FINAL ENVIRONMENTAL ASSESSMENT

Issuance of an Incidental Harassment Authorization
to the Washington State Department of Transportation to Take Marine Mammals
by Harassment Incidental to Dolphin Replacement Project
at Orcas Island and Friday Harbor Ferry Terminals, Washington

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LOCATION: Orcas Island and Friday Harbor Ferry Terminals, Washington

ABSTRACT: The National Marine Fisheries Service proposes to issue an Incidental Harassment Authorization (IHA) to the Washington State Department of Transportation (WSDOT) for the taking, by Level B harassment, of small numbers of marine mammals incidental to dolphin replacement project at Orcas Island and Friday Harbor ferry terminals in the State of Washington. The IHA would be valid from September 2013 through February 2014.

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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), the National Marine Fisheries Service (NMFS) proposes to issue an Incidental Harassment Authorization (IHA) that authorizes takes by level B harassment of marine mammals in the wild 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).

This Environmental Assessment (EA), titled "*Issuance of an Incidental Harassment Authorization to the Washington State Department of Transportation to Take Marine Mammals by Harassment Incidental to Dolphin Replacement Project at Orcas Island and Friday Harbor Ferry Terminals, Washington,*" (hereinafter, the Orcas Island and Friday Harbor EA) addresses the impacts on the human environment that would result from the issuance of this IHA.

1.2 BACKGROUND

On May 25, 2012, WSDOT submitted a request to NMFS requesting an IHA for the possible harassment of small numbers of 11 marine mammal species incidental to construction associated with the replacement of dolphin structures at the Orcas Island and Friday Harbor ferry terminals in Washington State. On July 20, WSDOT submitted a revised IHA application with updated information. Because underwater construction noise and the increase of human activities and vessel traffic could adversely affect marine mammal species and stocks in the proposed action area, WSDOT is seeking an IHA that would allow the incidental but not intentional, take of marine mammals by Level B behavioral harassment during the dolphin replacement construction at the Orcas Island and Friday Harbor ferry terminals. The proposed in-water construction is planned to take place between September 1, 2013, and February 15, 2014, but WSDOT requests that the IHA be issued in early May 2013 so they can begin the contracting process.

The proposed project will replace a single timber dolphin (an offshore structure that is used to guide the ferry into the terminal and hold it in place while docked) with a new dolphin at the Orcas Island and two timber dolphins with new steel dolphins at the Friday Harbor Ferry Terminal. The construction activities for dolphin replacement include removal of one 69-pile dolphin and pile driving four 24- or 30-inch hollow steel reaction piles and three 36-inch hollow steel fender piles to build a new dolphin at Orcas Island ferry terminal; removal of one 37-pile dolphin and one 102-pile dolphin and pile driving eight 24- or 30-inch hollow steel reaction piles and five 36-inch hollow steel fender pile to build two new dolphins at Friday Harbor ferry terminal. All pile driving and pile removal activities would be conducted using vibratory piling hammer. Vibratory pile removal will take a maximum of 15 minutes per pile. The removal of 69 piles at Orcas Island terminal would take 17.2 hours over 3 days, and the removal of 139 piles at the Friday Harbor terminal would take 34.75 hours over 5 days. It is expected to take approximately 20 minutes for each single pile driving, with three to five piles installed per day. Driving of 7 piles at Orcas Island terminal would take 2.3 hours over 2 days, and driving of 13 piles at the Friday Harbor terminal would take 4.3 hours over 5 days. No pile removal or pile driving would be conducted at night. The maximum number of days scenario for the proposed construction work would only take a total of 5 days at Orcas Island ferry terminal and 10 days at the Friday Harbor ferry terminal.

The WSDOT states that small numbers of 11 species of marine mammals could potentially be taken by vibratory pile driving and 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*), northern elephant seal (*Mirounga angustirostris*), Steller sea lion (*Eumetopias jubatus*), harbor porpoise (*Phocoena phocoena*), Dall's porpoise (*Phocoenoides dalli*), Pacific white-sided dolphin (*Lagenorhynchus obliquidens*), killer whale (*Orcinus orca*), gray whale (*Eschrichtius robustus*), humpback whale (*Megaptera novaeangliae*), and minke whale (*Balaenoptera acutorostra*).

IHA issuance criteria require that the take of marine mammals authorized by an IHA 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 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 an IHA 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 IHA.

1.2.1 PURPOSE AND NEED

In response to the receipt of an IHA application from the WSDOT, NMFS proposes to issue an IHA pursuant to the MMPA §101(a)(5)(D). The primary purpose of the IHA is to provide an exception from the take prohibitions under the MMPA to allow "takes" by "level B harassment" of marine mammals and thus authorize the incidental takes that may occur as a result of the dolphin replacement work at Orcas Island and Friday Harbor ferry terminal in Washington State.

NMFS' issuance of the IHA is necessary for the dolphin replacement work at Orcas Island and Friday Harbor ferry terminal to comply with the MMPA. Specifically the MMPA prohibits takes of marine mammals, with specific exceptions, including the incidental, but not intentional, taking of marine mammals, for periods of not more than one year, by United States citizens who engage in a specified activity (other than commercial fishing).

1.2.2 SCOPING SUMMARY

The purpose of scoping is to identify the issues to be addressed and 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 IHA require that upon receipt of a valid and complete application for an IHA, NMFS publish a proposed IHA in the *Federal Register* (*FR*). The notice summarizes the purpose of the requested IHA,

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 IHA.

NOAA Administrative Order (NAO) 216-6, established agency procedures for complying with the National Environmental Policy Act of 1969 (NEPA; 42 U.S.C. 4321 *et seq.*) and the implementing regulations issued by the President's Council on Environmental Quality (CEQ). NAO 216-6 specifies that the issuance of an IHA under the MMPA is among a category of actions that require further environmental review and the preparation of NEPA documentation. The CEQ regulations implementing the NEPA do not require that a draft EA be made available for public comment as part of the scoping process.

1.2.3 COMMENTS ON APPLICATION AND EA

On February 8, 2013, NMFS published a notice of a proposed IHA in the *Federal Register* (78 FR 9373), 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 Orcas Island and Friday Harbor EA on http://www.nmfs.noaa.gov/pr/permits/incidental.htm#applications.

NMFS received comments from the Marine Mammal Commission (Commission) and Aquatic Research and Monitoring, a private company for whale watching and marine mammal monitoring. None of the comments is considered controversial and all will be addressed in the *Federal Register* notice for the issuance of the IHA, and to the extent necessary, in this final EA.

1.2.4 ISSUES WITHIN THE SCOPE OF THIS EA

The Orcas Island and Friday Harbor EA addresses the proposal of NMFS to issue an IHA under Section 101(a)(5)(D) of the MMPA and the alternatives to the proposed action. The IHA, if issued, would authorize the harassment of 11 species of marine mammals incidental to the dolphin replacement construction at Orcas Island and Friday Harbor in Washington State.

Because the pile driving and removal activities associated with the proposed dolphin replacement project will produce intense noises, NMFS expects that marine mammals in the vicinity of the project area will be affected by man-made noises from pile driving, dredging, and other construction sounds. This EA provides detailed analyses and evaluation of the potential noise impacts to the affected environment that would result from the proposed pile removal and pile driving at the Orcas Island and Friday Harbor ferry terminals.

1.2.5 APPLICABLE LAWS AND NECESSARY FEDERAL PERMITS, LICENSES, AND ENTITLEMENTS

This section summarizes federal, state, and local permits, licenses, approvals, and consultation requirements necessary to implement the proposed action, as well as who is responsible for obtaining them. Even when it is the applicant's responsibility to obtain such permissions, NMFS is obligated under NEPA to ascertain whether the applicant is seeking other federal, state, or local approvals for their action.

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 IHA for incidental harassment of marine mammals represents approval and regulation of the applicant's activities. While NEPA does not dictate substantive requirements for an IHA, 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).

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 IHA 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 IHA 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 IHA under Section 101(a)(5)(D) of the MMPA. PR1 is required to consult with PRD because the action of issuing an IHA may affect threatened and endangered species under NMFS' jurisdiction.

1.2.5.3 MARINE MAMMAL PROTECTION ACT

Section 101(a)(5)(D) of the MMPA (16 U.S.C. 1371(a)(5)(D)) 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 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 the IHA for the taking of marine mammals incidental to the ferry terminals construction at Orcas Island and Friday Harbor 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. Each alternative must be feasible and reasonable in accordance with the President's Council on Environmental Quality (CEQ) regulations (40 CFR §§ 1500-1508). 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 an IHA for the take of marine mammals by level B behavioral harassment incidental to the WSDOT's dolphin replacement construction project at Orcas Island and Friday Harbor ferry terminals 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 an IHA.

The Proposed Action (Preferred) alternative represents the activities proposed in the application for an IHA, with standard monitoring and mitigation measures specified by NMFS. NMFS may not issue the IHA 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 PROJECT OBJECTIVES

The objectives of these two projects at the Washington State Department of Transportation/Ferries Division Orcas Island and Friday Harbor Ferry Terminals, located in Orcas and Friday Harbor, WA is to replace existing timber dolphins with new steel dolphins. At the Orcas Island Ferry Terminal, a single timber dolphin will be replaced. At the Friday Harbor Ferry Terminal two timber dolphins will be replaced.

2.2 ALTERNATIVE 1: NO ACTION ALTERNATIVE – DENY ISSUANCE OF AN IHA

Evaluation of the No Action Alternative is required by regulations of the CEQ 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 for the activities proposed by the WSDOT. The MMPA prohibits all takings of marine mammals unless authorized by a permit or exemption under the MMPA. If authorization to take, by incidental harassment, of marine mammals is denied, the WSDOT may decide not to conduct construction to replace dolphin structures at Orcas Island and Friday Harbor ferry terminals (although doing so without an IHA may subject them to the MMPA's penalty provisions). Should WSDOT not conduct the activities, marine mammals present in the vicinity of these areas would not be incidentally harassed from 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 to the WSDOT allowing the incidental take by Level B harassment of small numbers of 11

species of marine mammals during dolphin replacement project at Orcas Island and Friday Island ferry terminals in Washington State.

NMFS will incorporate the mitigation and monitoring measures and reporting requirements described in Sections 2.3.4 and 2.3.5 into the IHA. The Preferred Alternative (Issuance of an IHA with Mitigation) would enable the agency and the WSDOT to comply with the statutory and regulatory requirements of the MMPA and ESA.

The specific project activity is to replace a single timber dolphin at the Orcas Island Ferry Terminal, and two timber dolphins at the Friday Harbor Ferry Terminal with new steel dolphins. Over time, 13-in plastic/steel-core piles have been added to the timber dolphins to provide an improved rub-face for the ferry boats to rub against as they enter the slips. These plastic-faced piles have helped to extend the life of the structures. There are five of these piles in the Orcas Island dolphin, none in the smaller Friday Harbor dolphin, and six in the larger Friday Harbor dolphin.

In-water construction is planned to take place between September 2013 and February 2014. The on-site work will last approximately 8 weeks with actual pile removal and driving activities taking place approximately 25% of that time. All work at the Orcas Island terminal will occur in water depths between -24.6 and -31.6 feet (ft) mean low low water (MLLW). At the Friday Harbor terminal all work will occur between -30 and -34 ft MLLW. All pile removal and pile driving work would be conducted during daylight.

The following construction activities are anticipated for the Orcas terminal:

- Remove one 69-pile dolphin (13-in timber & plastic/steel-core piles/106 tons of creosote-treated timber) with a vibratory hammer or by direct pull and clamshell removal.
- Vibratory pile drive four 24- or 30-in (final size to be determined) hollow steel reaction piles and three 36-in hollow steel fender piles.
- Place precast concrete diaphragm on new dolphin.
- Attach fender panels to new fender piles.
- Reposition one floating dolphin anchor.

The following construction activities are anticipated for the Friday Harbor terminal:

- Remove one 37-pile dolphin (13-in timber piles/62 tons of creosote-treated timber) with a vibratory hammer or by direct pull and clamshell removal.
- Vibratory pile drive up to four 24- or 30-in (final size to be determined) hollow steel reaction piles and one 36-in hollow steel fender pile.
- Place precast concrete diaphragm on new dolphin.
- Attach fender panel to new fender pile.
- Remove one 102-pile dolphin (13-in timber and plastic/steel-core piles/166 tons of creosote-treated timber) with a vibratory hammer or by direct pull and clamshell removal.
- Vibratory pile drive up to four 24- or 30-in (final size to be determined) hollow steel reaction piles and four 36-in hollow steel fender piles.
- Place precast concrete diaphragm on new dolphin.
- Attach fender panels to new fender piles.

A total of 334 tons of creosote-treated timbers will be removed from the marine environment. The total mudline footprint of the existing dolphins is 256 square feet (ft^2). The total mudline

footprint of the new dolphins will be 95 ft^2, a reduction of 161 ft^2. In addition, the footprint of the new steel dolphins will be more open, allowing fish movement between the piles. The new dolphins will have 20 piles, compared to the existing dolphins, which have 208 tightly clustered piles with no space between them.

Detailed description of pile removal and pile driving is provided below.

2.3.1 VIBRATORY HAMMER PILE REMOVALS

Vibratory hammer extraction is a common method for removing piling. 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. The piling will be loaded onto the barge or into a container and disposed of offsite in accordance with State of Washington Administrative Code 173-304 Minimum Functional Standards for Solid Waste Handling.

2.3.2 DIRECT PULL AND CLAMSHELL REMOVAL

Older timber pilings are particularly prone to breaking at the mudline because of damage from marine borers and vessel impacts, and must be removed because they can interfere with the installation of new pilings. 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 piling 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 are not expected to produce noise loud enough for concerns of marine mammals.

2.3.3 VIBRATORY HAMMER PILE 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 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.

2.3.4 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 IHA.

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 Orcas Island and Friday Harbor ferry terminals dolphin replacement construction work, 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 pile removal and installation activities at the Orcas Island and Friday Harbor ferry terminals. The language in monitoring measures would be included in the Contract Plans and Specifications and must be agreed upon by the contractor prior to any pile activities.

Since the measured source levels (at 10 and 16 m) of the vibratory hammer involved in pile removal and pile driving are below NMFS current thresholds for Level A takes, i.e., below 180 dB_{rms} re 1 μPa, no exclusion zone would be established, and there would be no required power-down and shutdown measures. Instead, WSDOT would establish and monitor the 120 dB_{rms} re 1 μPa zone of influence (ZOI, see below Proposed Monitoring and Reporting section). Geographic maps of the monitoring zones at the Orcas Island and Friday Harbor ferry terminals are provided in Figures 2-1 and Figure 2-2.

One major mitigation measure for WSDOT's proposed pile removal and pile driving activities is ramping up, or soft start, of vibratory pile hammers. The purpose of this procedure is to reduce the startling behavior of marine mammals in the vicinity of the proposed construction activity from sudden loud noise.

Soft start requires contractors to initiate the vibratory hammer at reduced power for 15 seconds with a 1 minute interval, and repeat such procedures for an additional two times.

In addition, monitoring for marine mammal presence will take place 20 minutes before, during and 30 minutes after pile driving to ensure that marine mammals are not injured by the proposed construction activities (see Proposed Monitoring and Reporting section below).

Finally, if the number of any allotted marine mammal takes reaches the limit under the IHA (if issued), WSDOT will implement shutdown and power down measures if such species/stock of animal approaches the 120 dB Level B harassment zone.

2.3.5 MONITORING AND REPORTING

Under the Preferred Alternative (Alternative 2), NMFS would require the WSDOT to undertake the following monitoring activities for the Orcas Island and Friday Harbor ferry terminals dolphin replacement project in Washington State. The reporting requirements described in Section 2.3.5.3 would also be implemented under Alternative 2.

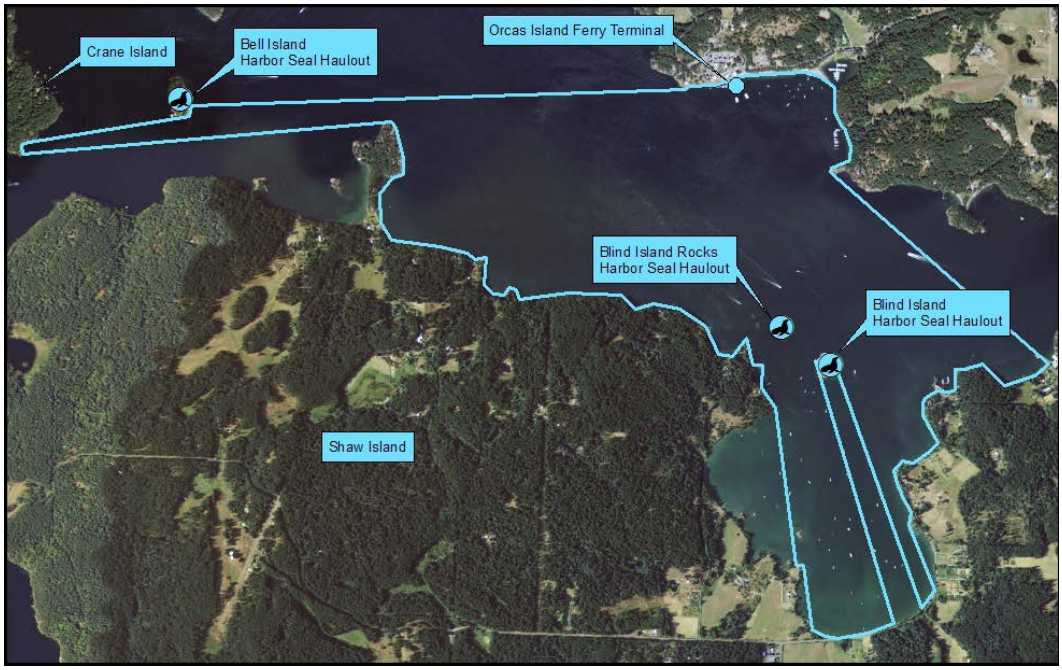

Figure 2-1. Orcas Island Ferry Terminal monitoring zone (blue line bounded aera)

Figure 2-2. Friday Harbor Ferry Terminal monitoring zone (blue line bounded aera)

2.3.5.1 MARINE MAMMAL OBSERVERS

WSDOT 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.

- Advanced education in biological science, wildlife management, mammalogy or related fields (Bachelors degree or higher is preferred), but not required.

- 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 ZOI.

2.3.5.2 MARINE MAMMAL MONITORING PROTOCOLS

PSOs will be present on site at all times during pile removal and driving. Marine mammal behavior, overall numbers of individuals observed, frequency of observation, and the time corresponding to the daily tidal cycle will be recorded.

The following protocols will be taken for marine mammal monitoring for WSDOT's proposed Orcas Island and Friday Harbor ferry terminal construction work:

- 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 (See section 4.2.1 *Acoustic Environment*) is monitored.

- A 20-minute pre-construction marine mammal monitoring will be required before the first pile driving or pile removal of the day. A 30-minute post-construction marine mammal monitoring will be required after the last pile driving or pile removal of the day. If the constructors 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 document:
    - 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 vibratory pile removal and driving, one land-based biologist will monitor the ZOI from the terminal work site, and one boat with a qualified PSO shall navigate the ZOI in a circular path. Both of the PSOs are required to use binoculars during marine mammal monitoring.

- In addition, WSDOT will contact the Orca Network and/or Center for Whale Research to find out the location of the nearest marine mammal sightings. Sightings are called or emailed into the Orca Network and immediately distributed to other sighting networks including: the Northwest Fisheries Science Center of NOAA Fisheries, the Center for Whale Research, Cascadia Research, the Whale Museum Hotline, and the British Columbia Sightings Network.

- Marine mammal occurrence information collected by the Orca Network also includes detection by the following hydrophone systems: (1) The SeaSound Remote Sensing Network, a system of interconnected hydrophones installed in the marine environment of Haro Strait (west side of San Juan Island) to study killer whale communication, underwater noise, bottom fish ecology, and local climatic conditions, and (2) A hydrophone at the Port Townsend Marine Science Center that measures average underwater sound levels and automatically detects unusual sounds.

2.3.5.3 REPORTING REQUIREMENTS

WSDOT 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 WSDOT'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 issues 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 for

an IHA (e.g., negligible impact, effecting the least practicable adverse impact, and monitoring and reporting of such takings). 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 Orcas and Friday Harbor Ferry Terminals are located in the San Juan Islands, in Northwest Washington State. The Orcas Island and Friday Harbor (San Juan Island) area is the affected environment. This area includes portions of Shaw Island and numerous smaller islands, all located in the water-body known as the Georgia Basin. The marine environment supports high concentrations of marine mammals, seabirds, fish and invertebrates occupying in-water and nearshore habitats, sea cliffs, 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 11 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 ORCAS ISLAND AND SAN JUAN ISLAND

Orcas Island and San Juan Island are located in northwestern Washington State, in the San Juan Islands (Figure 3-1). There are 172 islands in the San Juan archipelago, some little more than rocks, and over 408 miles (656 km) of shoreline. The majority of the San Juan Islands are hilly with some flat areas and valleys, often quite fertile, in between. The tallest peak is Mount Constitution, on Orcas Island, at almost exactly a half-mile (800 m) elevation. The coastlines are a mix of sandy and rocky beaches, shallow and deep harbors, placid and reef-studded bays. Gnarled, ochre-colored Madrona trees (Arbutus) grace much of the shorelines while evergreen fir and pine forests cover large inland areas.

The San Juan Islands get less rainfall than Seattle, about 65 miles (105 km) to the south, due to their location in the rain shadow of Olympic Mountains to the southwest. Summertime high temperatures are around 70°F (21°C) while average wintertime lows are in the high thirties and low forties. Snow is infrequent in winter except for the higher elevations, but the islands are subject to high winds at times—those from the northeast sometimes bring brief periods of freezing and Arctic-like wind chills.

The Orcas Island Ferry Terminal is located on southern Orcas Island, adjacent to Harney Channel, which separates Orcas Island and Shaw Island. Harney Channel is tributary to San Juan Channel, Georgia Basin, the Strait of Georgia and the Strait of Juan de Fuca. Smaller islands, including Crane, Bell Blind and Blind Rocks are located in Harney Channel.

The Friday Harbor Ferry Terminal is located on eastern San Juan Island, on Friday Harbor. Friday Harbor is tributary to San Juan Channel, Georgia Basin, the Strait of Georgia and the Strait of Juan de Fuca. Nearby islands include Brown, Shaw and Lopez.

Figure 3-1. Orcas Island and Friday Harbor ferry terminal locations.

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).

The only available in-water background noise data in the San Juan Islands area was collected on the west side of San Juan Island (approximately 11 miles west of the Orcas terminal/6 miles west of the Friday Harbor terminal), as part of the OrcaSound in-water monitoring study. Data was collected over an 18 month period (April 2004 – November 2005). Average daytime in-water noise levels during the summer (July-Aug.) were 118 $dB_{rms,}$ re 1 µPa and 116 dB_{rms} re 1 µPa non-summer (Oct.-April) (Veirs & Veirs 2005).

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; and therefore a detailed discussion of EFHs is not included.

3.2 BIOLOGICAL ENVIRONMENT

3.2.1 MARINE FLORA

Marine flora consist 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 WSDOT 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 within the Keyport 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*), northern elephant seal (*Mirounga angustirostris*), Steller sea lion (*Eumetopias jubatus*), harbor porpoise (*Phocoena phocoena*), Dall's porpoise (*Phocoenoides dalli*), Pacific white-sided dolphin (*Lagenorhynchus obliquidens*), killer whale (*Orcinus orca*), gray whale (*Eschrichtius robustus*), humpback whale (*Megaptera novaeangliae*), and minke whale (*Balaenoptera acutorostra*).

General information on these species is discussed by Caretta *et al.* (2011), and is available at the following URL: http://www.nmfs.noaa.gov/pr/pdfs/sars/po2011.pdf. 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 (i.e., Phocidae). For management purposes, three separate harbor seal stocks are recognized along the west coast of the continental U.S. (Boveng 1988): 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.* 2011). Pupping seasons vary by geographic region. For the San Juan Island region, pups are born from June through August, and in southern Puget Sound pups are born from mid-July through September (Jeffries et al. 2000). However, recent observations by the Washington Department of Fish and Wildlife (WDFW) biologists reveal that harbor seal pupping seasons in San Juan Island and Georgia Basin extend from June 1 to October 1 (WSDOT 2012). After October 1 all pups in the inland waters of Washington are weaned.

Of the four pinniped species that 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 14,600 animals (including the Strait of Juan de Fuca). The population across Washington increased at an average annual rate of 10 percent between 1991 and 1996 (Jeffries *et al.* 1997) and is thought to be stable (Jeffries *et al.* 2003). The Whale Museum/Marine Mammal Stranding Network estimates that approximately 4,000 seals are present in the San Juan Islands (Whale Museum 2012a).

Within the inland waters of Washington, there are numerous harbor seal haulout sites located on intertidal rocks, reefs, and islands. The nearest known haulout sites to the Orcas Island ferry terminal are Blind Island Rocks and Blind Island (approximately 1.2 and 1.4 km south of the Orcas Island terminal) and Bell Island (approximately 2.7 km west of the Orcas Island terminal). The nearest known haulout sites to the Friday Harbor ferry terminal are the intertidal rocks NE of Point George on Shaw Island (approximately 4 km and 4.7 km NE of the Friday Harbor terminal) offshore of Shaw Island. The number of harbor seals using these haulouts is less than 100 per haulout (WDFW 2000). The level of use of this haulout during the fall and winter is unknown, but is expected to be much less as air temperatures become colder than water temperatures resulting in seals in general hauling out less (WSDOT 2012).

Harbor seals are not considered to be "depleted" under the MMPA or listed as "threatened" or "endangered" under the ESA. The stock is also considered within its Optimum Sustainable Population level under the MMPA (Jeffries *et al.* 2003).

3.2.4.2 CALIFORNIA SEA LION

NMFS recognizes three stocks of California sea lion based on their geographic distribution: 1) the U.S. stock begins at the U.S./Mexico border and extends northward into Canada; 2) the Western Baja California stock extends from the U.S./Mexico border to the southern tip of the Baja California Peninsula; and 3) the Gulf of California stock, which includes the Gulf of California from the southern tip of the Baja California peninsula and across to the mainland and extends to southern Mexico (Lowry et al. 1992). California sea lions in the Washington State belong to the U.S. stock.

The U.S. stock was estimated at 296,750 in the 2011 Stock Assessment Report (SAR) and may be at carrying capacity (Carretta *et al.* 2011). The number of California sea lions in the San Juan Islands and the adjacent Strait of Juan de Fuca totaled fewer than 3,000 in the mid-1980s (Bigg 1985; Gearin *et al.* 1986). In 1994, it was reported that the number of sea lions had stabilized or decreased in some areas (Gearin *et al.* 1988; Calambokidis and Baird 1994). More recently, 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; WSDOT 2012). Peak counts of over 1,000 animals have been made in Puget Sound (Jeffries *et al.* 2000).

The closest documented California sea lion haulout site to the Bremerton Ferry Terminal is the Puget Sound Naval Shipyard security barrier, located approximately 435 m SW of the ferry terminal. The next closest documented California sea lion haulout sites to the Bremerton Ferry Terminal are navigation buoys and net pens in Rich Passage,

approximately nine and ten km east of the terminal, respectively. The number of California sea lions using each haulout is less than 10.

From August 2010 to February 2011, marine mammal monitoring was implemented during construction of the Manette Bridge. Counts were conducted only during pile removal/driving days, not every day of the month. Counts were recorded in blocks of working days (not counts per day). The highest number of California sea lions observed was 21 (September) over six days, an average of 3.5/day (WSDOT 2012).

The Bremerton Puget Sound Naval Shipyard (PSNS) is located to the west of the Bremerton Ferry Terminal. Since November 2010, PSNS personnel have been conducting monthly counts of the number of sea lions that use the security barrier floats as a haulout. As of June 13, 2012, the highest count has been 144 observed during one day in November 2011. All are believed to be California sea lions.

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 are not listed as endangered or threatened under the ESA, depleted under the MMPA, or considered a strategic stock under the MMPA.

3.2.4.3 NORTHERN ELEPHANT SEAL

Northern elephant seals are the largest pinniped found in Washington marine waters. Populations of northern elephant seals in the U.S. and Mexico are the result of a few hundred survivors remaining after hunting nearly led to the species' extinction (Stewart *et al.* 1994). Elephant seals present in the region of activity are considered part of the California breeding stock (Carretta *et al.* 2011). Northern elephant seals breed and give birth primarily on islands off of California and Mexico from December through March (Stewart and Huber 1993; Carretta *et al.* 2011). Typically, juveniles form new colonies and one or more females join to result in new haulout and rookery sites (Bonnell *et al.* 1991).

Northern elephant seal abundance estimates for inland Washington waters are not available due to the infrequency of sightings and the low numbers encountered (WSDOT 2012). Rough estimates suggest less than 100 individuals use the area annually (WSDOT 2012). Breeding rookeries are located on beaches and islands in California and Mexico (Jeffries *et al.* 2000). Historically, after their winter breeding season and annual molt cycles, individuals dispersed northward along the Oregon and Washington coasts and were present only on a seasonal basis. However, a few individuals are now found in Washington inland waters year-round.

Haulout areas are not as predictable as for the other species of pinnipeds. In total, WDFW has identified seven haulout sites in inland Washington waters used by this species. A few individuals use beaches at Protection Island (52/46 km south of the Orcas/Friday Harbor terminals, respectively) and Smith/Minor Islands (32/27 km south of the Orcas/Friday Harbor terminals) (WDFW 2000). Typically these sites have only two to ten adult males and females, but pupping has occurred at all of these sites over the past ten years (WSDOT 2012). A single individual has been observed hauled out at

American Camp on San Juan Island (NPS 2012), and at Shaw Island County Park on Shaw Island (WSDOT 2012).

Northern elephant seals are not listed as endangered or threatened under the ESA or as depleted under the MMPA.

3.2.4.4 STELLER SEA LION

Steller sea lions comprise two recognized management stocks (eastern and western), separated at 144º W longitude (Loughlin 1997). Only the eastern stock is considered here because the western stock occurs outside of the geographic area of the proposed activity. 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 (Allen and Angliss 2012). Steller sea lions primarily use haulout 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).

The eastern stock of Steller sea lions is estimated to be between 58,334 and 72,223 individuals based on 2006 through 2009 pup counts (Allens and Angliss 2012). Washington's estimate including the outer coast is 651 individuals (non-pups only) (Pitcher *et al.* 2007). However, recent estimates are that 1,000 to 2,000 individuals enter the Strait of Juan de Fuca during the fall and winter months (WSDOT 2012).

Steller sea lions 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 (Jeffries *et al.* 2000). A few Steller sea lions can be observed year-round in Puget Sound/Georgia Basin although most of the breeding age animals return to rookeries in the spring and summer.

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. However, the number of haulout sites has increased in recent years. The nearest documented Steller sea lion haulout site to the Bremerton ferry terminal are the Orchard Rocks in Rich Passage, approximately nine and ten km east of the terminal, respectively (WSDOT 2012).

From July 2006 to January 2007, a consultant completed 10 at-sea surveys in preparation for replacement of the WSDOT Manette Bridge that is located in Bremerton. Marine mammals were recorded during these surveys: no Stellar sea lions were observed (WSDOT 2012).

From August 2010 to February 2011, marine mammal monitoring was implemented during construction of the Manette Bridge. No Stellar sea lions were observed (WSDOT 2012).

Steller sea lions were listed as threatened range-wide under the ESA on November 26, 1990 (55 FR 49204). After division into two stocks, the western stock was listed as endangered under the ESA on May 4, 1997 and the eastern stock remained classified as threatened (62 FR 24345). On August 27, 1993, NMFS published a final rule designating

critical habitat for the Steller sea lion. No critical habitat has been designated in Washington. Critical habitat is associated with breeding and haulout areas in Alaska, California, and Oregon.

On June 29, 2010, NMFS initiated a review of the eastern stock of Steller sea lion status to reassess the listing classification under the ESA (75 FR 37385). Based on the comprehensive review, NMFS proposed to delist the eastern stock of Steller sea lion on April 18, 2012 (77 FR 23209).

Steller sea lions are listed as depleted under the MMPA. Both stocks are thus classified as strategic.

3.2.4.5 HARBOR PORPOISE

In the Northwest U.S., harbor porpoises are divided into two stocks: 1) the Washington Inland Waters Stock, and 2) the Oregon/Washington Coast Stock (Carretta *et al.* 2011). 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 Oregon/Washington Coast Stock extends from Cape Flattery, Washington south to Cape Blanco, Oregon. 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).

Little information regarding food habits of the harbor porpoise is available for British Columbia or inland Washington waters (Hall 2004). What prey species have been documented include juvenile blackbelly eelpout, opal squid, Pacific herring, walleye pollock, Pacific hake, eulachon, and Pacific sanddab (Walker *et al.* 1998). Based on the results from Walker *et al.* (1998) and Hall (2004), harbor porpoises in British Columbia and Washington are opportunistic feeders, with prey species varying based on seasonal abundance. They also likely alter their spatial and temporal distributions based on prey availability.

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 (Carretta *et al.* 2011). Abundance estimates of harbor porpoises for the Strait of Juan de Fuca and the San Juan Islands in 1991 were approximately 3,300 animals (Calambokidis *et al.* 1993). Harbor porpoises were once considered common in southern Puget Sound (Scheffer and Slipp 1948); however, there has been a significant decline in sightings within southern Puget Sound since the 1940s (Everitt et al. 1980; Calambokidis *et al.* 1985, 1992; Carretta *et al.* 2011).

Virtually no data are available to assess population trends in Puget Sound (Scheffer and Slipp 1948; Everitt *et al.* 1980; Calambokidis *et al.* 1985, 1992; Calambokidis and Baird 1994). 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. Declines were attributed to gill-net fishing, increased vessel activity, contaminants, and competition with Dall's porpoise. However, Puget Sound populations appear to be rebounding with increased sightings in central (Carretta *et al.* 2011) and southern (WDFW 2008) Puget Sound.

Harbor porpoises are common in the Strait of Juan de Fuca and south into Admiralty Inlet, especially during the winter, but are not at all common south of Admiralty Inlet. Harbor porpoises occur year-round and breed in the waters around the San Juan Archipelago and north into Canadian waters (Calambokidis and Baird 1994).

Little information exists on harbor porpoise movements and stock structure near the Orcas and Friday Harbor terminals, although it is suspected that in some areas harbor porpoises migrate (based on seasonal shifts in distribution). For instance Hall (WSDOT 2012) found harbor porpoises off Canada's southern Vancouver Island to peak during late summer, while WDFW's PSAMP data show peaks in Washington water to occur during the winter. Still, no additional evidence exists for migrations in the inland waters of Washington or British Columbia (Calambokidis and Baird 1994; Rosel *et al.* 1995).

Hall (WSDOT 2012) 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.

The harbor porpoise is not listed under the ESA and is classified as non-depleted under the MMPA.

3.2.4.6 DALL'S PORPOISE

Dall's porpoise occur in the North Pacific Ocean and is divided into two stocks: 1) California, Oregon, and Washington; and 2) Alaska (Carretta *et al.* 2011). The segment of the population within Washington's inland waters was last assessed in 1996 by aerial surveys (Calambokidis *et al.* 1997). During a ship line-transect survey conducted in 2005, Dall's porpoise was the most abundant cetacean species off the Oregon and Washington coast (Forney 2007). Dall's porpoises are migratory and appear to have predictable seasonal movements driven by changes in oceanographic conditions (Green *et al.* 1992, 1993). This species is commonly seen in shelf, slope, and offshore waters (Carretta *et al.* 2011).

The California, Oregon, and Washington stock mean abundance estimate of Dall's porpoises based on 2001 and 2005 ship surveys is 57,549 (Barlow 2003; Forney 2007). 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. In 1994, Calambokidis and Baird (1994) estimated the Juan de Fuca population at 3,015 animals and the San Juan Island population at about 133 animals. Calambokidis *et al.* (1997) estimated that 900 animals annually inhabited Washington's inland waters. 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 2012 citing J. Calambokidis pers. comm. 2006), but with different distributions throughout Puget Sound from winter to summer.

Dall's porpoise are not listed under the ESA and is classified as non-depleted under the MMPA.

3.2.4.7 PACIFIC WHITE-SIDED DOLPHIN

Pacific white-sided dolphins are occasionally seen in the northernmost part of the Strait of Georgia and in western Strait of Juan de Fuca, but are generally only rare visitors to this area (Calambokidis and Baird 1994). This species is rarely seen in Puget Sound. Pacific white-sided dolphins have been documented primarily in deep, off-shore areas (Green *et al.* 1992, 1993; Calambokidis *et al.* 2004a).

The California, Oregon, and Washington stock mean abundance estimate based on the two most recent ship surveys is 25,233 Pacific white-sided dolphins (Forney 2007). This abundance estimate is based on two summer/autumn shipboard surveys conducted within 300 nautical miles of the coasts of California, Oregon, and Washington in 2001 and 2005 (Barlow 2003, Forney 2007). Surveys in Oregon and Washington coastal waters resulted in an estimated abundance of 7,645 animals (Forney 2007).

Fine-scale surveys in Olympic Coast slope waters and the Olympic Coast National Marine Sanctuary resulted in an estimated abundance of 1,196 and 1,432 animals, respectively (Forney 2007), but there are no population estimates for Washington's inland waters. During aerial surveys of Washington inland waters conducted under WDFW's PSAMP program between 1992 and 2008, only a single group of three Pacific white-sided dolphins was observed (summer 1995 in the Strait of Juan de Fuca), although Osborne *et al.* (1988) states they are regularly reported in the Strait of Juan de Fuca and Haro Strait. There are few records for Puget Sound.

Pacific white-sided dolphins have been reported to be regular summer and fall inhabitants of the Strait of Juan de Fuca and San Juan Islands (specifically Haro Strait) (Osborne *et al.* 1988), but extremely rare in Puget Sound.

Pacific white-sided dolphins are not listed under the ESA and are classified as non-depleted under the MMPA.

3.2.4.8 KILLER WHALE

Two sympatric ecotypes of killer whales are found within the proposed activity area: transient and resident. These types vary in diet, distribution, acoustic calls, behavior, morphology, and coloration (Baird 2000; Ford *et al.* 2000). The ranges of transient and resident killer whales overlap; however, little interaction and high reproductive isolation occurs among the two ecotypes (Barrett-Lennard 2000; Barrett-Lennard and Ellis 2001; Hoelzel *et al.* 2002). Resident killer whales are primarily piscivorous, whereas transients primarily feed on marine mammals, especially harbor seals (Baird and Dill 1996). Resident killer whales also tend to occur in larger (10 to 60 individuals), stable family groups known as pods, whereas transients occur in smaller (less than 10 individuals), less structured pods.

One stock of transient killer whale, the West Coast Transient stock, occurs in Washington State. West Coast transients primarily forage on harbor seals (Ford and Ellis 1999), but other species such as porpoises and sea lions are also taken (NMFS 2008a).

Two stocks of resident killer whales occur in Washington State: the Southern Resident and Northern Resident stocks. Southern Residents occur within the activity area, in the Strait of Juan de Fuca, Strait of Georgia, and in coastal waters off Washington and

Vancouver Island, British Columbia (Ford *et al.* 2000). Northern Residents occur primarily in inland and coastal British Columbia and Southeast Alaska waters and rarely venture into Washington State waters. Little interaction (Ford *et al.* 2000) or gene flow (Barrett-Lennard 2000; Barrett-Lennard and Ellis 2001; Hoelzel *et al.* 2004) is known to occur between the two resident stocks.

The West Coast Transient stock, which includes individuals from California to southeastern Alaska, was estimated to have a minimum number of 354 (NMFS 2010b).

Trends in abundance for the West Coast Transients were unavailable in the most recent stock assessment report (Allen and Angliss 2012).

The Southern Resident stock was first recorded in a census in 1974, at which time the population comprised 71 whales. This population peaked at 97 animals in 1996, declined to 79 by 2001 (Center for Whale Research 2011), and then increased to 89 animals by 2006 (Carretta *et al.* 2011). As of 2012, the population collectively numbers 84 individuals.

Both West Coast Transient and the Southern Resident stocks are found within Washington inland waters. Individuals of both forms have long-ranging movements and thus regularly leave the inland waters (Calambokidis and Baird 1994).

The West Coast Transient stock of killer whales is not designated as depleted under the MMPA or listed as "threatened or "endangered" under the ESA. The Southern Resident stock is listed as an endangered distinct population segment (DPS) under the ESA. On November 29, 2006, NMFS published a final rule designating critical habitat for the Southern Resident killer whale DPS (71 FR 69054). Both Puget Sound and the San Juan Islands are designated as core areas of critical habitat under the ESA, but 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 2008a).

3.2.4.9 GRAY WHALE

Eastern North Pacific stock of Gray whales are recorded in Washington waters during feeding migrations between late spring and autumn with occasional sightings during winter months (Calambokidis *et al.* 1994, 2002; Orca Network 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). Forty-eight individual gray whales were observed in Puget Sound and Hood Canal in 2004 and 2005 (Calambokidis 2007). 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.* 2004b).

Gray whales migrate within 5 to 43 km of the coast of Washington during their annual north/south migrations (Green *et al.* 1995). Gray whales migrate south to Baja California where they calve in November and December, and then migrate north to Alaska from March through May (Rice *et al.* 1984; Rugh *et al.* 2001) to summer and feed. A very few gray whales are observed in Washington inland waters between the months of September

and January, with peak numbers of individuals from March through May (WSDOT 2012 citing J. Calambokidis pers. comm. 2007). Peak months of gray whale observations in the area of activity occur outside the proposed work window of September through February. The average tenure within Washington inland waters is 47 days and the longest stay was 112 days (WSDOT 2012 citing J. Calambokidis pers. comm. 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 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, 2002). In northern Puget Sound between Admiralty Inlet and the Edmonds/Kingston Ferry route, sightings of gray whales are more common and regular (Calambokidis *et al.* 1994, Orca Network 2011), although most all these sightings occur between March and May. Between January 2005 and February 2012, the Orca Network logged 13 sightings of gray whales in the September to February window proposed for the Orcas and Friday Harbor Ferry Terminal projects.

Early in the 20th century, it is believed that commercial hunting for gray whales reduced population numbers to below 2,000 individuals (Calambokidis and Baird 1994). After listing of the species under the ESA in 1970, the Eastern North Pacific stock of gray whales increased dramatically resulting in their delisting in 1994 after a 5-year review by NOAA Fisheries (Allen and Angliss 2012). Population surveys since the delisting estimate that the population fluctuates at or just below the carrying capacity of the species (~26,000 individuals) (Rugh *et al.* 1999; Calambokidis *et al.* 1994; Angliss and Outlaw 2007). In 2001 NOAA Fisheries received a petition to relist the Eastern North Pacific stock under the ESA, but it was determined that there was not sufficient information to warrant the petition (Allen and Angliss 2012).

3.2.4.10 HUMPBACK WHALE

Few humpback whales have been 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. Historically, humpback whales were common in inland waters of Puget Sound and the San Juan Islands (Calambokidis *et al.* 2002). 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). Since the mid-1990s, sightings in Puget Sound have increased. Between 1996 and 2001, Calambokidis *et al.* (2002) recorded only six individuals south of Admiralty Inlet. Between January 2005 and February 2012, the Orca Network logged 19 sightings of humpbacks in the September to February window proposed for the Orcas and Friday Harbor Ferry Terminal projects.

Humpback whales are listed as endangered under the ESA and depleted under the MMPA.

3.2.4.11 MINKE WHALE

The California/Oregon/Washington stock of minke whale is considered a resident stock, which is unlike the other Northern Pacific stocks of this species (NMFS 2008b). This stock includes minke whales within the inland Washington waters of Puget Sound and the San Juan Islands (Dorsey *et al.* 1990; Carretta *et al.* 2011).

The number of minke whales in the California/Oregon/Washington stock is estimated between 500 and 1,015 individuals (Barlow 2003; Carretta *et al.* 2011; NMFS 2008b). Over a 10-year period, 30 individuals were photographically identified in the transboundary area around the San Juan Islands and demonstrated high site fidelity (Dorsey *et al.* 1990; Calambokidis and Baird 1994). In a single year, up to 19 individuals were photographically identified from around the San Juan Islands (Dorsey *et al.* 1990). Minke whales are reported in Washington inland waters year-round, although few are reported in the winter (Calambokidis and Baird 1994). Minke whales are relatively common in the San Juan Islands and Strait of Juan de Fuca (especially around several of the banks in both the central and eastern Strait), but are relatively rare in Puget Sound. Infrequent observations occur in Puget Sound south of Admiralty Inlet (Orca Network 2011). Between January 2005 and February 2012, the Orca Network logged 42 sightings of minke in the September to February window proposed for the Orcas and Friday Harbor Ferry Terminal projects.

Minke whales are not listed under the ESA and are classified as non-depleted under the MMPA.

Table 3-1. 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
Northern elephant seal	*Mirounga angustirostris*	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	*Phocoenoides dalli*	Not ESA-listed, non-depleted
Pacific white-sided dolphin	*Lagenorhynchus obliquidens*	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
Minke whale	*Balaenoptera acutorostra*	Not ESA-listed, non-depleted

3.3 SOCIAL AND ECONOMICAL ENVIRONMENT

Orcas Island and Friday Harbor (San Juan Island) are in San Juan County, Washington, approximately 75 miles (121 km) north-northwest of Seattle.

Because of San Juan County's geographic location, it boasts an extremely self-reliant population. Island-grown businesses include tourism-related businesses, agriculture, single-family home construction, commercial fishing, forest management, real estate sales and investment. Tourism and real estate investing drives a large segment of the local economy.
As retirees and semi-retirees make up a sizeable percentage of county residents, a significant portion of San Juan County's economy addresses their health, recreation and other needs. Additionally, tourism in San Juan County drives the service sector, providing most of the wage jobs. Partnerships with educational institutions such as Skagit Valley College San Juan Center branch, or the world-renowned Friday Harbor Labs marine research facility of the University of Washington provide a skilled workforce. With few exceptions, very small businesses of 1-5 employees drive San Juan County's economy, and the region boasts more business licenses per capita than any other county in the state (WSDOT 2012).

The county population was 15,769 at the 2010 census, up from 14,077 at the 2000 census (WSDOT 2012). Median household income in San Juan County for 2009 was $55,133 (WSDOT 2012). The Town of Friday Harbor is the county seat, and the only incorporated town in San Juan County.

Reliable and safe operation of the Washington State Ferry Terminals at Orcas and Friday Harbor is a key element of the local economy. Commercial and retail deliveries are a daily occurrence on the ferries, and tourism depends on the ferry system for most of the visitors that come to the islands. Total ridership for WSDOT ferries serving the San Juan Islands (vehicles and passengers) for 2011 was 1,727,854 (WSDOT 2012).

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 ISSUANCE OF AN IHA (NO ACTION)

Under the No Action Alternative, NMFS would not issue the proposed IHA for the activities proposed by the WSDOT. Accordingly, should WSDOT proceed without an IHA, any takes of marine mammals resulting from the proposed dolphin replacement construction work at Orcas Island and Friday Harbor ferry terminals would not be authorized and any incidental take of marine mammals would be a violation of the MMPA. If the WSDOT decides not to proceed with the proposed dolphin replacement project at Orcas Island and Friday Harbor ferry terminals, 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, no ferry terminal construction at the Orcas Island and Friday Harbor ferry terminals would occur. The only affects to the action area would be from existing ferry and ferry terminal operations. There would be no additional effects in 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, there would be no takes of marine mammals that would result from the proposed ferry terminal construction activities, as WSDOT would have to forego the plan of dolphin replacement at the Orcas Island and Friday Harbor ferry terminals. The affects to marine mammals at 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 ECONOMICAL ENVIRONMENT

There would be no affects to the social and economical environment under the No Action alternative, as the issuance of the IHA would not have a direct effect on the social and economical environment of the proposed Orcas Island and Friday Harbor ferry terminals action areas.

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 WSDOT 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 September 2004, water quality monitoring conducted at the Friday Harbor Ferry Terminal during three pile-removal events showed turbidity levels did not exceed 1 NTU over background conditions and were generally less than 0.5 NTU over background levels. In general, turbidity associated with pile installation is localized to about a 25-foot radius around the pile (Everitt *et al.* 1980).

Removal of the timber dolphins at Orcas Island and Friday Harbor ferry terminal will result in 197 creosote-treated piles (334 tons) removed from the marine environment. This will result in the potential, temporary and localized sediment re-suspension of some of the contaminants associated with creosote, such as polycyclic aromatic hydrocarbons. However, the actual removal of the creosote-treated wood piles from the marine environment will result in a long-term improvement in water and sediment quality, meeting the goals of WSDOT's Creosote Removal Initiative started in 2000. Therefore, the proposed action is not expected to result in deterioration of water and sediment qualities at the Orcas Island and Friday Harbor construction sites.

***Acoustical Environment**:* The pile removal and installation work associated with dolphin replacement at Orcas Island and Friday Harbor ferry terminals is expected to raise the overall ambient noise at the proposed action area. The level of increase would largely depend on the type of piling hammer and the distance from the noise source(s). A vibratory pile hammer, which generates significantly less noise than an impact pile hammer, would be used by WSDOT for pile removal and installation.

The projects include vibratory removal of 13-inch timber and plastic-faced piles, and vibratory driving of 24-inch, 30-inch and 36-inch hollow steel piling.

No data is available for 13-inch timber and plastic-faced piles. Based on in-water measurements at the WSF Port Townsend Ferry Terminal (Laughlin 2011), removal of 12-inch timber piles generated 149 to 152 dB_{rms} re 1 µPa with an overall average RMS value of 150 dB_{rms} re 1 µPa measured at 16 m. A worst-case noise level for vibratory removal of 13-inch timber and plastic-faced piles will be 152 dB_{rms} re 1 µPa at 16 m.

Based on in-water measurements at the WSDOT Friday Harbor Ferry Terminal, vibratory pile driving of a 24-inch steel pile generated 162 dB_{rms} re 1 µPa measured at 10 meters (Laughlin 2010a).

Based on in-water measurements during a vibratory test pile at the WSDOT Port Townsend Ferry Terminal, vibratory pile driving of a 30-inch steel pile generated 170 dB_{rms} re 1 µPa (overall average), with the highest measured at 174 dB_{rms} re 1 µPa measured at 10 meters (Laughlin 2010b). A worst-case noise level for vibratory driving of 30-inch steel piles will be 174 dB_{rms} re 1 µPa at 10 m.

Based on in-water measurements at the Port Townsend Ferry Terminal, vibratory pile driving of a 36-in pile measured at 10 m generated 172 dB_{rms} re 1 µPa, with the highest measured at

177 dB_{rms} re 1 µPa (Laughlin 2010b). A worst-case noise level for vibratory driving of 36-in steel piles will be 177 dB_{rms} re 1 µPa at 10 m.

Currently NMFS uses 160 dB_{rms} re 1 µPa at received level for impulse noises (such as impact pile driving, mechanic splitting and pulverizing) as the onset of marine mammal behavioral harassment, and 120 dB_{rms} re 1 µPa for non-impulse noises (vibratory pile driving, saw cutting, drilling, and dredging). For the WSDOT's proposed Orcas Island and Friday Harbor ferry terminal dolphin replacement construction projects, only the 120 dB_{rms} re 1 µPa threshold is considered because only vibratory pile removal and pile driving would be used.

If no site-specific in-water noise attenuation data is available, the distances at which received noise level drops to 120 dB_{rms} re 1 µPa from the vibratory pile removal and pile driving, based on practical spreading model, are:

- 152 dB_{rms} re 1 µPa at 16m (13-inch vibratory pile removal) = ~2.2 km (1.4 mi)
- 162 dB_{rms} re 1 µPa at 10m (24-inch vibratory steel pile driving) = ~6.3 km (3.9 mi)
- 174 dB_{rms} re 1 µPa at 10m (30-inch vibratory steel pile driving) = ~39.8 km (24.7 mi)
- 177 dB_{rms} re 1 µPa at 10m (36-inch vibratory steel pile driving) = ~63.1 km (39.2 mi)

Land mass, however, is intersected before these extents are reached, therefore the distance to land mass is used to model acoustic propagation. For the Orcas terminal, land is intersected at a maximum of 3.5 km (2.2 miles). For the Friday Harbor terminal, land is intersected at a maximum of 4.7 km (2.9 miles).

As far as airborne noise is concerned, the estimated in-air source level from vibratory pile driving a 30-in steel pile is estimated at 97.8 dB re 20 µPa at 15 m (50 feet) from the pile (Laughlin 2010b). Using the spreading loss of 6 dB per doubling of distance, it is estimated that the distances to the 90 dB and 100 dB thresholds were estimated at 37 m and 12 m, respectively. The nearest pinniped haulout is 1 km away south of the Orcas Island terminal and 4 km northeast of the Friday Harbor ferry terminal offshore of Shaw Island.

***Essential Fish Habitat**:* Based on the Biological Opinion for the proposed Orcas Island and Friday Harbor ferry terminal dolphin replacement project (NMFS 2013). The proposed action will not adversely affect EFH for the following reasons:

- The footprint of the new steel dolphins will be more open, allowing fish movement between the piles. The new dolphins will have 20 piles, compared to the existing dolphins, which have 208 tightly clustered piles with no space between them.
- The projects will remove 334 tons of creosote-treated wood from the marine environment.
- The total mudline footprint of the existing dolphins is 256 ft^2. The total mudline footprint of the new dolphins will be 95 ft2, a reduction of 161 ft^2.

4.2.2 IMPACTS ON THE BIOLOGICAL ENVIRONMENT

4.2.2.1 MARINE MAMMALS

Although the proposed project area is not believed to be a prime habitat for marine mammals or considered an area frequented by marine mammals, WSDOT's proposed construction activities at Orcas Island and Friday Harbor Ferry Terminal would impact marine mammals in the ways described below.

Water & Sediment Quality

The net impacts of the removal of the timber dolphins at Orcas Island and Friday Harbor ferry terminal are beneficial to marine mammals in the project area that are high in the food chain and bioaccumulate toxins (i.e., toothed whales and pinnipeds) because the removal, as discussed above, will result in a long-term improvement in water and sediment quality. This is especially beneficial for long-lived species that spend their entire life in Puget Sound, such as Southern Resident killer whales (NMFS 2008a).

The impact from increased turbidity levels is expected to be discountable to marine mammals because: (1) cetaceans are not expected to be close enough to the Orcas Island and Friday Harbor ferry terminals to experience the temporary turbidity caused by the proposed project, and (2) pinnipeds transiting the terminal areas of the proposed project area are expected to avoid the localized areas of turbidity.

Acoustic Effects

WSDOT and NMFS determine that open-water pile driving and pile removal associated with the construction activities at Orcas Island and Friday Harbor Ferry Terminal has the potential to result in behavioral harassment of marine mammal species and stocks in the vicinity of the proposed activity. It is very unlikely, however, that WSDOT's proposed construction activities at Orcas Island and Friday Harbor Ferry Terminal would cause any marine mammals to experience temporary hearing threshold shift (TTS) or permanent hearing threshold shift (PTS).

Marine mammals exposed to high intensity sound repeatedly or for prolonged periods can experience hearing threshold shift (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). Since 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.

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 dolphin replacement work at Orcas Island and Friday Harbor 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. Therefore, 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 Orcas Island and Friday Harbor Ferry Terminal.

Chronic exposure to excessive noise, though not high in intensity, 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 and pile driving, contribute to the elevated ambient noise levels, thus intensify masking.

Nevertheless, the sum of noise from the proposed WSDOT construction activities is confined in 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.

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).

The biological significance of many of these behavioral disturbances is difficult to predict, especially if the detected disturbances appear minor. However, the consequences of behavioral modification could be expected to be biologically significant if the change affects growth, survival, and reproduction. Some of these significant behavioral modifications include:

- Drastic change in diving/surfacing patterns (such as those thought to be causing beaked whale stranding due to exposure to military mid-frequency tactical sonar);
- Habitat abandonment due to loss of desirable acoustic environment; and
- Cease feeding or social interaction.

For example, at the Guerreo Negro Lagoon in Baja California, Mexico, which is one of the important breeding grounds for Pacific gray whales, shipping and dredging associated with a salt works may have induced gray whales to abandon the area through most of the 1960s (Bryant *et al.* 1984). After these activities stopped, the lagoon was reoccupied, first by single whales and later by cow-calf pairs.

The onset of behavioral disturbance from anthropogenic noise depends on both external factors (characteristics of noise sources and their paths) and the receiving animals (hearing, motivation, experience, demography) and is also difficult to predict (Southall *et al.* 2007).

4.2.2.1.1 REQUESTED NUMBER OF TAKES

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

The requested number takes is documented in the 2012 *Request for Incidental Harassment Authorization Under the Marine Mammal Protection Act Orcas Island and Friday Harbor Ferry Terminals Dolphin Replacement Project* (WSDOT 2012). We incorporate this by reference.

Incidental take is estimated for each species by estimating the likelihood of a marine mammal being present within a ZOI during active pile driving and removal. Expected marine mammal presence is determined by past observations and general abundance near the Orcas and Friday Harbor ferry terminals 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. Requested numbers of takes are summarized in Table 4-1. All estimates are conservative.

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

Species	Orcas ZOI	Friday Harbor ZOI	Combined ZOIs
Harbor Seal	150	200	350
California Sea Lion	25	50	75
Northern Elephant Seal	15	30	45
Steller Sea Lion	25	50	75
Harbor Porpoise	50	100	150
Dall's Porpoise	15	30	45
Pacific White-Sided Dolphin	15	30	45
Killer Whale	32	32	64
Gray Whale	4	4	8
Humpback Whale	4	4	8
Minke Whale	10	10	20
Total	**345**	**540**	**885**

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. As mentioned above, WSDOT plans to use vibratory pile driving instead of impact hammer for pile driving, thus eliminating the likelihood of fish mortality from intense pulses.

4.2.3 SOCIAL AND ECONOMICAL ENVIRONMENT

The issuance of the IHA would not have a direct effect on the social and economical environment of the proposed Orcas Island and Friday Harbor ferry terminals action areas.

4.3 UNAVOIDABLE ADVERSE EFFECTS

NMFS does not expect WSDOT'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, and the project duration is brief. Given this and the likely response by marine mammals to the proposed dolphin 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, the project would have a negligible impact 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 dolphin replacement project at the Orcas and Friday Harbor Ferry Terminals are located in the San Juan Islands in Puget Sound in Northwest Washington State. The waters of Puget Sound are heavily used by vessels from both commercial and recreational activities.

4.4.1 FERRY TERMINAL CONSTRUCTION

Beside the proposed dolphin replacement at the Orcas Island and Friday Harbor ferry terminals, WSDOT 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, WSDOT is also planning to replace the wingwalls structure at the Bremerton Ferry Terminal between September 2013 and February 2014. These activities, however, are not expected to have significant impacts to the overall region environment as the activities involved are brief and of small scales.

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 WSDOT'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 WSDOT 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 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.

4.4.7 SUMMARY OF CUMULATIVE EFFECTS

All of the issues noted above are likely to have some level of impact on marine mammal populations in the area. 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 dolphin replacement project at the Orcas Island and Friday Harbor ferry terminals would only add negligible additional impacts to marine mammals in the project area due to the limited project footprint and brief duration within the action area.

The vibratory pile driving and pile removal activities associated with the dolphin 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 dolphin 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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