, transient	34	9.6%

Species	Estimated marine mammal takes	Percentage
Killer whale, Southern Resident	4	5.0%
Gray whale	30	0.2%
Humpback whale	30	1.5%
Year Four		
Pacific harbor seal	299	1.0%
California sea lion	127	0.04%
Steller sea lion	31	0.06%
Harbor porpoise	129	1.2%
Dall's porpoise	54	0.13%
Killer whale, transient	15	4.2%
Killer whale, Southern Resident	4	5.0%
Gray whale	6	0.03%
Humpback whale	6	0.3%

4.2.2.2 FISH SPECIES

Although high levels of underwater sound have been shown to have negative physiological and neurological effects on a wide variety of fish species (Yelverton *et al.* 1973; Yelverton and Richmond 1981; Hastings and Popper 2005), the adverse effects of WSDOT's proposed project on fish species are highly unlikely to include fish mortality because WSDOT plans to use vibratory pile driving instead of impact hammer for pile driving and thus would not produce intense pulses. The potential effects of high levels of underwater sound on fish species are described below.

High intensity sounds can injure and/or kill exposed individuals, temporarily stun them, and/or cause behavioral alterations (Popper 2003; Hastings and Popper 2005). There have been few directed experimental studies to date on fish response to elevated SPLs generated during pile driving. The information that is available has been derived from opportunistic studies of previously planned pile driving activities, the majority examining effects on caged fishes placed at varying distances from the noise source. These studies have produced variable results. For example, two studies in California (CALTRANS 2003) demonstrated significant injury in caged fishes exposed to approximately 4,000 pile strikes at peak pressures as low as 198 dB re: 1 μPa. The cages were located as far as 311 m (1,020 ft) from pile driving, indicating that injury level effects can occur at distance. In contrast, Ruggerone *et al.* (2008) found no evidence of injury in juvenile coho salmon (*Oncorhynchus kisutch*) exposed to driving of small steel piles at relatively close proximity. It is difficult to generalize from these findings, however, because of the opportunistic nature of the studies and the fact that several important environmental factors were largely uncontrolled.

Broadly, the effects of organism exposure to elevated underwater noise can vary from no observable response, to behavioral alteration, to temporary impairment, to permanent injury, to delayed or immediate death. Over this continuum of effect, there is no easily identifiable point at which behavioral responses begin, or where these responses transition to physical injury. While specific thresholds are unclear, noise from impact pile driving has clearly been implicated in fish injury and mortality, with sensitivity varying dependent on species specific physiology (Stotz and Colby 2001; Fordjour 2003; Gaspin 1975; Hastings and Popper 2005).

The primary mechanism of injury from impulsive sounds (sounds of very short duration with a rapid rise in pressure) is the effect of rapid, high amplitude pressure changes on body tissues. The injuries resulting from this type of exposure are referred to as barotraumas (Turnpenny *et al.* 1994). Gas-filled organs, such as swim bladders, are particularly sensitive to this type of injury because they resonate (i.e., vibrate at a frequency determined by the physical parameters of the affected object) to a greater degree than most other tissues. When a sound pressure wave strikes the swim bladder, the gas-filled space vibrates (rapidly expands and contracts) at the resonant frequency of that organ. When the amplitude of this vibration is sufficiently high, the pulsing swim bladder can rapidly compress adjacent organs, such as the liver and kidney. This pneumatic compression causes demonstrable injury, in the form of ruptured capillaries, internal bleeding, and maceration of highly vascular tissues (CALTRANS 2002). Hastings and Popper (2005) also noted that sound waves can cause non-gas-filled tissues to vibrate at different frequencies, leading to tearing of mesenteries and other sensitive connective tissues. Exposure to impulsive sounds can also induce "rectified diffusion." Rectified diffusion describes the process by which rapid pressure changes draw dissolved gasses out of solution, creating bubbles. When these bubbles form in body tissues they can cause inflammation, cellular damage, and blockage or rupture of capillaries, arteries, and veins (Stroetz *et al.* 2001; Vlahakis and Hubmayr 2000), leading to overt injury or even mortality. Death from barotrauma and rectified diffusion injuries can be instantaneous, or delayed for minutes, hours, or even days following exposure.

Regardless of species, smaller fish appear to be far more sensitive to injury of non-auditory tissues (Yelverton *et al.* 1975). For example, NMFS biologists observed that approximately 100 surf perch from three different species (*Cymatogaster aggregata*, *Brachyistius frenatus*, and *Embiotoca lateralis*) were killed during impact pile driving of 30-inch diameter steel pilings at Bremerton, Washington (NMFS 2009). Dissections revealed complete swim bladder destruction across all species in the smallest fish (80 mm fork length (FL)), while swim bladders in the largest fish (170 mm FL) were nearly intact. However, swim bladder damage was typically more extensive in *C. aggregata* when compared to *B. frenatus* of similar size. Comparable size specific results have been demonstrated in other species. Due to their large size, adult salmon can tolerate higher noise levels and are generally less sensitive to injury of non-auditory tissues than juveniles (Hubbs and Rechnitzer 1952). However, no information is available to determine whether or not the risk of auditory tissue damage decreases with increasing size of the fish.

Gravid female salmon, specifically ovarian tissues and egg masses, may face elevated injury risk relative to immature adults and sub-adults of comparable size. Eggs and supporting mesenteries are highly vascular tissues located in close proximity to the swim bladder, suggesting elevated sensitivity to barotrauma. These risks could include direct injury to individual eggs, tearing of the mesenteries that hold the eggs in place (resulting in the eggs being extruded prematurely), and loss of blood flow leading to developmental abnormalities or death. While this form of barotrauma has not been the subject of directed study, some inferences can be drawn from studies of other species. For example, Banner and Hyatt (1973) demonstrated increased mortality of sheepshead minnow eggs and embryos when exposed to continuous broadband noise (100 to 1,000 Hz) approximately 15 dB above ambient. Hatched sheepshead minnow fry were unaffected by the same exposure, as were the eggs and fry of the longnose killifish (*Fundulus similis*). It must be noted, however, that the sounds produced by impact driving of steel piles are very different in character than the sounds in this study, and the eggs were free floating and not contained within the ovaries of the mother. As such, extrapolations from this study to eggs in a gravid female salmon are tenuous, at best.

Overall due to the short duration and limited scale of the proposed action, direct and indirect impacts to fish species are expected to be minor or negligible.

4.2.2.3 MARINE INVERTEBRATES

Information is scant on invertebrate sensitivity to sound, and the ecological and behavioral functions of sound receptors. For example, squid have demonstrated responses to sound which has been hypothesized to be related to their schooling nature (which requires synchronization and predator aversion mechanisms). Statocysts and/or proprioception (the sensing of movement of bodily tissue by acoustic energy) may be involved in the detection of sound.

Information is even more scant on the sensitivity of sound by mollusks (i.e. clams, mussels, oysters, chiton, snails, slugs and limpets). Response to sound has been evident by changes in aggregations. Eradication of zebra muscles, for example, has been accomplished by using ultrasound (Donskoy *et al.* 1996). A study on the Ox-Heart Clam (*Glossus humanus*) has demonstrated sensitivity to vibrations and hypothesized that the sensitivity was related to sensing breaking waves on the incoming tide, to move with the tide (Frings 1964).

Nevertheless, there is no evidence that sound sources from human activities have adverse impacts to invertebrates, especially, the noise generated from the WSF's proposed wingwalls replacement construction using vibratory pile hammer is much less intense when compared to impact hammers. Therefore, it is unlikely that there will be environmental impacts to marine invertebrates.

4.2.3 SOCIAL AND ECONOMIC ENVIRONMENT

The issuance of the IHA would not have a direct effect on the social and economic environment of the Mukilteo Ferry Terminal action areas because the issuance of the ITAs does not directly affect the construction activities.

4.3 UNAVOIDABLE ADVERSE EFFECTS

NMFS does not expect WSF's requested activities to have adverse consequences on the viability of the species and populations of marine mammals in the vicinity of the proposed action area. Further, the noise source levels from vibratory pile driving and pile removal are of low intensity. Given this and the likely response by marine mammals to the proposed ferry terminal replacement project, individual animals are likely to be adversely affected by pile driving and removal noise during proposed project activities, as mentioned throughout this EA, but the overall effects of the project are expected to be insignificant on the affected species or stocks of marine mammals.

4.4 CUMULATIVE EFFECTS

Cumulative effects are defined as "the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-federal) or person undertakes such other actions" (40 CFR §1508.7). Cumulative impacts can result from individually minor but collectively significant actions that take place over a period of time.

The proposed construction project at the Mukilteo Ferry Terminal is located in the City of Mukilteo in Northwest Washington State, near Puget Sound. The waters of Puget Sound are heavily used by vessels from both commercial and recreational activities. The cumulative effects of the local environment are discussed in the following subsections.

4.4.1 FERRY TERMINAL CONSTRUCTION

Beside the proposed Mukilteo Ferry Terminal replacement project, WSDOT/WSF also performs other types of coastal construction activities. Between August 2010 and February 2011, WSDOT conducted pile driving activities associated with the Manette Bridge replacement in the city of Bremerton in Kitsap County. From November 2012 to February 2013, WSDOT's Washington State Ferry (WSF) replaced a cable-lift transfer span at the Port Townsend Ferry Terminal. In addition, WSF is also working on replacement of the dolphin structure at the Orcas Island and Friday Harbor ferry terminals between September 2013 and February 2014. Furthermore, WSF is planning several other ferry terminal engineering projects, which include Vashon Terminal timber trestle and terminal replacement, Seattle Terminal building and north trestle replacement, Spur/Anacortes Terminal tie-up slips dolphin and wingwall replacement, and Southworth Terminal timber trestle and terminal replacement in 2015, and Spur/Friday Harbor Terminal timber trestle and terminal replacement and Coupeville Terminal bridge timber towers preservation in 2016. These activities, however, are not expected to have significant impacts to the overall region environment as the activities involved are brief, localized, and of small scales. In addition, most of these projects will not be occurring concurrently.

4.4.2 COASTAL DEVELOPMENT

Between 2000 and 2008, the population of Kitsap County increased by roughly 15,000. Thus, NMFS assumes that future public and private actions will continue within the action area, increasing as the population density rises. NMFS does not expect that areas already set-aside as limited and public open space will be converted to intensive land uses. Furthermore, much of the area that may be redeveloped in future years is already under uses that impair or reduce ecological function.

4.4.3 MARINE POLLUTION

Marine mammals are exposed to contaminants via the food they consume, the water in which they swim, and the air they breathe. Point and non-point source pollutants from coastal runoff, offshore mineral and gravel mining, at-sea disposal of dredged materials and sewage effluent, marine debris, and organic compounds from aquaculture are all lasting threats to marine mammals in the project area. The long-term impacts of these pollutants, however, are difficult to measure.

The persistent organic pollutants (POPs) tend to bioaccumulate through the food chain; therefore, the chronic exposure of POPs in the environment is perhaps of the most concern to high trophic level predators such as Southern Resident killer whales, Eastern Pacific gray whales, California sea lions, Pacific harbor seals, and Steller sea lions.

The WSF's construction and demolition activities associated with the Manette Bridge replacement project are not expected to cause increased exposure of POPs to marine mammals in the project vicinity due to the small scale and localized nature of the activities.

Additionally, the WSF will use barges to carry out all construction debris and demolition material for proper disposal.

4.4.4 DISEASE

Disease is common in many marine mammal populations and has been responsible for major die-offs worldwide, but such events are usually relatively short-lived.

As recent as April 2010, five gray whales were found dead in Puget Sound. The die-off raised concerns among researchers who monitor gray whales and the health of marine mammals in the region. The total number of recent mortalities remains well below the peak numbers documented in big mortality year and the 5 that have died so far in 2010 is still under the average for an entire year. These mortalities are currently being investigated by scientists from the Northwest Marine Mammal Stranding Network including NMFS, Cascadia Research, Central Puget Sound Marine Mammal Stranding Network, and Washington Department of Fish and Wildlife.

4.4.5 COMMERCIAL AND PRIVATE MARINE MAMMAL WATCHING

Although marine mammal watching is considered by many to be a non-consumptive use of marine mammals with economic, recreational, educational and scientific benefits, it is not without potential negative impacts. One concern is that animals may become more vulnerable to vessel strikes once they habituate to vessel traffic (Swingle *et al.* 1993; Laist *et al*. 2001; Jensen and Silber 2004; Douglas *et al.* 2008). Another concern is that preferred habitats may be abandoned if disturbance levels are too high. Several recent research efforts have monitored and evaluated the impacts of people closely approaching, swimming, touching and feeding marine mammals and has suggested that marine mammals are at risk of being disturbed (“harassed”), displaced or injured by such close interactions. Researchers investigating the adverse impacts of marine mammal viewing activities have reported boat strikes, disturbance of vital behaviors and social groups, separation of mothers and young, abandonment of resting areas, and habituation to humans (Nowacek *et al.* 2001).

There are no known marine mammal watching operations based in the vicinity of the proposed action area. Marine mammal watching operations, however, especially killer whale watching operations, are common in the nearby Greater Puget Sound area, and thus marine mammals that occur in both the action area and the Puget Sound area could be adversely affected by such marine mammal watching operations over time. These cumulative adverse effects, however, are not expected to be significant.

4.4.6 SHIPPING

The Puget Sound is home to major Pacific Northwest shipping routes; literally thousands of vessels enter and leave the major ports of Washington State and British Colombia. In addition, to cargo ships, vacation cruise lines, and fishing vessels that travel on a regular basis throughout the region there are scores of recreational vehicles, ferry traffic, and whale watching boats. While long-term studies are needed to better understand the impact of vessel traffic on marine mammals like whales, short-term research has already begun and findings suggest that boat noise directly affects the behavior of marine mammals. Increased boat traffic not only has the potential to increase the likelihood of ship strike of marine mammals, it also contributes to increased ambient noise level. The proposed action area is mainly served by WSDOT ferries that shuttle among different city ports within the Puget Sound region. There is no increase in ferry services and number in the foreseeable future.

4.4.7 COMMERCIAL FISHING

Commercial fisheries may affect marine mammals indirectly by altering the quality of their habitat. The removal of large numbers of fish (both target and non-target or bycatch species) from a marine ecosystem can change the composition of the fish community, altering the abundance and distribution of prey available for marine mammals. In addition, by removing large amounts of biomass, commercial fisheries compete with other consumers that depend on the target species for food, which can, in turn, increase competition between different piscivorous predators. Nevertheless, the proposed action area is a ferry terminal where no fishing activity is occurring. The proposed ferry terminal replacement will not change the current status quo of commercial fisheries in the Pudget Sound area.

4.4.8 CLIMATE CHANGE

Global climate change could significantly affect the marine resources of the Northwest Pacific region. Possible impacts include temperature and rainfall changes and potentially rising sea levels and changes to ocean conditions. These changes may affect the coastal marine ecosystem in the proposed action area by increasing the vertical stratification of the water column and changing the intensity and rhythms of coastal winds and upwelling. Such modifications could cause ecosystem regime shifts as the productivity of the regional ecosystem undergoes various changes related to nutrients input and coastal ocean process (FWS 2011).

The precise effects of global climate change on the action area, however, cannot be predicted at this time because the coastal marine ecosystem is highly variable in its spatial and temporal scales.

4.4.9 SUMMARY OF CUMULATIVE EFFECTS

Although commercial harvest no longer takes place and existing subsistence harvest is set by quotas, scientific research activities, whale watching, coastal construction and development, marine pollution, and disease continue to result in some level of impact to marine mammal populations in the area. Nonetheless, the proposed construction work at the Mukilteo Ferry Terminal would only add negligible additional impacts to marine mammals in the project area due to the limited project footprint within the action area.

The vibratory pile driving and pile removal activities associated with the wingwalls replacement project are well planned to minimize impacts to the biological and physical environment of the areas by implementing mitigation and monitoring protocols. Therefore, NMFS has determined that the WSDOT's Mukilteo Ferry Terminal replacement project would not have a significant cumulative effect on the human environment, provided that the mitigation and monitoring measures described in Sections 2.3.4 and 2.3.5 are implemented.

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