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BIOLOGICAL ASSESSMENT

STEILACOOM FERRY LANDING IMPROVEMENT PROJECT

Prepared for
Pierce County
Department of Public Works and Utilities
Airport and Ferry Division

Prepared by
Herrera Environmental Consultants, Inc.

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Note:
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Department of Public Works and Utilities
Airport and Ferry Division
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EXECUTIVE SUMMARY

Pierce County (Washington) is proposing to improve the Steilacoom Ferry Landing by constructing a second ferry slip south of and adjacent to the existing slip and relocating existing ferry mooring facilities. The Steilacoom Ferry Landing is operated by the Pierce County Airport and Ferry Division. FHWA is providing funding for the proposed action through the Washington State Department of Transportation (WSDOT) Highways and Local Programs (HLP) office. WSDOT is FHWA's non-federal designee in Washington State. The proposed action has been designed by Pierce County Public Works and Utilities.

Per Section 7(a)(2) of the Endangered Species Act (ESA), the provision of federal funding for the proposed action by FHWA constitutes a federal nexus, necessitating ESA consultation with the National Marine Fisheries Service (NMFS) and the (USFWS). The proposed action will also require federal permits under Section 404 of the Clean Water Act (CWA) and Section 10 of the Rivers and Harbors Act, issued by the U.S. Army Corps of Engineers (Corps), which also constitutes a federal nexus, however the federal funding nexus promotes FHWA to lead agency status for the purpose of this consultation.

Consistent with WSDOT HLP requirements, Pierce County prepared a biological assessment (BA) in August 2011 to support FHWA's ESA consultation with the Services, and an associated Essential Fish Habitat (EFH) assessment for consultation with NMFS. On August 29, 2012, NMFS issued a Biological Opinion addressing ESA-listed species and critical habitat under their jurisdiction. This BA was prepared for USFWS to address listed species under the jurisdiction of USFWS. This BA contains much of the information provided in the 2011 BA. Changes in the project design that have occurred since 2011, recent changes in the ESA listing status of species, and current guidance on evaluating effects of noise on listed species have been incorporated.

The changes in project design are essentially a reduction in the project scope, and result in less impact than proposed in 2011. Key elements of the currently proposed action include the removal of existing landing and moorage structures, construction of a new approach trestle, pedestrian trestle and transfer span, wing walls, and dolphins to secure and moor ferry vessels. Major project impacts include a 120.8 square foot benthic habitat displacement by structural support, anchoring, and dolphin piles, and 147.5 square foot gain in benthic habitat due to structure removal (net 26.9 square foot increase in benthic habitat); a net 2,680 square foot increase in shading of water column and benthic habitat by new overwater structures; temporary turbidity impacts; and impact and vibratory pile driving of steel piles up to 36 inches in diameter, resulting in alteration of the ambient noise environment and underwater noise effects sufficient to cause injury and behavioral alteration in a variety of marine species. The action area is divided into terrestrial and underwater components, the boundaries of which are defined by the distance necessary to attenuate in-air and underwater construction noise to ambient levels. These boundaries extend as far as 9.82 miles and 12.12 miles from the project site, respectively.

ESA-listed species and designated critical habitat occurring in the action area, a summary of effects, and effect determinations for these species are summarized in Table ES-1. As shown, the proposed action is likely to result in adverse effects on ESA-listed bull trout and marbled murrelet. The project is not likely to adversely affect yellow-billed cuckoo due to the limited and unlikely potential for individuals to be present within the state, or near the action area during project activities.

The primary source of adverse effects is the potential for exposure to underwater noise in excess of biological effects thresholds. These effects are limited in extent and duration. The proposed action will produce permanent effects on species and critical habitat in the form of temporary benthic habitat disturbance and permanent increase of overwater structure area. The project could result in beneficial effects associated with removing existing piles, including a slight net gain in benthic habitat area. However, because these effects will be limited in extent and will occur within the footprint of an existing ferry facility, they will not significantly affect the conservation value of designated critical habitat for any ESA-listed species occurring in the action area.

Table ES-1. Summary of Species Under the Jurisdiction of USFWS Known to Occur or Potentially Occurring in the Action Area.				
Species	**Current Status**	**Critical Habitat Designation**	**Summary of Effects**	**Effect Determination [a]**
Coastal-Puget Sound Bull Trout DPS (*Salvelinus confluentus*)	Threatened – November 1, 1999 (64 FR 58909 58933)	October 18, 2010 Revision (75 FR 63898)	• Potential subadult and adult exposure to underwater noise in excess of behavioral and injury level thresholds. • Permanent increase in in-water and overwater structure area	Species: LTAA Critical Habitat: LTAA
Marbled Murrelet (*Brachyramphus marmoratus marmoratus*)	Threatened – October 1, 1992 (57 FR 45328)	Does not occur in action area	• Potential exposure to underwater noise in excess of behavioral effects thresholds • Discountable potential for exposure to underwater noise in excess of injury level effects thresholds	Species: LTAA
Western Yellow-Billed Cuckoo (*Coccyzus americanus*)	Proposed Threatened – October 3, 2013 (78 FR 61621)	Not designated	• Discountable potential exposure due to unlikely potential for presence in the action area during project activities.	Species: NLTAA

[a] NLTAA = Not likely to adversely affect; LTAA = Likely to adversely affect.

INTRODUCTION

Pierce County Public Works and Utilities is proposing to improve the Steilacoom Ferry Landing by constructing a second ferry slip south of and adjacent to the existing slip and relocating existing ferry mooring facilities. Key elements of the proposed action include the removal of existing landing and moorage structures, construction of a new bridge trestle, pedestrian trestle and transfer span, wing walls, and dolphins to secure and moor ferry vessels.

The Steilacoom Ferry Landing is operated by Pierce County (Washington) Airport and Ferry Division. FHWA is providing funding for the proposed action through the Washington State Department of Transportation (WSDOT) Highways and Local Programs (HLP) office. WSDOT is FHWA's non-federal designee in Washington State. This facility supports the operation of Pierce County's ferry system, the sole public access serving isolated islands in Puget Sound, and the operation prisoner and personnel ferries and supply barges serving the McNeil Island Correctional Facility, a medium security state prison. The primary objectives of the proposed action are to reduce operational conflicts between these two users, improve public safety, and increase overall operational reliability. The upgraded second slip will provide Department of Corrections' vessels with a dedicated 24-hour landing facility immediately adjacent to their onshore security buildings. The proposed action has been designed by Pierce County Public Works and Utilities.

Section 7(a)(1) of the Endangered Species Act (ESA) of 1973, as amended (16 U.S.C. 1531 et seq.), requires all federal agencies to provide for the conservation of threatened and endangered species. Under Section 7(a)(2) of the ESA, the authorization, funding, or implementation of an action by a federal agency constitutes a federal nexus, triggering a requirement for that federal agency to consult with the National Marine Fisheries Service (NMFS) and/or the US Fish and Wildlife Service (USFWS) (referred to collectively as the "Services") in order to determine: 1) if the action in question might adversely affect listed species, and 2) whether those effects are sufficient to jeopardize the continued existence of listed species and/or destroy or adversely modify their critical habitats. In addition, Section 305(b)(2) of the Magnuson-Stevens Fisheries Conservation and Management Act (as amended by Public Law 104-267) (MSA) requires federal agencies to consult with NMFS if activities conducted under a federal nexus are likely to degrade designated essential fish habitat (EFH) for species governed by the MSA.

Per ESA Section 7(a)(2), the provision of federal funding for the proposed action by FHWA constitutes a federal nexus, necessitating ESA consultation with the Services. The proposed action will also require federal permits under Section 404 of the Clean Water Act (CWA) and Section 10 of the Rivers and Harbors Act, issued by the US Army Corps of Engineers (Corps), which also constitute a federal nexus; however, the federal funding nexus promotes FHWA to lead agency status for the purpose of this consultation. Consistent with WSDOT HLP requirements, Pierce County prepared a biological assessment (BA) in August 2011 to support

FHWA's ESA consultation with the Services, and an associated EFH assessment for consultation with NMFS.

In addition to the BA, Pierce County provided the Services with information relevant to this consultation on October 16, 2009, at a regularly scheduled meeting between county and Corps staff to discuss permitting issues.

NMFS issued a Biological Opinion on August 29, 2012, based on the 2011 BA. Much of the information from that BA is included herein. However, the project description and effects analysis have been updated to address changes in the project design, which primarily consist of an overall reduction in the project scope and extent of impacts compared to the previous design. This BA is focused on species and habitats under the jurisdiction of USFWS and includes an assessment of effects based on the current project design.

PROJECT LOCATION

The project site is the existing Steilacoom Ferry Landing, located on the eastern shoreline of Puget Sound in the town of Steilacoom, Washington (see Figure 1). The ferry landing is located on the western boundary of Township/Range/Section T20-0N R2-0E S46 in 6th field HUC 17110019 (Puget Sound), and is also within Washington State Water Resource Inventory Area (WRIA) 12 (Chambers-Clover). The area in question lies within Washington State Tidal Reference Area 3 (WAC 220-110-240).

This ferry crossing and the related terminal facilities are identified as Pierce County Bridge #31202-A.

Geologic and Geographic Features

The geology of the project surroundings is typical of the Puget Sound lowlands in the southern Puget Sound basin. The Puget Sound shoreline bordering the project site is characterized by low, shallow-sloped coastal bluffs that form a small coastal plateau rising approximately 300 feet above sea level (Finlayson 2005). This plateau is separated from surrounding upland areas by a series of shallow lakes and lowland areas between 1.5 and 4 miles inland. These lowlands are associated with Chambers Creek, a moderately sized Puget Sound tributary covering approximately 67,000 acres. The Nisqually River estuary lies approximately 6.5 miles to the southwest and the Tacoma Narrows lies approximately 7 miles to the northeast.

Chambers Creek drains to a small estuary approximately 7,000 feet northeast of the project site. An unnamed independent tributary drains to Puget Sound approximately 1,000 feet southwest of the project site. There are no significant wetlands in the action area or the immediate vicinity.

Oceanographic Features

This segment of southern Puget Sound has fjord-like topography and bathymetry. Shorelines in the project vicinity are narrow, and the offshore bathymetry is relatively steep. For example, depths in the project vicinity reach 50 feet or greater within 500 feet of the mean lower low water (MLLW) mark, increasing to a maximum depth of nearly 600 feet approximately 8,500 feet offshore (Finlayson 2005). Eight major nearshore habitats have been characterized and quantified: rocky reefs, kelp beds, mixed sediment intertidal beaches, saltmarsh, tide flats, subtidal soft sediments, eelgrass beds, and open water/pelagic habitats (Dethier 1990; Levings and Thom 1994; NMFS 2007). The nearshore habitats in the project vicinity are in the mixed sediment intertidal beach category.

This area lies south of the Tacoma Narrows, the site of a prominent upland constriction and associated underwater sill demarcating the oceanographic boundary between southern and central Puget Sound (Cannon 1983). The Narrows exerts a dominant influence on tidal circulation in the southern Puget Sound basin, which determines the current environment,

Legend

BNSF rail line

Figure 1. Vicinity Map for the Steilacoom Ferry Landing Improvement Project.

N

0 2,500 5,000 10,000 Feet

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Aerial photograph: USDA 2011

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water quality conditions, and other oceanographic factors that create a biological productivity regime that is distinct from the remainder of Puget Sound (Cannon 1983; Strickland 1983).

Land Use

Land uses in the project vicinity are primarily moderate density residential and commercial, consistent with Steilacoom zoning regulations (Steilacoom 2014). The gradually sloping coastal bluffs abutting the ferry landing have been developed primarily for residential uses. A major regional rail corridor parallels the Puget Sound shoreline throughout the project vicinity. The adjacent shoreline has been armored with large angular riprap to protect the railroad prism. While this entire area was historically logged, much of the upland plateau between Steilacoom and the Nisqually River estuary has returned to forested condition (Runge et al. 2003).

PROJECT DESCRIPTION

The proposed work will expand the Steilacoom Ferry Landing, also known as Pierce County Bridge #31202-A, by upgrading an existing idle ferry moorage to an operable ferry slip with an approach trestle and pedestrian access. The elements of the upgraded second slip will include a new bridge approach trestle, pedestrian trestle and transfer span, wingwalls, dolphins, and associated mechanical and utility systems including electrical, water, and sewer work. The upgraded facility will provide one 6-foot wide pedestrian walkway. A new pedestrian access trestle will be constructed and an existing pedestrian span will be removed.

The NMFS (2012) Biological Opinion prepared for the project limits pile driving activity to between July 15 and September 30. Pile driving activity will also be limited to the approved in-water work windows for salmon, bull trout, and forage fish (USACE 2012). The in-water work window for the combination of species is July 16 through September 30. Although project construction could begin as early as July 16, construction is currently scheduled to begin in the fall (September) 2015 and will be completed by the spring of 2016. For this biological assessment, it is assumed that barge operation and overwater construction activities may occur from July 16 through May 31.

The primary purpose of the proposed action is to eliminate scheduling conflicts and increase vessel safety associated with the joint use of the existing single slip ferry landing by Pierce County and the State Department of Corrections. The project will also increase security and public safety by allowing McNeil Island vessels 24-hour access to dedicated facilities.

The proposed action will require the removal of 136 existing piles located below mean higher high water (MHHW), these include:

- Two 19-pile creosote-treated dolphins (38 piles total)
- One 37-pile creosote treated dolphin
- One existing support pile (steel) associated with a pedestrian gangway
- Two existing 30-pile creosote treated wingwalls (60 piles total)

The project will also require the removal of an existing 3-foot wide by 60-foot long pedestrian access trestle and gangway that lies partially within the footprint of the proposed pedestrian transfer span.

Newly constructed elements of the proposed action include:

- A two-span, concrete, approach trestle, approximately 65 feet long supported by approximately 16, concrete filled, steel pipe piles
- A single-span, aluminum, pedestrian transfer span, approximately 60 feet long, with two steel pipe piles and overhead support frame for hoists

- Two new steel wingwalls with approximately 13 steel pipe piles each
- Two new steel dolphins with two steel pipe piles each
- Ancillary mechanical and utility systems including hydraulic and electrical control systems, water and sewer

Detailed Project Description

This section provides a detailed description of each of the major project elements identified above. The description of each element includes a brief characterization of the structure to be constructed or removed and the associated construction methods and equipment; a description of impact minimization measures associated with each project element, and a summary of the extent of impacts associated with each project element. The material quantity and work duration figures provided are conservative best estimates. The major project features are detailed in plan view in Figure 2.

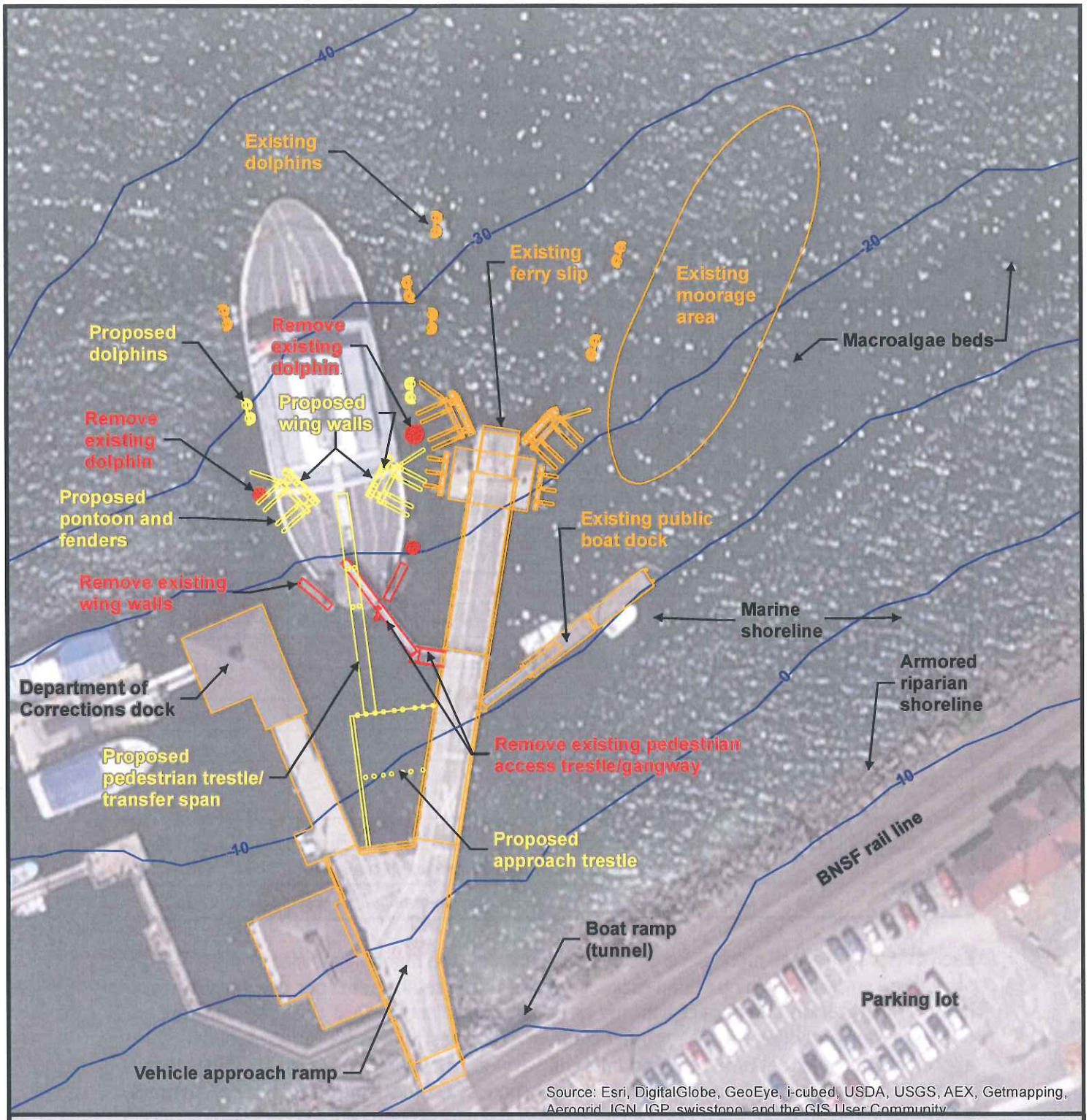
The majority of project construction will be conducted from barges moored in the nearshore adjacent to the Steilacoom Ferry Landing. The number and size of construction barges and the quantity and placement of anchoring mechanisms are expected to vary depending on contractor requirements. Pierce County anticipates as few as one or as many as three barges may be required for all construction activities. The shading footprint for the barges is expected to range from approximately 4,000 to 15,000 square feet. The anchorage system employed to immobilize the barges will likely occupy an area of approximately 12 to 75 square feet on the subtidal bed surface.

Installation of steel piles using both vibratory and impact hammers is a significant construction element. Pile sizes used in this design range from 16-inch diameter to 36-inch diameter. Impact hammer placement of the 36-inch piles is expected to produce the most intense and farthest-reaching underwater noise effects, therefore reference noise levels for 36-inch piles are used as the basis of the noise impact analysis.

The total number of piles by size category and the area of benthic habitat displaced are summarized for each construction element in Table 1. Table 1 also shows the number existing piles to be removed and the benthic habitat area restored as a result.

Pile installation methods are expected to be similar across all construction elements. Each pile will be inserted to refusal or the designated tip elevation using a vibratory hammer and then proofed for load bearing capacity using an impact hammer. Most impact hammer pile driving will be conducted using a noise attenuation device. However, unattenuated piles will be driven to gather baseline noise levels. As described in the NMFS (2012) Biological Opinion, one pile from each size of piles (36-inch, 24-inch, and 16-inch) will be sampled to provide the baseline information. Twenty-inch piles are assumed to be similar to 24-inch and will not be sampled.

The piles are to be initially vibrated into the substrate to resistance. The vibratory head is then replaced with an impact driving pile head. A noise attenuation device, likely a bubble curtain, is deployed and operates as the impact pile driving ramps up from a slow start to full



Legend

- Proposed ferry slip
- Existing infrastructure to remain
- Existing infrastructure proposed for removal
- 10-foot contour

Figure 2.
Steilacoom Ferry Landing Existing and Proposed Project Features.

N

0 35 70 140 Feet

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Aerial photograph: ESRI 2011
Bathymetry: Finlayson 2005

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compression. The bubble curtain is then turned off for two, 90-second sessions (a total of 3 minutes per pile sample, 9 minutes total for all samples). One session occurs near the beginning and one is near the end of pile driving. Noise is not monitored during the first 60 seconds of each session to allow bubbles in the water column to rise and disperse. The remnant bubbles can alter the results. During the last 30 seconds of "bubbles off", data is recorded and analyzed to define the baseline of maximum noise. After each session of unattenuated baseline noise information is recorded, the noise attenuation device is turned back on ("bubbles on") for the duration of the impact pile driving.

Table 1. Placement of New In-water Piles, Removal of Existing Piles, and Total Benthic Impact Area by Construction Element.

Project Element	Pile Specifications			Total Benthic Area Restored/Displaced (square feet)
	Type	Diameter (inches)	Number	
Existing Piles Removed				
Wingwalls	Creosote-treated wood	14	60	+64.1
Pedestrian Access Trestle	Steel	24	1	+3.1
Dolphins	Creosote-treated wood	14	75	+80.2
			Total benthic habitat gain	***+147.5***
New Piles Placed				
Approach trestle	Steel	16	16	-22.3
Wingwalls	Steel	20	18	-39.3
	Steel	24	8	-25.1
Pedestrian trestle and transfer span	Steel	16	4	-5.6
Dolphins	Steel	36	4	-28.3
			Total benthic habitat displacement	***-120.6***
			Net benthic habitat gain	***+26.9***

Each major project element description below includes the number and size of piles associated with each structure, an estimate of the time requirements per pile for vibratory hammer installation and impact hammer proofing, and an estimate of the total duration of pile driving activities for that project element. These estimates are conservative approximations, actual time requirements will vary depending on the substrate conditions at each site and the type of equipment used. A reasonable estimate of the number of hammer strikes required to proof each pile can be derived from data collected during construction projects at WSDOT Washington State Ferries facilities (WSDOT 2009a). Typical impact hammer strike per pile estimates ranged from approximately 300 to 675 per pile in construction projects at the Bainbridge Island, Friday Harbor, and Anacortes Ferry terminals. For the purpose of this consultation, proofing will require an estimated 675 impact hammer strikes per pile, for up to a total of approximately 2,700 pile strikes per day.

Pile Removal

Project construction will require the removal of 136 piles associated with existing ferry moorage and overwater structures. These include 75 14-inch diameter creosote-treated piles associated with existing dolphins (two 19-pile dolphins and one 37-pile dolphin), 60 14-inch creosote-treated piles associated with two 30-pile wingwalls, and one 24-inch steel support pile.

Pile removal will be conducted from barges using vibratory extraction, direct pulling with a crane, or some combination of these methods. Vibratory removal is conducted using a vibratory hammer suspended from a crane by a cable and positioned on the top of a pile. The hammer clamps onto the pile then the hammer and crane unseat the pile from surrounding sediments by vibrating and slowly lifting it. Once the pile is unseated, the pile is extracted from the sediment by the crane, the vibratory hammer is disengaged, and the pile is then placed on a barge or into a container. Badly decomposed timber pilings may break at the mudline during removal. Broken or damaged piles and pile stubs that cannot be unseated with a vibratory hammer may be removed by wrapping the piles with a cable or chain and pulling them directly from the sediment with a crane or extracting them with a clamshell bucket. All extracted piles, pile fragments, and any sediments extracted with the piles will be disposed of at a permitted commercial facility in accordance with Washington Administrative Code (WAC) 173-304.

In some cases it may not be possible to remove broken pile stubs without causing significant environmental disturbance. Consistent with Washington State Department of Natural Resource guidance for this practice (WDNR 2008), the stubs will be mechanically cut and removed down to a minimum of 2 feet below the existing bed surface and the voids left by the piles are backfilled with clean gravel or sediment.

Approach Trestle

The approach trestle is a pile-supported structure that carries passenger and vehicle traffic from shore to the pedestrian trestle and transfer span. The proposed two-span, concrete approach trestle will extend between the new ferry slip and the existing ferry slip. The proposed approach trestle is a trapezoidal deck 65 feet long and ranging from 25 to 45 feet wide, and will be supported by two rows or bents of concrete filled, 16-inch steel pipe piles. The landward bent of piles consists of seven piles and the seaward bent of piles consists of nine piles. The decking material will consist of cast in-place concrete over pre-cast concrete panels. Cast in place concrete requires the use of forms to contain the concrete until it cures. Forms are sealed with rubber or foam to ensure no uncured concrete escapes.

Piles will be installed with a vibratory hammer then proofed with an impact hammer. The vibratory hammer process begins by placing a choker around the pile and lifting it into vertical position with the crane. The pile is then lowered into position for installation. The pile is stabilized while the vibratory hammer installs the pile to the required tip elevation or refusal. To meet design criteria and ensure proper functioning of the structure, the piles are "proofed" by striking them with an impact hammer. During the proofing process, the distance the pile is embedded with each impact hammer blow is recorded, and reviewed by the Project Engineer to ensure the pile will meet the design criteria.

The total duration of the pile driving operations associated with this element is anticipated to be approximately 5 days, assuming an installation rate of approximately four piles per day. Vibratory hammer installation and impact hammer proofing will require an estimated 30 minutes and 15 minutes per pile, respectively. The new piles will result in the permanent loss of 22 square feet of benthic habitat between 0 and -10 MLLW.

General impact minimization measures identified above will be employed for this project element. In addition, the following pile installation impact minimization measures will be implemented.

Aluminum Pedestrian Trestle and Transfer Span

The proposed pedestrian trestle and transfer span will consist of two parts. First, a 6-foot wide by 60-foot long aluminum grated deck pedestrian trestle will be installed to connect the approach trestle to the transfer span. This will be supported by two 16-inch steel piles and a crossbeam. Second, the pedestrian trestle will lead to a similarly constructed 6-foot wide by 60-foot long aluminum grated deck transfer span supported by two 16-inch steel piles and a cross frame to support the transfer span hoist.

The Steilacoom Ferry Landing has an existing 3-foot wide by 60-foot long access trestle and gangway that lie partially within the footprint of the proposed structure. The existing trestle and gangway will be disassembled and removed from the site to accommodate the new pedestrian transfer span. The new pedestrian trestle and transfer span will be installed by lifting them into place with a crane from the approach trestle or barge. The pieces will then be welded and bolted to fasten the structures.

The total duration of the pile driving operations associated with this element is anticipated to be approximately two days, assuming an installation rate of two piles per day. Vibratory hammer installation and impact hammer proofing will require an estimated 30 minutes and 15 minutes per pile, respectively. The new piles will result in the permanent loss of 6 square feet of benthic habitat between -15 and -20 MLLW.

Steel Wingwalls

The two proposed steel pile wingwalls will be positioned at an angle at the seaward end of the facility to protect the pontoon and transfer span from direct vessel impact and help guide and hold the vessel in position. The proposed wingwalls each consist of 13 steel piles located at approximately -22 MLLW.

Each wingwall will be composed of two rows of 20-inch and 24-inch diameter plumb piling and one row of 20-inch diameter batter piling, for a total of nine 20-inch and four 24-inch piles per structure. A rubber fender between the first and second rows of plumb piling will absorb much of the energy and return the front row to its original vertical position after an impact. The second row of plumb piling will be driven deeper into the sediment and braced with batter piling to minimize movement of the structure. Both pile rows are welded together with horizontal I-beams to which rubbing timbers are attached.

Pile installation will occur at a rate of up to two piles per day. Vibratory hammer installation and impact hammer proofing will require approximately 45 minutes and 20 minutes per pile.

The total duration of pile driving activities associated with this project element will be approximately fourteen days. The support piles will permanently displace 64 square feet of benthic habitat at approximately -22 feet MLLW.

Steel Dolphins

Two new inner dolphins (closest to the ferry slip wing walls) will be constructed at approximately -25 MLLW and -30 MLLW. Existing outer dolphins will be retained (Figure 2). Each dolphin will be composed of two 36-inch steel plumb piles welded together with horizontal I-beams to which laminated rubber fenders are attached.

Pile installation is expected to proceed at a rate of up to one pile per day. Vibratory hammer installation and impact hammer proofing will require approximately 2 hours and 20 minutes per pile, respectively. The total duration of pile driving activities associated with this project element will be approximately 4 days. The dolphins will permanently displace approximately 28.3 square feet of benthic habitat between -18 and -25 MLLW.

Ancillary Mechanical and Utility Systems

Electrical power will be provided via conduit from the Steilacoom shore to power this system and to provide shore power for the docked ferryboat. Water and sewer conduits will also be installed to provide water and sewer hook-ups for moored idle ferries. These project elements will be installed from the approach trestle and associated overwater structures or the construction barges and will not require in-water work.

Impact Avoidance and Minimization Measures

Pierce County will implement a suite of best management practices (BMPs) to avoid and minimize adverse effects on the aquatic environment. These include general measures applied throughout project construction, and specific measures intended to avoid and minimize the adverse effects of activities like pile driving.

General Measures

Timing restrictions will be used to avoid in-water work when salmonids and bull trout are most likely to be present. Work windows are typically imposed by the Corps and/or Services if data indicates that listed species are present in the area and by WDFW if forage fish spawning is known to occur near the terminals. The in-water window is anticipated to be between July 16 and March 2 for the protection of bull trout and salmon. However, pile driving is restricted to a maximum of 40 days between July 16 and September 30 (NMFS 2012), which affords additional protection for forage fish.

Hydraulic Project Approval (HPA) will be obtained from WDFW and a Shoreline Substantial Development Permit (SSDP) or Permit Exemption, and SEPA approval will be obtained from the Town of Steilacoom, and the contractor will follow the conditions of these permits. HPA and SSDP or Permit Exemption requirements will be listed in the contract specifications for the contractor to agree to prior to construction and the HPA will be attached to the contract such that conditions of the HPA and SSDP are made part of the contract.

The project will comply with water quality restrictions imposed by Washington Department of Ecology (Ecology) (Chapter 173-201A WAC), which specify a mixing zone beyond which water quality standards cannot be exceeded. Compliance with Ecology's standards is intended to ensure that fish and aquatic life are being protected to the extent feasible and practicable.

The contractor shall be responsible for the preparation of a Spill Prevention, Control, and Countermeasures (SPCC) Plan to be used for the duration of the project. The plan shall be submitted to the project engineer prior to the commencement of any construction activities. A copy of the SPCC Plan with any updates will be maintained at the work site by the contractor. The SPCC Plan shall identify construction planning elements, and recognize potential spill sources at the site. The SPCC will outline what measures shall be taken by the contractor to prevent the release or spread of hazardous materials, either found on site and encountered during construction but not identified in contract documents, or any hazardous materials that the contractor stores, uses, or generates on the construction site during construction activities. These items include, but are not limited to, gasoline, oils, and chemicals. Hazardous materials are defined in Regional Code of Washington (RCW) 70.105.010 under "hazardous substance." The contractor shall maintain the necessary spill response equipment and material designated in the SPCC Plan at the work site.

In addition:

- No petroleum products, fresh cement, lime, concrete, chemicals, or other toxic or deleterious materials will be allowed to enter surface waters.
- If beach access is required, use of equipment on the beach area will be held to a minimum and confined to designated access corridors that minimize foot traffic on the upper beach.
- Barge operations will be restricted to tide elevations adequate to prevent grounding of the barge.
- Wash water resulting from washdown of equipment or work areas will be contained for proper disposal, and will not be discharged into state waters unless authorized through a state discharge permit.
- Equipment that enters the surface water will be maintained to prevent any visible sheen from petroleum products appearing on the water.
- There will be no discharge of oil, fuels, or chemicals to surface waters, or onto land where there is a potential for reentry into surface waters.
- No cleaning solvents or chemicals used for tools or equipment cleaning will be discharged to ground or surface waters.
- The contractor will regularly check fuel hoses, oil drums, oil or fuel transfer valves, fittings, etc. for leaks, and will maintain and store materials properly to prevent spills.
- Projects and associated construction activities will be designed so potential effects to species and habitat are avoided and minimized.

Pile Removal

The following BMPs will be employed during pile removal:

- A containment boom surrounding the work area will be used during creosote-treated pile removal to contain and collect any floating debris and sheen, provided that the boom does not interfere with vessel operations. The boom will remain in place until all oily material and floating debris have been collected and all sheens have dissipated.
- Any oily sheens or spills observed during pile removal will be captured with oil-absorbent materials and disposed of in accordance with the SPCC plan.
- Removed piles, stubs, and associated sediments (if any) will be contained on a barge. If piles are placed directly on the barge and not in a container, the storage area will have filter fabric, or similar BMP placed around the perimeter of the barge.
- All creosote-treated material, pile stubs, and associated sediments will be disposed of by the contractor in a landfill that meets the liner and leachate standards of the Minimum Functional Standards, Chapter 173-304 WAC.
- The contractor will also retrieve any debris generated during construction, which will be properly disposed of at a permitted commercial facility.
- Excess or waste materials will not be disposed of or abandoned waterward of Ordinary High Water (OHW) or allowed to enter waters of the state, as per WAC 220-110-070. Waste materials will be disposed of in a landfill. Hazardous waste and treated wood waste will be disposed of by the contractor in a landfill that meets the liner and leachate standards of the Minimum Functional Standards, Chapter 173-304 WAC.
- Pilings that break or are already broken below the waterline may be removed with a clamshell bucket. To minimize disturbance to bottom sediments and splintering of a broken piling, the contractor will use the minimum size bucket required to pull out the piling based on pile depth and substrate. The clamshell bucket will be emptied of piling and debris on a contained barge. If the bucket contains only sediment, the bucket will remain closed, be lowered to the mudline, and opened to redeposit the sediment.
- Demolition and construction materials will not be stored where high tides, wave action, or upland runoff can cause materials to enter surface waters.

Pile Installation

The following BMPs will be employed during pile installation:

- Pile driving will be limited to no more than 40 days between July 16 and September 30.
- Each 12-hour period of impact pile driving will be followed by a 12-hour cessation.

- Piles will be inserted to the maximum practicable depth using a vibratory hammer in order to minimize the extent and duration of impact hammer operation.
- A confined bubble curtain or other approved noise attenuation device will be employed during installation or proofing of steel piles unless the piles are driven in the dry.
- The contractor will implement an approved hydroacoustic monitoring plan to establish attenuation system performance. A proposed hydroacoustic monitoring plan is provided in Appendix A.
- The contractor will submit attenuation device specifications to the Services for review and approval a minimum of 60 days prior to initiating pile driving activities.
- The attenuation device will achieve a minimum average performance of -10 dB attenuation during impact pile driving and vibratory hammer operation.
- Timing restrictions to avoid pile driving within two hours after sunrise and to hours before sunset will be used to avoid pile-driving when marbled murrelets are most likely to be present.
- Pierce County will submit a hydroacoustic and marbled murrelet monitoring plan to the Services for approval in advance of initiating construction. This plan will include provisions for immediately halting pile driving operations if marbled murrelets are observed in proximity to the approved monitoring perimeter.
- The contractor will be required to ensure that wet concrete does not come in contact with marine waters. Associated BMPs will include:
    - Forms for onsite concrete pouring will be constructed to prevent leakage of concrete leachate to surface waters. Forms will remain in place until concrete is cured.
    - The hose used to fill steel pilings with concrete will be placed toward the bottom of the piling to prevent splashing and concrete overflow.
    - The contractor will be required to retrieve any floating debris generated during construction. Any debris in the containment boom will be removed by the end of the work day or when the boom is removed, whichever occurs first. Retrieved debris will be disposed of at an upland disposal site.
    - Whenever activities that generate sawdust, drill tailings, or wood chips from treated timbers are conducted, tarps or other containment material will be used to prevent debris from entering the water. If tarps cannot be used (because of the location or type of structure), a containment boom will be placed around the work area to capture debris and cuttings.

Action Area

The action area is defined as the geographic extent of all areas affected by any and all direct and indirect effects resulting from the proposed action, as well as the effects of any interrelated or interdependent activities. It includes the full extent of project-related physical, biological and chemical effects, taking into consideration all appropriate avoidance and minimization measures identified in the project description.

For the purpose of this consultation, the action area is defined in terms of its aquatic and terrestrial components in order to better discriminate the physical extent and intensity of project related effects and the likelihood of species exposure to these effects. The boundaries of the terrestrial and aquatic components of the action area are shown in Figure 3. The outer boundaries of both components are defined by the distance required to attenuate construction noise to ambient levels in the project vicinity. Specifically:

- The terrestrial component of the action area extends overland in an arc extending approximately 1,150 feet (0.22 miles) to the east and south (inland) of the project site, and overwater in an arc extending approximately 15,811 feet (2.99 miles) to the north and west of the project site, covering a total area of approximately 11 square miles.
- The aquatic component of the action area extends outwards from the project site in an irregular bounded polygon defined by surrounding land masses, extending as far as 64,000 feet (12.12 miles) from the project site, covering a water column surface area of approximately 30.5 square miles.

It is important to note that the outer bounds of the action area represent the distance required to attenuate construction related noise to ambient levels in the aquatic and terrestrial environment. The area in which adverse effects on ESA-listed species could occur, for example the outer limits of in-air and aquatic noise levels that exceed established biological effects thresholds will be smaller in some cases depending on the type of disturbance (e.g., attenuated vs. unattenuated pile driving activity) and type of biological threshold being considered. The extent of potential adverse effects from underwater noise and in-water noise exposure extend varying distances from the source within this limit, depending on the type of exposure (i.e., in-air or underwater noise) and the type of adverse effect (e.g., behavioral disturbance or injury). The potential behavioral response zone is shown in Figure 3. Additional underwater and overwater biological threshold distances are shown in Figure 4. The methods and reference values used to determine the outer bounds of the action area are described in the *Environmental Baseline* section. Calculated distances to biological thresholds are included in Appendix B. The biological threshold distances are discussed in more detail under *Analysis of Effects*.

The remaining direct and indirect effects of the action, including construction related water quality and permanent habitat conversion impacts, are far more limited in geographic extent and are contained within the boundaries defined by noise effects.

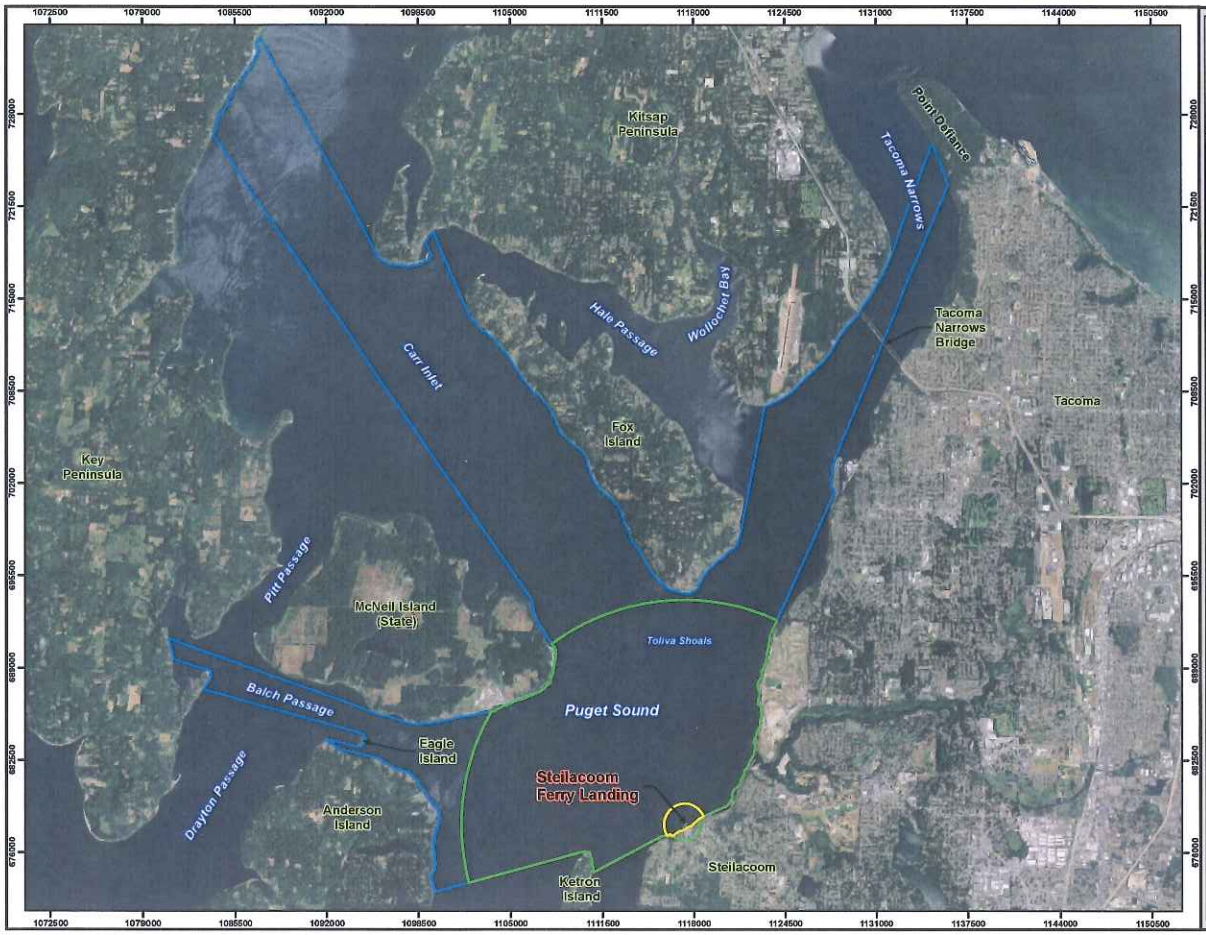

Figure 3.
Action Area for the Steilacoom Ferry Landing Improvement Project.

Legend

- Aquatic component of action area and potential behavioral response zone (150dBRMS)
- Terrestrial component of action area
- Aquatic outer bound of injury level effects (183dB SEL)

N

0 3,250 6,500 13,000 Feet

HERRERA

NAD83 HARN State Plane Washington South (Feet)
Aerial photograph: NAIP 2013

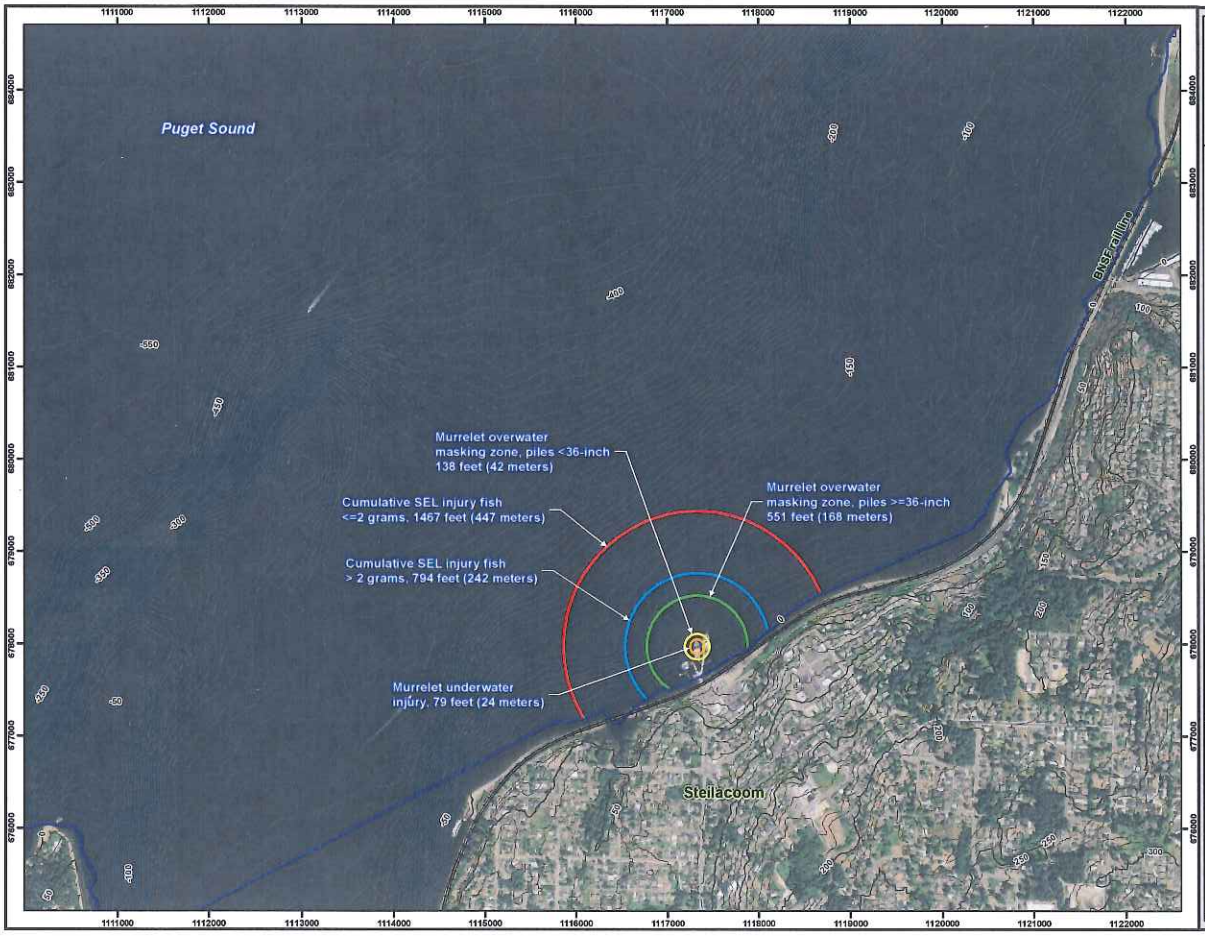

Figure 4.
Threshold Exposure Distances for Underwater and Overwater Noise Exposure Effects on ESA-Listed Fish and Bird Species Occurring in the Action Area.

Legend

- BNSF rail line
- 50-foot contour
- 10-foot contour
- Aquatic component of action area and potential behavioral response zone (150dBRMS)

Underwater noise threshold exposure distance

- Fish <= 2 gram cumulative SEL injury, 183dB (447 meters)
- Murrelet injury, 202dB SEL (24 meters)
- Fish > 2 gram cumulative SEL injury, 187dB (242 meters)

Overwater noise threshold exposure distance

- Murrelet masking zone, piles < 36-inch (42 meters)
- Murrelet masking zone, piles >= 36-inch (168 meters)

Note: Underwater threshold exposure calculated for unattenuated pile driving with 208dB cumulative SEL at 10 meters.

N

0 500 1,000 2,000 Feet

HERRERA

NAD83 HARN State Plane Washington South (Feet)
Aerial photograph: NAIP 2013
Bathymetry: Finlayson 2005

ESA-Listed Species and Designated Critical Habitat Occurring in Action Area

Information regarding the presence of species protected under the ESA that occur or may possibly occur in and adjacent to the marine waters of Pierce County, Washington, was acquired from species lists provided by USFWS and are presented in Appendix C. These sources identify ESA-listed species potentially occurring in the general vicinity.

Additional sources of information were consulted in order to specifically characterize known and potential species occurrence and habitat use in the action area. These information sources include, but are not limited to, the WDFW Priority Habitats and Species (PHS) database (WDFW 2009); the WDFW Salmonscape database (WDFW 2014a); and personal communications with WDFW biologists having area-specific expertise. This assessment was further informed by site-specific surveys of shoreline and subtidal aquatic habitat conditions conducted on October 2, 8, 9, and December 15, 2009.

The USFWS currently identifies three species listed under the ESA that occur or could possibly occur in the general vicinity of the proposed action. These species are identified in Table 2. The USFWS identifies several other ESA-listed species as occurring or potentially occurring in Pierce County (Appendix C). However, these species are limited to habitat types that do not occur in the action area and therefore, they are not considered further in this document.

Table 2. ESA Status of Species Under the Jurisdiction of USFWS Known to Occur or Likely to Occur in the Action Area.

Species	Current Status	Critical Habitat Designation
Coastal-Puget Sound Bull Trout DPS (*Salvelinus confluentus*)	Threatened – November 1, 1999 (64 FR 58909 58933)	October 18, 2010 Revision (75 FR 63898)
Marbled Murrelet (*Brachyramphus marmoratus marmoratus*)	Threatened – October 1, 1992 (57 FR 45328)	Does not occur in action area
Western Yellow-Billed Cuckoo (*Coccyzus americanus*)	Proposed Threatened – October 3, 2013 (78 FR 61621)	Not designated

Coastal-Puget Sound Bull Trout

Species: *Salvelinus confluentus*
DPS: Coastal-Puget Sound
Federal Status: Threatened
Critical Habitat: Designated critical habitat occurs within action area

Species Status

The Coastal/Puget Sound (C-PS) DPS of bull trout was listed as a threatened species on November 1, 1999 (64 FR 58909 58933). This DPS encompasses all Pacific coast drainages within Washington, including the Hood Canal portion of Puget Sound. This DPS is discrete because the Pacific Ocean and the crest of the Cascade Mountain Range geographically segregate it from subpopulations. The DPS is significant to the species as a whole because it is thought to contain the only anadromous form of bull trout in the contiguous United States. Critical habitat was designated for all bull trout populations in the coterminous United States on September 26, 2005 (70 FR 56212) and the designation was revised on October 18, 2010 (75 FR 63898).

Occurrence in the Action Area

Amphidromous[1] C-PS bull trout are known to forage in nearshore marine waters salt water moving as far as 100 miles (Brenkman and Corbett 2005). Goetz et al. (2004) reviewed available data on bull trout use of nearshore marine habitats in Puget Sound. They concluded that bull trout use marine habitats predominantly for foraging purposes, preferentially selecting habitats on the basis of prey availability (notably locations where salmon smolts are abundant during early marine migration. They also summarized evidence documenting the likelihood that small numbers of sub-adult bull trout may move between core habitats in the Puyallup River and productive foraging habitats in south Puget Sound, specifically the Nisqually River delta. The Nisqually and the Puyallup River systems support independent populations of bull trout, with the Puyallup River system the larger and more significant (WDFW 2004).

Recent studies using acoustic telemetry have provided insight into the nature and timing of marine habitat use by bull trout. For example, Goetz et al. (2004) reported that bull trout are typically found in marine habitats between early-March and mid-July, peaking in late-May and early-June, timing which corresponds to salmonid smolt outmigration from many river systems in the region. They are typically absent from marine waters between August and November, which corresponds with freshwater spawning. Brenkman and Corbett (2005) observed similar patterns in a larger acoustic telemetry study of marine habitat use and spawning migration timing in a bull trout population on the Olympic Peninsula. Goetz et al. (2004) also noted that depth preference in marine waters appears to be a function of size, with larger bull trout found predominantly at depths between 5 and 10 meters (16 to 33 feet), with rare excursions as deep as 25 meters (~80 feet), with smaller individuals (less than 1,500 grams, or approximately 3.3 pounds) typically found at depths shallower than 5 meters (16 feet).

The shoreline and offshore habitats in the project vicinity are fairly uniform with a steep sloping and soft bottomed substrate lacking in eelgrass. While kelp is present, it does not

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[1] Bull trout, coastal cutthroat trout, and other species are more properly termed ''amphidromous.'' Unlike strictly anadromous species, such as Pacific salmon, amphidromous species often return seasonally to fresh water as subadults, sometimes for several years, before returning to spawn (Wilson 1997).

occur in the dense anchored beds conducive to productive salmonid rearing habitats. This suggests that bull trout are unlikely to use the area immediately surrounding the Steilacoom Ferry Landing as a primary foraging habitat. Collectively, this information suggests that adult and sub-adult bull trout occurrence in this part of the action area is likely infrequent, limited to migration to and from productive foraging habitats between March and mid-July, and distributed within 300 feet of the shore where water depths are approximately 30 feet or less.

Amphidromous bull trout rear in freshwater during early juvenile life history and migrate to marine foraging habitats as immature subadults from 1 to 3 years of age, typically between 90 and 250 millimeters in length (Goetz et al. 2004; McCormick 1994). Subadults of this length would be expected to range from 90 to 450 grams or greater in weight.

Critical Habitat Occurrence in the Action Area

The action area overlaps designated critical habitat for C-PS bull trout, specifically the nearshore marine foraging and migratory corridor between the Nisqually and Puyallup Rivers in critical habitat Unit 2: Puget Sound (75 FR 63898). Critical habitat PCEs (75 FR 63898) specific to the marine environment include:

> (ii) Migration habitats with minimal physical, biological, or water quality impediments between spawning, rearing, overwintering, and freshwater and marine foraging habitats, including but not limited to permanent, partial, intermittent, or seasonal barriers;
>
> (iii) An abundant food base, including terrestrial organisms of riparian origin, aquatic macroinvertebrates, and forage fish;
>
> (iv) Complex river, stream, lake, reservoir, and marine shoreline aquatic environments, and processes that establish and maintain these aquatic environments, with features such as large wood, side channels, pools, undercut banks and unembedded substrates, to provide a variety of depths, gradients, velocities and structure; and
>
> (v) Water temperatures that support bull trout use, ranging from 36 to 59°F (2 to 15°C) in marine waters.
>
> (viii) Sufficient water quality and quantity such that normal reproduction, growth, and survival are not inhibited.

Marine critical habitat for bull trout extends from MHHW to a depth of 33 feet (10 meters) below MLLW (i.e., the depth of the photic zone) (75 FR 63898). Based on this delineation, critical habitat is clearly widespread throughout the broader aquatic component of the action area. Bull trout critical habitat within the limits of potential adverse effects can be demarcated using available bathymetric data (Finlayson 2005). Based on the 30-foot bathymetric isolpleth, bull trout critical habitat runs parallel to the shoreline in a swath extending from MLLW to approximately 200 to 300 feet offshore.

Marbled Murrelet

Species: *Brachyramphus marmoratus marmoratus*
DPS: Georgia Basin
Federal Status: Threatened
Critical Habitat: Does not occur in action area

Species Status

The marbled murrelet was listed as a threatened species on October 1, 1992 (57 FR 45328). Designated critical habitat for this species includes old growth stands and other suitable nesting areas. It does not include marine habitats in Puget Sound (61 FR 26258).

Occurrence in the Action Area

Marbled murrelets feed in the nearshore marine environment, usually up to 350 to 2,000 feet off the shoreline. They forage year-round in waters generally less than 90 feet deep and are most frequently observed within 1,500 feet of protected shoreline waters. Marbled murrelets generally do not forage in waters less than 30 feet deep. This species is most commonly associated with waters greater than 30 feet in depth (Speich and Wahl 1995; Strachan et al. 1995). Marbled murrelet density is generally low in south Puget Sound, but individuals or small groups of murrelets are periodically observed in the action area or the generally vicinity during summer months, most prominently associated with the Nisqually River delta (Nysewander et al. 2005).

Pile driving between July 16 and September 30, as well as other overwater project activities (July 16 through May 31), overlap with several murrelet life history periods of relevance to this consultation (Carter and Stein 1995; Nelson 1997; Thompson 2003, USFWS 2012). These include:

- Nesting period - April 1 to September 23
- Pre-alternate molting - late February through mid-May
- Pre-basic molting - mid-July through the end of August

Pre-basic molting is of particular interest because murrelets are unable to fly during this period and are therefore surface bound. Murrelets escape from stressful stimuli by both flight and diving depending on specific circumstances. Diving is the only possible escape response during the pre-basic molt period.

On the basis of this information, foraging marbled murrelets may possibly occur in the action area during any season of the year. Sensitive life history stages may occur during the in-water work window.

Yellow-Billed Cuckoo

Species: *Coccyzus americanus*
DPS: Western
Federal Status: Proposed Threatened
Critical Habitat: Not designated

Species Status

The yellow-billed cuckoo was proposed threatened on October 3, 2013 (78 FR 61621). Critical habitat has not been proposed or designated for this species.

Occurrence in the Action Area

The yellow-billed cuckoo is a neotropical migrant bird that winters in South America and breeds in North America. Yellow-billed cuckoos spend the winter in South America, east of the Andes (78 FR 61623). The western yellow-billed cuckoo generally arrives on its North American breeding grounds in mid-June, and begin their southbound migration in late summer between mid-August and mid-September (78 FR 61632). Yellow-billed cuckoos use wooded habitat with dense cover and water nearby, including woodlands with low, scrubby, vegetation, overgrown orchards, abandoned farmland, and dense thickets along streams and marshes (Cornell University 2014).

In the Pacific Northwest, including Oregon, Washington, and British Columbia, Canada, the western yellowbilled cuckoo was formerly common in cottonwood and willow bottoms along the Willamette and lower Columbia Rivers in Oregon and Washington, and in the Puget Sound lowlands of Washington. In Washington, the last confirmed breeding records of yellow-billed cuckoos are from the 1930s, and it is likely to have been extirpated as a breeder in the state. Incidental sightings have occurred throughout the state, and the possibility of a vestigial breeding population may still exist. Researchers made 17 records from 1956 to 2012, of which 13 were east of the Cascades. There are few remaining examples, none of which is extensive, of the river floodplain habitats bordering Puget Sound, which historically had the most yellow-billed cuckoo sightings in the state (78 FR 61635). Preferred nesting habitat consists of large cottonwood gallery forests ranging from 50 to 200 acres (78 FR 61635). Habitat within the action area is highly modified by urban development and does not generally contain suitable or preferred habitat for yellow-billed cuckoo.

Project timing overlaps with the species' southbound migration timing and overwintering period. Yellow-billed cuckoo could incidentally occur within the action area; however, it is unlikely to be present in the action area for any extended period because suitable nesting habitat is not present. Presence during project activities would be limited to unlikely brief excursions through the vicinity in the first two weeks of September during their southbound migration.

Environmental Baseline

The action area encompasses a large portion of southern Puget Sound, with the majority of this area defined by the distance necessary to attenuate construction related underwater noise to ambient levels. The principal project effects relevant to this consultation result from the direct and indirect effects of project construction, and permanent habitat impacts from the removal and replacement of in-water structures.

The Services have each defined a Matrix of Pathways and Indicators that are typically used for identifying and characterizing environmental baseline conditions for habitat parameters that are pertinent to ESA consultation (NMFS 1996; USFWS 1998). However, neither of these matrices identifies specific pathways and indicators for assessing impacts on marine habitats. For the purpose of this BA, environmental baseline conditions are characterized for habitat elements that will be altered by the proposed action, either temporarily or permanently. These include:

- The terrestrial noise environment
- The underwater noise environment
- Water quality conditions (turbidity)
- Sediment quality conditions
- Shoreline geomorphic conditions and processes
- Nearshore habitat structure
- Forage fish spawning, rearing, and foraging habitat

Environmental baseline conditions for these habitat elements are described below. This discussion focuses on baseline conditions for these habitat elements within the limits of potential adverse effects resulting from the action. Environmental conditions in the broader action area are summarized briefly because the majority of this area will not be subject to permanent or significant short-term effects from the action.

Terrestrial Noise

Ambient noise levels in the project vicinity were estimated at 61 dBA, based on noise levels measured in nearby residential areas (Pierce County 1997). Estimated ambient noise levels at the water surface are derived from in-air noise studies of ferry operations conducted at WSF terminals in January 2005. In-air noise from ferry operations at the Bremerton Ferry terminal produced peak noise levels of 65.5 dBA during ferry arrival, 72.5 dBA during unloading of vehicles, 67.5 dBA during loading of vehicles, and 67.5 dBA during departure. From arrival to the next departure, noise recordings ranged from a low of 56 dBA during departure to a high

of 72.5 dBA during unloading. Ambient noise levels between ferry landings and departures ranged from 54 to 61 dBA at the terminal (McMullen Associates, Inc. 2005). An ambient noise level of 60 dBA was selected for the surface of Puget Sound because this value lies within the range observed at WSF ferry terminals and is consistent with onshore terrestrial noise levels.

Underwater Noise

Ambient underwater noise levels can vary considerably in the marine environment depending on a number of natural and anthropogenic factors (Urick 1983). Ambient levels in Puget Sound are generally in the area of 130 dB_{peak} (Laughlin 2005), plus or minus 15 dB. For example, measured noise levels ranged from 115 to 135 dB_{RMS} in Hood Canal (Carlson et al. 2007), 131 and 136 dB_{peak} (ranging as high as 151 dB_{peak}) near the Friday Harbor Ferry Terminal (WSDOT 2005), and as high as 145 dB_{peak} at the Mukilteo Ferry Terminal even when ferry traffic was not present (Jasco 2007). While site-specific data are lacking for the action area, ambient noise conditions are expected to be similar to those observed conditions.

Water Quality Conditions

Water quality conditions in south Puget Sound in the portion of the action area adjacent to the project site are rated as a Class "A" under Ecology Water Quality Standards for Surface Waters of the State of Washington (WAC 173-201A) and are generally considered to be good. However, the Washington State Department of Ecology has identified a number of water quality concerns applying across south Puget Sound, specifically the risk of eutrophication resulting from increasing discharges of nutrients and toxic pollutants associated with development in the surrounding watersheds (Ecology 2001). Eutrophication refers to the process in which elevated nutrient levels result in excessive primary production by the plant community, potentially leading to a number of deleterious consequences. The proposed action will have no measurable effect on these water quality parameters in the project vicinity and no effect on the rate of eutrophication in the action area. Therefore, eutrophication is not considered further as a potential effect of the action.

The primary water quality effect resulting from the proposed action will be periodic pulses of suspended sediments during construction, barge operation and anchoring, removal of existing in-water structures, and placement of new steel piles. Suspended sediment data are lacking for the project vicinity, however turbidity data for locations in central Puget Sound are available and can be considered generally representative of suspended sediment conditions in the nearshore component of the action area. The International Standards Organization (ISO) defines turbidity as the "reduction of transparency of a liquid caused by the presence of undissolved matter" (Lawler 2005), as measured by turbidimetry or nephelometry. Turbidity is a measure of the full range of inorganic materials like silt and clay, as well as organic materials such as tannins, algae, plankton, microorganisms and other organic matter, while suspended sediments refer only to the inorganic particulate materials in the water column. Turbidity is more easily measured than suspended sediments however, and is therefore commonly used as a surrogate measure for suspended sediment effects.

Real time turbidity data collected by King County (2009) collected at the marine mooring monitoring buoy located at the mouth of Quartermaster harbor provide a generally

representative characterization of turbidity conditions in the nearshore areas of Puget Sound. Turbidity conditions at this location for the period from April 30 to September 30 averaged 27.2 nephelometric turbidity units (NTU) at the surface and 1.2 NTU at the bottom, ranging from near zero NTU to 1,000 NTU or greater. The standard deviation of surface and bottom measurements was 162.1 and 57.7 NTU, respectively. The broad range of turbidity conditions at this site reflects the influence of both natural and anthropogenic sources of suspended sediment and biological contributions to turbidity.

The April 30 to September 30 period examined here overlaps the in-water work window for Tidal Reference Area 3, indicating that these turbidity conditions are at minimum representative of those likely to occur in the project vicinity during construction. Actual baseline turbidity conditions in the project vicinity are likely to be higher on average due to periodic propwash events associated with regular ferry operations.

Sediment Quality Conditions

There are no historical long-term or rotating sediment monitoring stations in the project vicinity listed in Ecology's SEDQUAL database however, a sediment characterization study was completed prior to replacement of the Steilacoom Ferry Landing facilities in 1994 that included researching historic uses, and sampling and analysis of sediments adjacent to the landing. Sediments were sampled and characterized in accordance with the Washington Sediment Quality Standards and an Ecology approved Sampling and Analysis Plan (WAC 173-204). The study concluded that significant sediment contamination was not present in the area (Sverdrup 1994). Ecology's review of the sediment study results ranked the area low-priority and attached no conditions to federal approval of the proposed project.

Some sediment contamination may occur immediately adjacent to existing creosote-treated piles within the project site. Sediment bound environmental toxins typically associated with creosote include polyaromatic hydrocarbons (PAHs), polychlorinated biphenyls (PCBs), and metals including copper, zinc, and arsenic (Poston 2001). Goyette and Brooks (1998, 2000) studied sediment contamination resulting from the installation of several new creosote-treated timber pile dolphins in British Columbia. They found measurable PAH contamination within approximately 25 feet (7.5 meters) of the structures, with concentrations of some contaminants exceeding biological effects thresholds for benthic macroinvertebrates within 8 feet (2.5 meters). The distribution of contaminants was patchy and variable and decreased over time as a result of physical and biological dispersion. Poston (2001) notes that PAH concentrations surrounding creosote treated structures tend to decrease over time due to biological degradation. Given that the existing creosote treated structures have been in place for several years, it is unlikely that significant sediment contamination occurs beyond the area immediately surrounding the existing creosote-treated structures.

Shoreline Geomorphic Conditions and Processes

Geomorphic conditions and processes within the action area are strongly influenced by the naturally steep shoreline bathymetry and extensive shoreline armoring protecting the BNSF railroad corridor. Shoreline armoring has effectively interrupted the majority of sediment supply to the nearshore environment for several miles in each direction from the project site.

Wave action reflecting off of this hard surface has contributed to erosion of the beach and the adjacent intertidal bench. The beach has eroded down to hardpan in many areas, and fine substrates capable of supporting intertidal vegetation like eelgrass are generally lacking. In addition to the direct loss of suitable habitats for juvenile salmonids, this has also degraded and potentially eliminated forage fish spawning habitat, reducing the forage base available for subadult and adult salmon and bull trout. This form of degradation is pervasive and persistent in Puget Sound (Downing 1983). Shoreline modification and natural geomorphic conditions (naturally steep offshore bathymetry) have strongly influenced intertidal and subtidal habitat conditions in the project vicinity.

Given the lack of substrates available for longshore drift, the Steilacoom Ferry Landing has had a negligible impact on the highly modified shoreline geomorphic conditions and processes in the action area.

Nearshore Habitat Structure

A site specific survey which included classification and characterization of nearshore habitat conditions in the project site and the vicinity was conducted in support of the consultation for the proposed project. The survey methods and results are reported in Appendix E. Nearshore habitat structure in the action area is typical of modified mixed sediment intertidal beaches in Puget Sound. Based on conditions observed during the field survey, shoreline armoring has clearly contributed to erosion of finer substrates from the intertidal zone. In some areas the substrate has degraded to the hardpan, effectively eliminating suitable habitats for eelgrass (*Zostera* spp.). No eelgrass was observed in the vicinity of the project. Submerged aquatic vegetation is limited to several species of green, red, and brown macroalgae growing in small patches and on the drift.

Other marine habitats in the action area, primarily on the surrounding islands and the western shore of Puget Sound, have not been subject to the same degree of shoreline armoring and modification and are less degraded as a consequence.

Forage Fish Habitat

The action area provides documented habitat for three species of forage fish, which are usefully characterized on the basis of spawning behavior and preferred spawning habitats. All three of these forage fish species provide key prey items for adult and juvenile salmonids, marbled murrelets, and marine mammals.

As discussed previously, the action area is largely defined by underwater noise levels that exceed ambient conditions. However, the proportion of the action area in which forage fish could experience underwater noise exposure sufficient to cause adverse effects is considerably smaller than the action area as a whole. It is therefore useful to characterize the forage fish environmental baseline relative to both the action area as a whole and the outer bound of areas within which noise effects are likely to exceed biological effects thresholds.

Surf Smelt and Sand Lance

Adult, subadult, and rearing juvenile surf smelt and Pacific sand lance are likely to be present in the action area throughout the year (Bargmann 1998; WDFW 1997, 2014b). Eggs and larvae are also common in the action area, but they are most likely to occur in late fall and winter months outside of the proposed pile driving activity (Bargmann 1998). Surf smelt and sand lance spawn in coarse sand substrates high on intertidal beaches (typically between mean high tide line and about +5 feet in tidal elevation). Known and potential spawning habitat are broadly distributed on intertidal shorelines throughout the broader action area, particularly on the less developed shorelines of Ketron, Anderson, and Fox Islands. McNeil Island has not been surveyed, however this island has little shoreline development so spawning habitat is likely to be comparably abundant. Population units have not been defined for surf smelt and sand lance and their abundance and productivity is not routinely monitored (WDFW 1997), therefore the current status of spawning units in south Puget Sound is unknown.

Known and potential spawning habitats are far more limited within the range of potentially adverse underwater noise effects. Documented surf smelt spawning habitat occurs on the eastern shore of Puget Sound approximately 3,700 feet to the northeast of the project site, or within the limits of potential behavioral level underwater noise effects on the eastern shore of Puget Sound. Additional habitats potentially suitable for surf smelt and sand lance spawning have been identified 1,600 feet to the southwest and 1,900 feet to the northeast of the project site (WDFW 2009), also within the range of behavioral level underwater noise effects. Surf smelt spawning is believed to occur in the fall and winter in south Puget Sound in multiple events without a discrete peak (WDFW 1997). Sand lance spawning occurs between November and February, also in multiple events without a discrete peak (Bargmann 1998).

Based on this information, juvenile, subadult, and adult surf smelt and sand lance are likely to occur within the range of potentially adverse underwater noise effects during the in-water work window.

Pacific Herring

Based on the documented distribution of Pacific spawning and pre-spawn staging habitats in Puget Sound (Stick 2005), herring belonging to the Squaxin Pass and Wollochet Bay stocks are likely to occur within the broader aquatic component of the action area as larvae, juveniles, and foraging and migrating adults. Use of the action area is limited to open water foraging habitats and migratory corridors between foraging habitats and spawning, and pre-spawn staging areas. The primary pre-spawn staging areas and spawning habitats for both stocks are outside of the action area.

Sexually mature adult herring are most likely to occur in the action area during migration to pre-spawn holding habitats. Documented spawning activity for the Squaxin Pass occurs from early January through mid-April, with peak activity in late-February and early-March. The Wollochet Bay stock spawns in January and February (Stick 2005). Larval herring are likely to be present in the action area well into June, while juvenile and adult herring are likely to be present throughout the year.

The Squaxin Pass stock is currently considered stable and healthy, based on recent 2-year and 5-year population trends. Insufficient data are available to rate the status of the Wollochet Bay stock (Stick 2005).

Analysis of Effects

This section considers the direct and indirect effects of the proposed action on ESA-listed species and PCEs of designated critical habitat that occur in the action area. There are no interrelated or interdependent actions associated with the proposed action and therefore no additional related effects to consider. Finally, the cumulative effects of the proposed action in combination with anticipated state and local actions likely to occur in the action area in the foreseeable future are also considered.

The anticipated effects of the proposed action include short-term direct effects associated with project construction, and intermediate-term indirect effects and long-term direct and indirect effects associated with the permanent modification of nearshore habitats by new overwater- and in-water structures. There are no significant operational changes associated with the proposed action that would, for example, modify the frequency, timing, or duration of vessel operations (and related noise and disturbance) or other activities in the nearshore.

Elements of the proposed action producing potentially significant effects include:

- Short-term construction related water quality impacts
- Short-term increase in in-air noise levels associated with impact pile driving and other construction activities
- Short-term increase in underwater noise levels associated with impact and vibratory pile driving
- Permanent alteration (displacement and shading) of benthic and water column habitat by new in-water and overwater structures

The direct and indirect effects of the action, the ecological stressors they produce, the effects of these stressors on ESA-listed and proposed species and designated critical habitats, and the cumulative effects of the action are described in detail below.

Construction Related Water Quality Impacts

Intensity/Extent: Turbidity plumes associated with bed disturbance as high as 1 NTU above baseline levels within 50 feet of the source

Duration: No more than 12 hours per day over a total of 40 days between July 16 and September 30

Construction of overwater- and in-water structures, including the removal of existing piles and the placement of new piles, has the potential to alter water quality conditions in the immediate surroundings. While examples are limited, available data indicate water quality effects caused by the kinds of construction activities being proposed are relatively minor in

intensity and extent. For example, Roni and Weitkamp (1996) monitored water quality parameters during a pier replacement project in Manchester, Washington, before, during, and after pile removal, placement of new piles, and minor dredging. They found that these activities had "little or no effect on DO (dissolved oxygen), water temperature, and salinity." Some turbidity effects were observed, but these were limited to an increase of typically less than 1 NTU over reference locations and typically did not extend beyond the monitoring locations nearest to the activity.

WSDOT conducted water quality monitoring during three pile removal events at the Friday Harbor Ferry Terminal (WSDOT 2009b). Similar to the proposed action, these events included the removal of dolphins and wingwalls composed of creosote-treated wood piles. WSDOT found that turbidity levels produced by pile removal did not exceed 1 NTU over background conditions and were generally less than 0.5 NTU over background levels. In October 2005, water quality monitoring conducted at the Eagle Harbor Maintenance Facility during four pile removal events of creosote and steel piles showed turbidity levels did not exceed 0.2 NTU over background levels (WSDOT 2009b). Citing information provided by the US Environmental Protection Agency, WSDOT (2009b) indicates that measurable turbidity impacts associated with pile installation are typically limited to within 25 feet of the pile.

Other minor water quality effects may occur during project construction as a result of minor spills or leaks from construction equipment. In addition, oily sheens are occasionally observed during the removal of creosote-treated materials from the marine environment. Under the assumption that proposed BMPs and SPCC measures will effectively avoid and control any accidental spills of fuel, lubricants, or other toxic substances, this information suggests that that minor turbidity impacts are the only water quality impact likely to occur during construction. For the purpose of this BA, these water quality impacts are expected to be limited to no greater than 1 NTU above baseline conditions at 50 feet from the construction activity.

Direct Effects on ESA-Listed Species

Turbidity effects on ESA-listed species are expected to be negligible, on the basis that the turbidity levels resulting from construction activities are well within the range of natural variability for nearshore locations in Puget Sound during the in-water work window. As stated in the *Environmental Baseline - Water Quality* section, the standard deviation of representative turbidity data for this site is, at minimum, approximately 58 NTU. Turbidity impacts from construction, which are in the range of 1 NTU or less, are negligible in comparison.

Direct Effects on Designated Critical Habitat for Bull Trout

Water quality effects resulting from project construction are expected to be short-term in duration and negligible in severity. On this basis, the effects of the proposed action on the water quality components of C-PS bull trout critical habitat PCEs 2 and 8 will be insignificant.

Contaminated Sediment Disturbance

Intensity/Extent: Short-term resuspension of contaminated sediments during creosote-treated pile removal, potentially leading to measurable surface contamination of sediments contamination within 25 feet of removal site

Duration: Uncertain, but likely less than 1 year

Removal of creosote-treated piles is likely to result in the temporary resuspension of contaminated sediments immediately surrounding the piles and the dispersal of these sediments on the surrounding bed surface. Based on the anticipated extent of turbidity impacts (WSDOT 2009b) and monitoring studies of contaminated sediment distribution associated with installation of new creosote treated piles (Goyette and Brooks 1998, 2000), measurable changes in contaminant levels in surface sediments could potentially occur within 25 feet of pile removal activities; however, these levels are unlikely to exceed sediment management standards beyond 8 feet from the pile. Contaminant concentrations in surface sediments are likely to dissipate over time as a result of biological and physical degradation and dispersal mechanisms (Goyette and Brooks 1998, 2000; Poston 2001). The rate at which this is likely to occur is uncertain but is likely to be less than 1 year based on conditions observed at other locations and the tidal current and propwash dynamics present at this site.

Direct and Indirect Effects on ESA-Listed Species

ESA-listed fish species may be directly exposed to PAH compounds in resuspended sediments, while fish and other ESA-listed species may be indirectly exposed to these compounds through dietary mechanisms. Poston (2001) reviewed available literature on the effects of acute and chronic PAH exposure associated with creosote, identifying a range of adverse effects from varying degrees of exposure. While these effects are acknowledged, insufficient information is available on the extent of PAH contamination at the site and the potential for exposure from sediment resuspension resulting from the proposed action to characterize the potential for adverse effects.

Direct and Indirect Effects on Designated Critical Habitat for Bull Trout

Effects of water quality alteration from contaminates such as PAH compounds are expected to be minor, localized, and temporary. The potential effects on water quality components of bull trout PCEs (PCE 2 and 8), or the potential to indirectly alter food base (PCE 3) due to water quality impacts is insignificant. NMFS (2012) found that for listed Puget Sound salmon, exposure to low concentrations of suspended sediment and contaminates will be localized, short duration (before becoming diluted or settling back to the substrate), and not expected to measurably affect fish species' ability to forage, migrate, or avoid predation. On the same basis, the project would not measurably affect water quality or habitat conditions important to bull trout foraging and migration. In the long term, the removal of creosote treated piles should improve water quality.

In-air Noise (Overland and Overwater)

Intensity/Extent: In-air noise levels as high as 110 maximum A-weighted decibels (dBA $_{Lmax}$), propagating in an arc extending as far as 1,150 feet overland from the

project site, attenuated by terrain, vegetation, and urban development; and in an arc extending as far as 15,811 feet over water from the project site

Duration: July 16 to May 31 during the construction period

The geographic extent of in-air noise effects was based on the calculated distance necessary to attenuate the loudest construction noise source to ambient levels over different types of terrain. The loudest source of in-air construction noise is expected to be the installation of steel piles using impact and vibratory pile drivers. Based on field observations and reference sources, WSDOT (2014) estimates typical noise levels for these activities as follows:

- Impact pile driving of steel piles - 110 dBA $_{Lmax}$
- Steel pile installation using a vibratory hammer - 101 dBA $_{Lmax}$

Impact pile driving of steel piles is expected to produce the loudest continuous construction noise, which is estimated at 110 dBA at a reference distance of 50 feet from the source (WSDOT 2014). Vibratory and impact pile driving and other construction activities will produce elevated in-air (and overwater) noise reaching as high as 101 dBA at a reference distance of 50 feet.

The approach used to define the extent of in-air noise propagation is based on methods developed by the Federal Highway Administration (FHWA 2003), further refined with assistance from specialists in noise effect analysis (Magnoni 2006). This approach is consistent with WSDOT guidance for biological assessment preparation (WSDOT 2014).

Sound is a pressure wave that diminishes over distance from the source due to attenuation caused by surface characteristics, terrain, vegetation effects, and atmospheric scattering. For the purpose of this analysis, construction noise is expected to emanate from the defined noise point sources, traveling outward from the source with diminishing intensity until it attenuates to ambient, or background, noise levels. Based on FHWA guidance for calculating noise attenuation (FHWA 2003; Magnoni 2008), the following rules apply for point noise sources (where D = distance from the source, and Do = the reference distance for source noise measurement; typically 50 feet):

- Hard site (water, asphalt, or concrete) sound level propagation from a point source is 20 Log (D/Do), or a 6-dB reduction for every doubling of distance
- Soft site (ploughed fields, grass, light vegetation, or residential and urban neighborhoods) sound level propagation from a point source is 25 Log (D/Do), or a 7.5-dB reduction for every doubling of distance

In addition, the following site-specific factors can strongly influence sound propagation (FHWA 2003):

- Ridgelines causing shielding attenuation that reduce propagated noise by 5 dBA

- Rows of buildings that interrupt line of sight cause 4.5 dBA of shielding attenuation for the first row and 1.5 dBA for each subsequent row up to a maximum reduction of 10 dBA
- Line of sight from the project is interrupted by a minimum of five rows of structures, providing the maximum -10 dBA attenuation

As described previously, elevated in-air noise will extend approximately 1,150 feet inland in a semicircular pattern and overwater in a semicircular pattern approximately 15,811 feet from the Steilacoom Ferry Landing before attenuating to ambient noise levels (see Figure 3). Construction noise within these limits is likely to exceed ambient levels during project construction.

Direct Effects on ESA-Listed Species

ESA-listed species are not expected to occur in the terrestrial component of the action area (i.e., the urbanized areas of the town of Steilacoom and the surroundings); therefore only overwater in-air noise is considered here.

Marbled murrelet is the only ESA-listed species for which biological effects thresholds for in-air noise exposure are available. USFWS currently uses distance thresholds for evaluating the potential effects to marbled murrelet from in-air noise associated with pile driving. In a terrestrial environment, a zone of potential disruption (e.g., flushing or significant behavioral responses) is conservatively estimated at 110 meters (361 feet) from the pile driving activity. The zone of potential hearing loss or injury would be smaller, less than 15 feet. These distances are used as a guideline to evaluate potential effects from exposure to continuous sounds from impact pile driving.

Over water in the marine environment, noise disturbance can also result in noise "masking" where one sound is drowned out by a louder sound. This has the potential to interfere with communication between murrelets during foraging, and therefore result in direct behavioral effects. Based on recent analysis and guidance from USFWS (2013), the threshold distance for this disturbance, or masking zone, is estimated at 42 meters for steel piles less than 36-inch diameter, and 168 meters for piles 36 inches or greater in diameter. These noise masking threshold distances are used for "typical" pile driving projects, which include use of an impact pile driver only for proofing piles that are first placed with vibratory equipment, and include use of noise attenuation devices and monitoring. Because the project involves installation of both size classes, (piles ranging from 16 to 36 inches in diameter) both masking zone distances are shown in Figure 4. Murrelet monitoring within the noise masking zones will reduce the potential for exposure and associated adverse effects.

In-air noise would potentially result in similar behavioral effects or injury to Western yellow-billed cuckoo to the extent that individuals are present in the area of impacts during pile driving activity. However, adverse effects are unlikely to occur due to the absence of suitable habitat in the area of significant noise impacts, the unlikely potential for individuals to be present, and unlikely potential for exposure.

Underwater Noise

Intensity/Extent: Elevated underwater sound pressure levels (SPLs) as high as 214 peak decibels (dB_{peak}), 201 root mean square decibels (dB_{RMS}), 186 dB sound exposure level (SEL), and 208 dB cumulative SEL extending as far as 64,000 feet (12.12 miles) from the project site.

Duration: No more than 12 day light hours per day over a total of 40 days between July 16 and September 30

The Fisheries Hydroacoustic Working Group (FHWG 2008) is a multi-agency working group composed of representatives from federal and state transportation and resource agencies with expertise in underwater acoustics, aquatic organism biology, and transportation project permitting. The FHWG periodically updates biological effects threshold criteria and guidance for ESA-listed species, and methods for calculating sound attenuation and related exposure risk for these species. Leading up to current USFWS guidance for noise analysis associated with pile driving, panels comprised of multiagency biologists and acoustic experts convened to address the potential for noise impacts to effect marbled murrelet (USFWS 2013). The FHWG and USFWS have developed a methodology for calculating the distance necessary to attenuate construction noise to ambient levels and to biological effects thresholds for ESA-listed species including marbled murrelet and bull trout. These methods were used to calculate the area of Puget Sound potentially affected by elevated underwater noise impacts, and the areas within which ESA-listed species might be exposed to behavioral and injury level effects.

Unmitigated SPLs were estimated based on summarized literature and WSDOT monitoring (WSDOT 2014). For this analysis, the following SPLs were assumed for pile strikes at 10 meters from the source. SPLs generated by a single strike on a 16-inch hollow steel pile will produce a peak pressure of 200 dB and 187dB_{RMS}, and an estimated 175 dB SEL. A single strike to a 24-inch hollow steel pile will produce a peak pressure of 212 dB, 181 dB SEL, and 189 dB_{RMS}; and a single strike on a 36-inch hollow steel pile will produce a peak pressure of 214 dB, 186 dB SEL, and 201 dB_{RMS}.

The geographic extent of underwater noise impacts is estimated by calculating the distance required to attenuate elevated SPLs produced by the loudest noise source to ambient noise levels in Puget Sound. As stated before, the loudest source of underwater noise impacts will be the installation of 36-inch steel piles using an impact hammer for proofing, with vibratory hammer installation a secondary significant noise source. During the worst case scenario (36-inch pile during the unattenuated sampling) the behavioral threshold of 150 dB_{RMS} used for fish and marbled murrelet would be exceeded for a distance of 15.61 miles from the most waterward pile. The behavior of bull trout and marbled murrelet within this distance, and in direct line-of-site of the pile driver, may be adversely affected. However, land masses at Anderson Island, McNeil Island, Fox Island, and the Key Peninsula block the furthest extent of elevated noise from impact pile driving at 12.12 miles. For the purpose of the proposed project consultation, it is also necessary to estimate the distance necessary to attenuate underwater noise below established biological effects thresholds for ESA-listed fish and birds. These exposure distances for the worse-case scenario (unattenuated pile sampling event) are

summarized in Table 3 and are displayed in Figure 4. Additional threshold distances for various pile sizes and installation rates are included in Appendix B.

Table 3. Calculated Pile Driving Noise Threshold Exposure Distances for ESA-listed Species Under the Jurisdiction of USFWS.

Fish Threshold Exposure Distance (feet/[meters])				Marbled Murrelet Threshold Exposure Distance (feet/[meters])		
Peak Pressure Injury [a] (206 dB_{peak})	Cumulative SEL Injury [b,c]					
	Fish > 2 g (187 dB SEL)	Fish ≤ 2 g (183 dB SEL)	Behavioral (150 dB_{RMS})	Auditory Injury (202 dB SEL)	Barotrauma (208 dB SEL)	Behavioral (150 dB_{RMS})
112 [34]	794 [242]	1,467 [447]	82,411 [25,119][d]	79 [24]	33 [10]	82,411 [25,119][d]

[a] Assumes 36-inch steel piles without attenuation, 150 strikes, 214 dB peak sound level, 201 dB_{RMS}, and 186 dB SEL at 10 meters from the source.

[b] Distance to biological threshold assumes 150 pile strikes and 208 dB cumulative SEL at 10 meters from source.

[c] Calculation assumes that single pile strike SELs below 150 dB will not contribute to cumulative SEL.

[e] Surrounding geography limits the distance underwater noise can propagate to no more than 19,500 meters (12.12 miles) from the source.

Unattenuated sampling will not exceed 3 minutes total on the three piles that will be sampled on separate days. It is important to emphasis that this is a worst case scenario and that this extent of injurious noise will only occur during the two, 90-second baseline analysis periods for each of the three sample piles. Up to 25 strikes may occur during each 90-second period (six sample events times 25 strikes per sample equals 150 total unattenuated strikes).

Direct Effects on ESA-Listed Species

Broadly speaking, the effects of organism exposure to elevated underwater noise associated with pile driving can vary from no observable response, to behavioral alteration, to temporary impairment, to permanent injury, to delayed or immediate death, depending on the intensity and duration of stressor exposure. 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 (Fordjour 2003; Gaspin 1975; Hastings and Popper 2005; Abbott et al. 2005; Stadler, NMFS, pers. obs. 2002).

The assessment of effects on ESA-listed species is based on a summary of the available literature and the basis for existing biological effects thresholds, which are incorporated into the USFWS calculator for estimating distances to biological thresholds for bull trout and marbled murrelet (Appendix B).

Bull Trout

Coastal/Puget Sound bull trout are known to occur or are likely to occur within the calculated limits of potential behavioral level and injury level underwater noise effects resulting from the proposed action. Cumulative SEL from exposure to multiple pile strikes produces the largest potential area of behavioral and injury level effects. The calculated threshold

exposure distance for salmonids >2 grams is approximately 794 feet (242 meters) from the source. The threshold exposure distance for juvenile salmonids ≤2 grams is approximately 1,467 feet (447 meters) from the source.

All salmonid species including bull trout are likely to be exposed to underwater noise in excess of the behavioral effects threshold, which will extend throughout the aquatic component of the action area during unattenuated pile driving. During attenuated pile driving the extent of behavioral effects would be less, estimated at a distance of 5,412 meters (3.36 miles) for 36-inch piles, 858 meters for 24-inch piles, and 631 meters for 16-inch piles, assuming an attenuation device operating at a -10 dB effectiveness (see Appendix B). Attenuated pile driving represents the majority of impact pile driving activities.

Foraging adult and subadult bull trout are believed to have an affinity for nearshore marine habitats in Puget Sound (Goetz et al. 2004), typically remaining within 33 feet (10 meters) below MLLW (i.e., the depth of the photic zone) (75 FR 63898). This indicates the potential for exposure to underwater noise in excess of biological effects thresholds during migration through the action area en route to preferred foraging habitats. Potential exposure to injury and disturbance level noise effects is reduced by timing pile driving activities (July 16 through September 30) to correspond with the bull trout in-water work window (July 16 - October 14), when bull trout are least likely to be present in marine waters.

Marbled Murrelet

Murrelet exposure to underwater noise caused by impact pile driving has been clearly associated with adverse effects ranging from behavioral modification to direct injury and mortality. Pile driving noise in excess of biological effects thresholds can temporarily disrupt or displace foraging murrelets. Diving murrelets exposed to underwater noise in excess of injury thresholds are likely to experience direct harm and even mortality (USFWS 2003).

Based on the calculations presented in Appendix B, a murrelet approaching within approximately 79 feet (24 meters) of unattenuated pile driving would experience the onset of physical injury (i.e., exposure to noise levels in excess of 202 dB SEL injury threshold). Underwater noise exceeding behavioral effects threshold extends further than potential injury level effects. As with bull trout, murrelets within the aquatic component of the action area (extending up to 12.12 miles) may experience behavioral disturbance or alteration during unattenuated pile driving. The potential for effects will typically be less however, as unattenuated pile driving will be limited to brief 90-second increments over three separate days, totaling nine minutes. The remainder of impact pile driving activities (the significant majority) will be conducted using an approved sound attenuation device. Assuming that this device will achieve a minimum effectiveness of -10 dB, the distances within which behavioral effects would be expected are the same as described for bull trout, and included in Appendix B. Injury could occur within 24 meters (79 feet) of unattenuated pile driving activity. Attenuated pile driving is expected to result in smaller zones of potential injury, distances between 7 meters (23 feet) for 16-inch piles and 14 meters (46 feet) for 36-inch piles. Murrelet monitoring within the noise masking zone (168 meters) will include the full extent of the injury threshold distance (24 meters). This will reduce the potential for murrelets to be exposed to injury and behavioral effects associated with pile driving noise.

Direct and Indirect Effects on Designated Critical Habitat for Bull Trout

The proposed action will produce short-term underwater noise effects that alter the ambient noise environment and may potentially affect prey availability through effects on forage fish.

Ambient underwater noise conditions in the marine environment can be considered elements of the following bull trout critical habitat PCEs:

> "(ii) Migration habitats with minimal physical, biological, or water quality impediments between spawning, rearing, overwintering, and freshwater and marine foraging habitats...;
>
> (iii) An abundant food base including terrestrial organisms of riparian origin, aquatic macroinvertebrates, and forage fish; and
>
> (viii) Sufficient water quality and quantity such that normal reproduction, growth, and survival are not inhibited."

The proposed action will temporarily alter the ambient noise environment as described above for a period of approximately 40 days between July 16 and September 30. Noise levels in excess of biological effect thresholds will occur within approximately 12.12 miles of pile driving activities, although distance will generally be less (5,412 meters or less) due to noise attenuation during the majority of pile driving activity. These effects are considered to represent a temporary alteration of the rearing and foraging habitat suitability for bull trout. It is important to recognize however that these effects are short-term in nature and have limited overlap with habitat use by the species. Bull trout may experience exposure, as these species are likely to be present within the limits of potentially adverse noise effects. However, due to the limited duration and extent of the impacts, the effects are likely to be discountable for critical habitat over the long term.

Underwater noise impacts may also affect prey availability elements of critical habitat, but these effects are not likely to be significant. Specifically, juvenile and adult forage fish are likely to occur within the limits of potentially adverse underwater noise effects. Individuals occurring within the zone of significant noise impacts (the zone where injury thresholds are exceeded) between July 16 and September 30 are likely to experience underwater noise levels sufficient to cause injury alter behavior.

This could theoretically affect the availability of forage, which is an element of critical habitat for bull trout. However, effects on foraging opportunities are unlikely for several reasons. First, the area of potential injury level effects is small (447-meter radius or less) relative to the extent of open water habitats occupied by forage fish throughout the action area. Second, these effects will occur outside the respective fall and winter spawning seasons when the largest forage fish aggregations are most likely to occur in the vicinity. Finally, pelagic forage fish have evolved in the context of very high natural egg and larval mortality, commonly ranging from 95 to 99 percent or higher (Alaska Sea Grant 1991; Kawasaki et al. 1991; Penttila 2001; Rice 2006). In this context, even if every forage fish occurring within this 447-meter radius during impact pile driving experienced mortality, the resulting effect on the

prey availability components of bull trout would, in all likelihood, be unmeasurable relative to the range of natural variability across the range of critical habitat for the species.

Habitat Alteration

Extent: Net 26.9 square feet of benthic habitat gain due to removing existing piles
Net 2,680 square feet of water column and benthic habitat permanently shaded by new overwater structures

Duration: Permanent

The new ferry landing structures will result in a permanent net increase in overwater structures and water column shading of approximately 2,680 square feet. New steel piles supporting these and related mooring structures will permanently displace 120.6 square feet of benthic and water column habitat resulting in a net gain of 26.9 square feet of benthic habitat (120.6 square feet of new support piles, dolphins, and wingwalls, minus 147.5 square feet of existing piles removed). These impacts will occur within habitats that have already been modified by vessel moorage and related infrastructure.

Direct and Indirect Effects on ESA-Listed Species

The proposed action will result in a nominal increase in water column shading and habitat displacement caused by new overwater structures. However, because these new structures are located within the general footprint of existing ferry landing structures and idle ferry moorage, the effects of these permanent impacts on ESA-listed species will vary depending on the nature of their habitat use. Effects on marbled murrelets, and marine mammals are expected to be insignificant. In contrast, the habitat modification footprint significantly overlaps habitats used by bull-trout and Chinook salmon, and somewhat overlaps habitats used by rockfish. Therefore, effects on these species groups are discussed separately below.

Marbled Murrelet

All new overwater and in-water structures and ferry mooring will be located within the general footprint of existing ferry docking, loading, and idle mooring operations, and will not extend beyond the -35 foot bathymetric isopleth. Marine habitats used by marbled murrelet in Puget Sound are typically greater than 30 feet deep. Given that all new in-water structures are located at less than -30 feet MLLW, all changes in the ferry landing footprint will be located within -35 feet MLLW, and the existing level of vessel activity currently discourages habitat use in the vicinity, the permanent habitat alterations resulting from the proposed action are unlikely to significantly affect the quantity and quality of habitats available for this species.

Bull Trout

The information presented in this section is derived from a summary analysis of overwater structure impacts developed to support ESA-consultations for Washington State Ferries projects (WSDOT 2009b). The environmental modifications and ecological effects of the proposed action are similar to those addressed in this existing consultation document.

The proposed action will increase the amount of water column shading by overwater structures shoreward of the -35 foot bathymetric isopleth. Summarizing the available literature, Nightengale and Simenstad (2001) concluded that overwater structures have the potential to affect juvenile salmonids through changes in epibenthic prey availability, increased predation, and disruption of migration patterns. These effect pathways have been studied to varying degrees but these studies have not yielded conclusive results as to the extent of actual adverse effects. These effects are expected to apply to bull trout migrating and foraging in nearshore habitats.

Migratory Disruption

Recent studies and compilations of available research have concluded that the movement of juvenile salmonids in shallow water habitats is affected by sharp shadows and dark/light interfaces cast by overwater structures (Celedonia et al. 2008a, 2008b, 2009; Nightengale and Simenstad 2001; NMFS 2004; USFWS 2004; Southard et al. 2006). Under varying circumstances juvenile salmonids may alter or delay movement along marine shorelines when they encounter the shadow cast by overwater structures. For example, juveniles may migrate around the structure by following the shadow line at the edge of the piers rather than passing under it, or they may loiter at the edge of the pier for an extended period before passing underneath.

A study conducted by Pacific Northwest National Laboratory (PNNL) at 10 WSF ferry terminals (Southard et al. 2006) found that the shadows cast by the overwater structures appear to impede juvenile salmonid movement during specific times of day (depending on light level, sun angle, and cloud cover) or under specific environmental conditions (depending on current magnitude and direction, and tidal stage). However, another study conducted by PNNL at the existing Mukilteo Ferry Terminal found that salmon fry moved freely under the relatively narrow, shaded portion of the terminal in areas where mean light levels in water were reduced by over 97 percent (Williams et al. 2003). Celedonia et al. (2008a, 2008b, 2009) studied the movements of juvenile Chinook salmon under and around floating and elevated bridge structures in a freshwater lake and found that some individuals delayed migrating under the structure while others appeared to pass unimpeded. A proportion of out-migrant smolts loitered around the bridge structure for an extended period, behavior that was tentatively associated with the rate of residualism (i.e., overwintering in freshwater rearing habitats rather than migrating to marine habitats).

The implications of altered or delayed migration may include increased energy expenditure, missed feeding opportunities, and increased predation exposure (see below), which can in turn lead to reduced survival and fitness (Nightingale and Simenstad 2001). However, the proposed action is not expected to significantly increase migratory delay effects because the shading effects of the new overwater structures will occur within the limits of the existing facility and within the footprint of shading impacts from existing overwater structures and ferry mooring sites.

Increased Predation Exposure

Studies have suggested that migrating salmonids may not pass under an overwater structure and may be forced to move farther offshore where they may become more susceptible to

predation from birds, mammals, and fish. However, the evidence indicating that overwater structures contribute to increased predation on juvenile salmonids is equivocal.

Williams et al. (2003) conducted bird/mammal surveys at six north-central Puget Sound WSF terminals and paired reference sites between April 1 and May 10, 2002. In addition, intensive surveys for potential predators of juvenile salmonids were conducted at the Mukilteo Ferry Terminal and reference sites in May 2002. The studies included SCUBA transects (benthic predatory fishes), snorkel transects (pelagic fishes), bird and marine mammal predatory surveys, salmon fry abundance surveys, documentation of nearshore fish assemblages during all diel phases using boat-deployed beach seines, collection of live potential fish predators and stomach content analysis, documentation of light measurements, and the use of Dual-frequency Identification Sonar (DIDSON) to document potential predators associated with the water column and terminals at night. They found no conclusive evidence that predation by avian, marine mammal, or other fish on juvenile salmonids increased in the vicinity of WSF terminals located on unmodified shorelines during the study period. In contrast, Celedonia et al. (2009) found that juvenile Chinook salmon were attracted to artificial light cast from the overwater structures and speculated that this could lead to increased predation. While direct evidence of this effect was lacking, the potential is apparent based on reported observations of increased predation effects resulting from artificial lighting in many different environments (Celedonia et al. 2009).

The body of available research on the effects of overwater structure related to predation on juvenile salmonids that use nearshore habitats is inconclusive. However, given the fact that the net change in in-water and overwater structure area that would result from the action are relatively small, and these changes would lie within the existing footprint of the ferry landing, the effects on bull trout migration through the action area are unlikely to be significant.

Epibenthic Prey Availability

A research report by Haas et al. (2002) studied the relationship between the large overwater structures associated with ferry terminals and abundance of epibenthic prey species. Although results were variable, the differences in epibenthic assemblages indicated negative effects from the terminals. The results demonstrated that significant differences in epibenthic assemblages do exist around the ferry terminals. Adjusted in-water photosynthetically active radiation (PAR) was generally close to zero under the existing structure at Bainbridge Island. Substrate composition for all three terminals studied (Bainbridge Island, Clinton, and Southworth) was noticeably different around the terminal structures, with higher gravel, shell, and cobble proportions as compared to sand, the dominant component. This was attributed to a combination of sea star foraging on pilings and substrates and the decomposition of shells from large numbers of bivalves in the sediments under and near the terminals. The Haas et al. (2002) study suggested that propeller wash may contribute to differences in epibenthic productivity at Bainbridge Island.

The Haas et al. (2002) study concluded that ferry terminal structures induce decreases or changes in epibenthos density, diversity, and assemblage composition, but attributed it to a combination of four interacting factors rather than to overwater coverage alone:

1. Direct disturbance and/or removal by regular vessel disturbance
2. Reduced benthic vegetation or compromised benthic vegetation function due to shading and physical disturbance
3. Physical habitat alterations (e.g., altered grain-size distribution from propeller wash or piling effects)
4. Biological habitat alterations (e.g., increased shell hash from sea star foraging and reduced eelgrass density due to benthic macrofauna disturbance)

Given that the proposed action will result in a modest increase in overwater structure area and no meaningful changes in ferry operations, the proposed action is unlikely to significantly alter habitat conditions and epibenthic prey availability relative to the existing conditions present on the site (see Appendix E).

Direct and Indirect Effects on Designated Critical Habitat for Bull Trout

The identified habitat effects will occur within the limits of the bull trout critical habitat corridor along the east shoreline of Puget Sound between MHHW and -33 feet MLLW. Changes in in-water and overwater structure area will alter the following PCEs of designated critical habitat for C-PS bull trout:

> "(ii) Migration habitats with minimal physical, biological, or water quality impediments between spawning, rearing, overwintering, and freshwater and marine foraging habitats...;
>
> (iii) An abundant food base including terrestrial organisms of riparian origin, aquatic macroinvertebrates, and forage fish; and
>
> (iv) Complex river, stream, lake, reservoir, and marine shoreline aquatic environments, and processes that establish and maintain these aquatic environments, with features such as large wood, side channels, pools, undercut banks and unembedded substrates, to provide a variety of depths, gradients, velocities and structure."

The habitat alteration effects described above are representative of the nature and extent of the anticipated effects on designated critical habitat for bull trout.

Cumulative Effects

The cumulative effects analysis considers the effects of the action in the context of all future state and private actions that are reasonably certain to occur within the action area. Actions that are reasonably certain to occur are those actions that are permitted, in the permit application process or are currently being discussed and planned out at the local jurisdiction level. While the action area covered by the proposed action is quite broad, little of this area is subject to actions that will not require federal permitting. Specifically, the terrestrial component of the action area covers approximately 47 acre area that encompasses a segment of Burlington Northern rail line, and municipal and private lands within the City of

Steilacoom. The vast aquatic component of the action area is limited to subtidal lands only, which covers the marine waters and subtidal lands owned and administered by the State of Washington.

The terrestrial component of the action area is currently fully developed. The only significant non-federal actions likely to occur in the future are possible redevelopment projects within the City of Steilacoom. Much of the existing development occurred prior to the advent of modern stormwater treatment standards, meaning that the majority of this untreated stormwater currently drains directly to surface waters of Puget Sound. Future redevelopment actions will comply with improved stormwater detention and treatment standards, meaning that incremental improvements in stormwater quality are likely to occur.

The aquatic component of the action area could be subject to an array of non-federal actions in the foreseeable future. These include, but are not limited to:

- Issuance of new or revoking of existing aquatic lands leases by the State of Washington
- Implementation of shoreline habitat restoration projects in conjunction with regional salmon recovery plans
- Changes to state and tribal fisheries management plans

The most significant effects resulting from the proposed action are temporary and short-term in nature. The permanent habitat effects of the action are limited in scale to within the existing footprint of the Steilacoom Ferry Landing. The proposed action will not significantly change the operation of the two marine transport systems that use this facility, nor will it lead, directly or indirectly, to any other changes in the management or development of upland, shoreline, or subtidal lands. In this context, the addition of the proposed action to the environment would not expected to measurably alter the combined cumulative effects of future non-federal actions on the conservation of ESA-listed species and the conservation value of designated critical habitats.

Conclusions and Effect Determinations

The proposed expansion of the Steilacoom Ferry Landing will produce a range of short-term direct effects and long-term direct and indirect effects on adjacent and offshore habitats in Puget Sound. Specific direct and indirect effects are of sufficient extent and/or intensity to adversely affect ESA-listed species and designated critical habitat. This section provides summary conclusions regarding the effects of the action for each of these species and designated critical habitat, and an effect determination based on these conclusions. The conclusions and effect determinations presented here are based on the occurrence of ESA-listed species in the action area, the likelihood of exposure to stressors resulting from the direct and indirect effects of the action, the anticipated effects of exposure on survival and fitness, and any long-term changes in habitat suitability produced by the action.

Coastal-Puget Sound Bull Trout

The proposed action ***may affect*** C-PS bull trout because:

- The action area encompasses migratory and foraging habitats used by subadult and adult C-PS bull trout.
- The project footprint overlaps habitats likely to be used by subadult and adult bull trout during migration between marine foraging and freshwater spawning and rearing habitats.
- Subadult and adult bull trout may occur in the action area during pile driving activities between July 16 and September 30.

The proposed action is ***likely to adversely affect*** C-PS bull trout because:

- Sub-adult and adult bull trout are likely to be exposed to elevated underwater SPLs associated with impact pile driving in excess of the 150 dB_{RMS} behavioral effect and 183 dB cumulative SEL injury effect thresholds.
- Ferry landing expansion will increase overwater structure shading of the water column within the nearshore migratory corridor.

Other short-term construction effects resulting from the proposed action, including temporary turbidity effects, are expected to be insignificant.

The proposed action ***may affect*** and ***is likely to adversely affect*** designated critical habitat for C-PS bull trout because:

- The proposed action will temporarily alter the ambient noise environment within the action area, which could temporarily alter the availability of forage fish prey (PCE 3).

- The proposed action will result in a net 2,680 square foot increase in water column area shaded by overwater structures within the marine critical habitat migratory component of designated critical habitat between high water and -33 feet MLLW. This will potentially reduce the suitability of the habitat for migration between foraging and spawning areas (PCE 2), alter foodbase (PCE 3), or alter the habitats structure and processes important to bull trout (PCE 4).

Although these constitute measurable adverse effects, as identified for Puget Sound Chinook and other salmon in the biological opinion prepared by NMFS (2012), these habitat effects do not constitute an adverse modification of critical habitat for C-PS bull trout. The expanded ferry terminal structure will permanently increase nearshore shading an additional 2,680 square feet from the existing 34,109 square feet. The additional shading is insignificant in area of Puget Sound that has few nearshore anthropomorphic structures (three piers, one railroad trestle, and one marina) in the 12 miles between the Nisqually River delta and the Tacoma Narrows Bridge (NMFS 2012). The underwater noise impacts are temporary by definition and will be relatively short-term in duration. While the habitat conversion effects are permanent, they will take place within the footprint of existing infrastructure and operations at the Steilacoom Ferry Landing, and they will not significantly modify the suitability of underlying or adjacent habitats for use as migratory corridors or for foraging.

Marbled Murrelet

The proposed action ***may affect*** marbled murrelets because:

- Murrelets are likely to be present in the action area during the in-water work window.
- Murrelets could be in the project vicinity during the in-water work window.

The proposed action is ***likely to adversely affect*** marbled murrelets because:

- Murrelets could potentially be exposed to in-air and underwater noise in excess of behavioral effects thresholds including masking distance thresholds during impact pile driving.
- Murrelets could potentially be exposed to underwater noise in excess of the 202 dB SEL injury level effects threshold during limited unattenuated impact pile driving.

The marbled murrelet monitoring plan (Appendix A) is expected to render the likelihood of murrelet exposure to injury level noise effects discountable during attenuated pile driving. These impacts will be limited to within a radius of approximately 14 meters (46 feet) or less. Injury level noise effects could extend underwater as far as 24 meters (79 feet) during limited unattenuated pile driving. Behavioral effects associated with noise masking that can interfere with communication between foraging murrelets could extend up to 168 meters (551 feet) during installation of four 36-inch diameter dolphin piles, but will generally be limited to within 42 meters (138 feet) during installation of piles smaller than 36 inches diameter. The likelihood of murrelets entering the perimeters associated with these impacts undetected with the monitoring plan in effect is considered remote.

Noise levels exceeding the behavioral effects threshold of 150 dB_{RMS} will occur throughout the action area during unattenuated pile driving. However, the duration of unattenuating pile driving and the potential for effects to extend this far are limited to brief 90-second intervals (total of 9 minutes) over a 3-day period, limiting the potential for significant behavioral effects. The majority of pile driving will result in potential behavioral effects in a smaller zone, up to 5,412 meters (3.36 miles) during attenuated pile driving for the four 36-inch piles, indicating at least some potential for behavioral affects or injury level exposure.

Murrelets are unlikely to be exposed to the non-noise related effects of the proposed action. All construction related disturbance, short-term water quality effects, and new infrastructure will occur within the limits of the existing perimeter of the ferry landing and landward of the -30 foot MLLW mark. This marks the typical minimum depth limit of areas used during marine foraging. Further, the area is currently subject to routine vessel traffic likely to discourage habitat use. These factors indicate that murrelet use of the marine habitats within the limit of probable construction disturbance and permanent habitat modification is unlikely.

The proposed action is also unlikely to measurably affect the availability of forage for murrelets. Documented and potential forage fish spawning habitat lies outside the outer boundary of potential injury level noise effects. Moreover, the water column area within which injury level effects are likely to occur represents an insignificant fraction of the suitable habitat area for marine forage species. This suggests that even in the event that forage fish within the 447-meter cumulative SEL injury threshold distance suffered 100 percent mortality, the net effect on forage fish abundance in the action area would be insignificant in comparison to the range of natural variability.

Western Yellow-billed Cuckoo

The proposed action ***may affect*** Western yellow-billed cuckoo because:

- Individuals could enter the action area during project activities.
- Individuals could be exposed to elevated noise levels that could result in behavioral or injury level effects.

The proposed action is ***not likely to adversely affect*** yellow-billed cuckoo because:

- The action area does not contain preferred habitat or significant suitable habitat that would likely be used by yellow-billed cuckoo.
- Individuals are unlikely to be present in the action area due to the developed nature and absence of suitable habitat.
- The duration of significant noise impacts (pile driving) will be limited to 12-hour days for a duration of up to 40 days.
- The potential for exposure is discountable due to the lack of habitat, limited geographic extent and duration of significant noise impacts, and subsequent unlikely potential for individuals to be present within the area of significant noise impacts during project activity.

Although there is limited potential for yellow-billed cuckoo to enter the action area during project activities, their presence would be limited to brief occurrences during their southbound migration. The potential for adverse effects is discountable because the area of significant noise impacts (i.e., noise levels that would result in "take") is small compared to the area that would potentially be used as a migration route, and does not contain suitable habitat for the species. The unlikely potential for presence, limited duration that an individual would be present if it did enter the vicinity, and limited duration of significant noise impacts (impact pile driving) reduce the potential for exposure and adverse effects.

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APPENDIX A

Hydroacoustic and Marbled Murrelet Monitoring Plans

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Hydroacoustic Monitoring Plan

Hydroacoustic Monitoring Plan

The hydroacoustic monitoring plan for the Steilacoom Ferry Landing Improvement project was derived from an existing monitoring plan prepared by the Washington State Department of Transportation (WSDOT) for the Manette Bridge Replacement project (NMFS 2009, Appendix B). The Manette Bridge plan diverged from the existing hydroacoustic monitoring plan template developed by the Fisheries Hydroacoustic Work Group (FHWG 2008) and used by WSDOT due to a change in requirements imposed by USFWS based on increased understanding of the potential population level impacts of unattenuated pile driving on marbled murrelets. This plan varies from the FHWG guidance accordingly.

Hydroacoustic monitoring will be conducted during construction of the proposed action when impact pile driving activities occur in order establish the intensity and extent of underwater noise effects, monitor these effects relative to proscribed take limits, and to confirm the effectiveness of proposed noise attenuation measures used during construction. The proposed action includes a number of steel piles ranging from 16 to 24 inches in diameter installed in water depths ranging between -10 and -35 feet MLLW.

Baseline noise levels and attenuation system performance will be monitored during impact hammer operation for the first two piles installed in each size category.

Monitoring parameters for each pile will include

- Measurement of ambient underwater noise levels
- Measurement of pile driving noise with the attenuation system in place and operational during the first 30 pile strikes, 30 pile strikes approximately mid-way through installation, and 30 pile strikes near the end of installation

Methodology

Ambient underwater noise levels will be measured for a minimum of 1 minute in the absence of construction activities to determine background sound levels. Ambient sound levels will be reported as Root Mean Square (RMS) and include a spectral analysis of the frequencies.

Pile driving will be conducted only with the proposed attenuation system in full operation. A total of up to six piles will be monitored, two in each size category, to determine the attenuated noise levels produced during impact hammer installation. Monitoring equipment and specifications used to monitor underwater sound pressure levels are detailed in Table A-1.

Monitoring equipment will be set to a minimum frequency range of DC to 10 KHz and a sampling rate of 24,000 Hz. To facilitate further analysis of data the underwater signal will be recorded as a text file (*.txt).

Table A-1. Equipment for Underwater Sound Monitoring (Hydrophone, Signal Amplifier, and Calibrator).[1]			
Item	**Specifications**	**Quantity**	**Usage**
Hydrophone with 200 feet of cable	Receiving Sensitivity- 211dB ±3dB re 1V/μPa	1	Capture underwater sound pressures and convert to voltages that can be recorded/analyzed by other equipment.
Signal Conditioning Amplifier (4-channel)	Amplifier Gain- 0.1 mV/pC to 10 V/pC Transducer Sensitivity Range- 10-12 to 103 C/MU	1	Adjust signals from hydrophone to levels compatible with recording equipment.
Calibrator (pistonphone-type)	Accuracy- IEC 942 (1988) Class 1	1	Calibration check of hydrophone in the field.
Portable Dynamic Signal Analyzer (4-channel)	Sampling Rate- 24K Hz or greater	1	Analyzes and transfers digital data to laptop hard drive.
Microphone (free field type)	Range- 30 – 120 dBA Sensitivity- -29 dB ± 3 dB (0 dB = 1 V/Pa)	1	Monitoring airborne sounds from pile driving activities (if not raining).
Laptop computer	Compatible with digital analyzer	1	Record digital data on hard drive and signal analysis.
Real Time and Post-analysis software	-	1	Monitor real-time signal and post-analysis of sound signals.
Weighted nylon line marked in 5-foot increments to attach hydrophone	-	1	Takes the strain off of the hydrophone cables preventing damage.
Various surface floats	-	-	To keep the hydrophone at the appropriate depth in relation to the surface.

One hydrophone will be placed at mid water depth at distance of 10 meters from each pile being monitored. A weighted tape measure will be used to determine the depth of the water. The hydrophone will be attached to a nylon cord or a steel chain if the current is swift enough to cause strumming of the line. The nylon cord or chain will be attached to an anchor that will keep the line 10 meters from the pile. The nylon cord or chain will be attached to a float or tied to a static line at the surface 10 meters from the pile. The distance will be measured

[1] Any equipment used for monitoring purposes will have current National Institute of Standards and Technology (NIST) traceable calibration. If acoustic monitoring is conducted by a contractor specialized in hydroacoustic monitoring and not conducted directly by Pierce County, the contractor will submit a detailed equipment list for underwater sound pressure level monitoring for approval by an acoustic specialist approved by Pierce County.

by a tape measure, where possible, or a range finder. There should be a direct line of sight between the pile and the hydrophone in all cases.

The hydrophone calibration will be checked at the beginning of each day of monitoring activity. Prior to the initiation of pile driving, the hydrophone will be placed at the appropriate distance and depth as described above.

Ambient underwater sound levels will be measured for 1 to 2 minutes prior to initiation of pile driving as well as in the absence of construction activities. It will be necessary to have the inspector/contractor inform the acoustics specialist when pile driving is about to start because the monitoring equipment will need to be shut down between recordings to change batteries or conserve battery power.

Underwater sound levels will be continuously monitored during the entire duration of each pile being driven. Peak levels of each strike will be monitored in real time. Sound levels will be measured in Pascals which are easily converted to decibel (dB) units (e.g. 1000 Pascals = 180 dB).

Prior to and during the pile driving activity environmental data will be gathered such as wind speed and direction, air temperature, humidity, surface water temperature, water depth, wave height, weather conditions, and other factors that could contribute to influencing the underwater sound levels (e.g., aircraft, boats, etc.). Start and stop time of each pile-driving event and the time at which the bubble curtain or functional equivalent is turned on and off will be recorded.

The chief construction manager will supply the acoustics specialist with the substrate composition, hammer model and size, hammer energy settings and any changes to those settings during the piles being monitored, depth pile driven, total number of pile strikes, and blows per foot for the piles monitored.

Signal Processing

Post-analysis of the sound level signals will include determination of absolute peak overpressure and underpressure levels recorded for each pile, Root Mean Square (RMS) value for each absolute peak pile strike, rise time, average duration of each pile strike, number of strikes per pile, percent of strikes exceeding 206 dB_{peak}, percent of strikes exceeding 150 dB_{rms}, Sound Exposure Level (SEL) of the absolute peak pile strike, mean SEL, and cumulative SEL (Accumulated SEL = single strike SEL + 10*log*number of hammer strikes) and a frequency spectrum, between 0 and 10,000 Hz for up to eight successive strikes with similar sound levels.

Analysis

Analysis of the data from the San Francisco-Oakland Bay Bridge Pile Driving Demonstration project (PIDP) indicated that 90 percent of the acoustic energy for most pile driving impulses occurred over a 50 to 100 milliseconds period with most of the energy concentrated in the first 30 to 50 milliseconds. The RMS values computed for this project will be computed over the duration between where 5 percent and 95 percent of the energy of the pulse occurs. Cumulative energy levels and Sound Exposure Levels (SEL) will be calculated from data

between 5 percent and 95 percent of the energy of the pulse. The cumulative SEL energy plot will assist in interpretation of the single strike waveform.

In addition, a waveform analysis of the individual absolute peak pile strikes will be performed to determine any changes to the waveform with the bubble curtain or functional equivalent attenuation device. Units of underwater sound levels will be dB re: 1 micropascal.

Reporting

A draft report including data collected and summarized from all phases will be submitted to the Services within 120 days of the completion of hydroacoustic monitoring. The results will be summarized in graphical form and include summary statistics and time histories of impact sound values for each pile. A final report will be prepared and submitted to the Services within 30 days following receipt of comments on the draft report from the Services. The report shall include:

1. Size and type of piles
2. A detailed description of the bubble curtain or functional equivalent, including design specifications
3. The impact hammer force used to drive the piles
4. A description of the monitoring equipment
5. The distance between hydrophone and pile
6. The depth of the hydrophone
7. The distance from the pile to the wetted perimeter
8. The depth of water in which the pile was driven
9. The depth into the substrate that the pile was driven
10. The physical characteristics of the bottom substrate into which the piles were driven
11. The total number of pile strikes
12. The ranges and means for peak, RMS, and SELs for each pile
13. The results of the hydroacoustic monitoring, including the frequency spectrum, peak and RMS SPL's, and single-strike and cumulative SEL with the attenuation system
14. A description of any observable fish or bird behavior in the immediate area and, if possible, correlation to underwater sound levels occurring at that time.

Marbled Murrelet Monitoring Plan

Marbled murrelet monitoring will be conducted in accordance with the US Fish and Wildlife Service - Washington Fish and Wildlife Office Protocol for Marbled Murrelet Monitoring During

Pile Driving, included in this appendix, and according to the terms and conditions in the final biological opinion prepared by USFWS.

Application of this protocol is required as specified through the Endangered Species Act consultation process for individual projects. This protocol applies to monitoring associated with in-water impact pile driving. It does not apply to monitoring that may be necessary for vibratory pile driving, pile removal, or out-of-water pile driving. Additional monitoring requirements such as notification of monitoring activities to Pierce County's chief construction manager, or WSDOT or FHWA points of contact, may be included in the final monitoring plan. Any modifications to the protocol will be coordinated between Pierce County, the FHWA, and the Washington Fish and Wildlife Office.

The monitoring area is shown in Figure A-1. The monitoring area was determined based on the 168-meter noise masking zone for 36-inch piles and includes the calculated area of potential injurious effects described in the Biological Assessment. Monitoring will be conducted from the beach, barges, and existing structures. Specific locations will depend on the location and orientation of barges and other equipment, but will provide good visual coverage of the monitoring area. Due to limitations that could result from construction activity and/or other site specific variables, the monitoring locations may be refined in the field. In that case, final monitoring locations will be noted on an aerial photo or plan sheet, and documented in the final monitoring report. Each land-based observer can cover a 180° arc over a 50 meter area. Each boat observer can cover a 50 meter transect on one side of the boat.

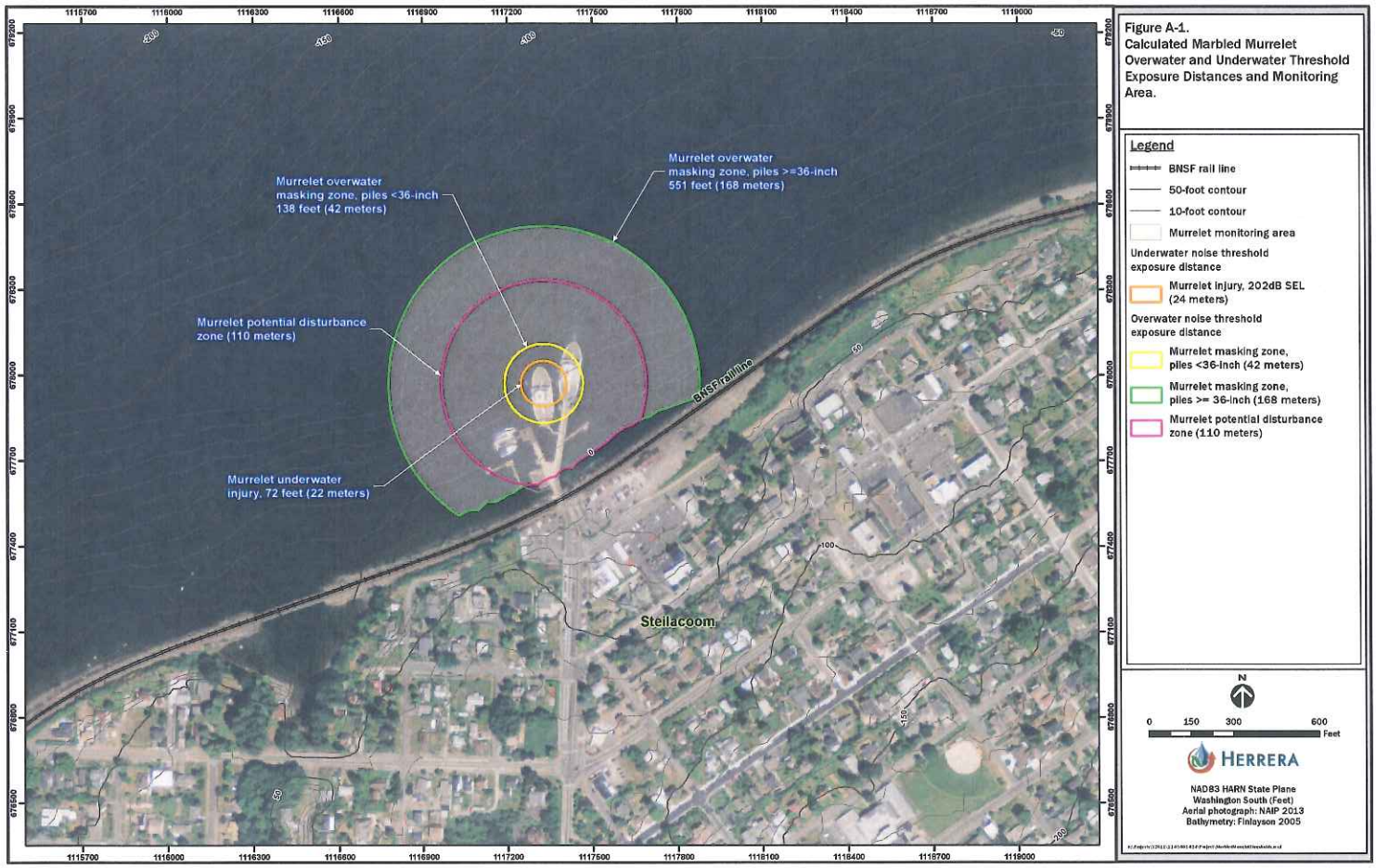


Figure A-1.
Calculated Marbled Murrelet Overwater and Underwater Threshold Exposure Distances and Monitoring Area.

U.S. Fish and Wildlife Service – Washington Fish and Wildlife Office
Protocol for Marbled Murrelet Monitoring During Pile Driving (Revised 8/13/2012)

1.0 Objective

The intent of the monitoring protocol is to:

1. Comply with the requirements of the Endangered Species Act Section 7 consultation.
2. Detect all marbled murrelets (*Brachyramphus marmoratus*) (murrelets) within the monitoring area.
3. To minimize take of murrelets from both exposure to potentially injurious underwater sound pressure levels, and from the masking effects of in-air sound by communicating immediately with the pile driver operator.
4. Track incidental take exempted through the Incidental Take Statement found in the final Biological Opinion for the project so that the Lead Federal Action Agency will know when take occurs and/or when take exemptions might be exceeded.

2.0 Adaptive Approach

The individuals that implement this protocol will assess its effectiveness during implementation. They will use their best professional judgment throughout implementation and will seek improvements to these methods when deemed appropriate. Any modifications to this protocol will be coordinated between the Lead Federal Action Agency and the Washington Fish and Wildlife Office.

3.0 Monitoring

3.1 Activities to be Monitored

Application of this protocol is required as specified through the Endangered Species Act consultation process for individual projects. It may apply projects that involve either in-water impact pile driving when injurious sound pressure levels are expected and to projects that involve either vibratory or impact pile driving when in-air sounds are expected to cause masking effects.

3.2 Equipment

- Binoculars - quality 8 or 10 power
- Spotting scopes
- Two-way radios with earpieces
- Range finder
- Log books

- Seabird identification guide
- Life vest or other personal flotation device for observers in boats
- Cellular phone to contact Lead Federal Action Agency, the Construction Contractor, or WFWO.

3.3 Monitoring Locations

The spacing and placement of monitoring locations must be designed to provide adequate coverage of the entire monitoring area. Locations are determined ahead of time and are identified on the Seabird Monitoring Site/Transect Identification Form. The monitoring design should allow for the entire monitoring area to be fully surveyed within five minutes.

Each land-based observer can cover a 180° arc over a 50 m area. Each boat observer can cover a 50 m transect on one side of the boat. Using the *Seabird Monitoring Site/Transects Identification Form*, insert an aerial photo of the project site and outline each boat transect or land-based monitoring site. Identify on the aerial photo where each of the two types of monitoring (boat transects and land-based sites) will occur (See Example Dolphin Repair). Construction activity and/or other site specific variables (i.e., topography, pier or barge placement, etc.) can limit visibility. These should be identified on the aerial photo when known ahead of time. If conditions change on-site (e.g., a barge moves into the monitoring zone), monitoring locations can be refined in the field. In that case, note final monitoring locations on an aerial photo or plan sheet, and document the changes in the final monitoring report.

For each land-based monitoring site, draw the shoreline on the *Seabird Land-Based Monitoring Site Form*. Include on-site information such as structures that could be used by seabirds, or fishing piers, which may draw in feeding birds (i.e. gulls). The gridwork will allow the observer to quickly fill in location identifiers during monitoring.

3.4 Monitoring Techniques

One qualified biologist shall be identified as the Lead Biologist. The Lead Biologist has the authority to stop pile driving when murrelets are detected in the monitoring area or when visibility impairs monitoring. The Lead Biologist is responsible for:

- Ensuring consistency with the criteria in the consultation;
- Communicating with monitoring crew(s), the pile driver operator, and the WFWO; and
- Determining monitoring start and end times.

An appropriate number of qualified observers will be positioned on shore and in boats to provide adequate coverage of the monitoring area to ensure no murrelets are in the monitoring area. Monitoring will begin at least 30 minutes prior to commencement of pile driving. Each qualified observer will cover an on shore station or boat transect that is no more than 50 m wide. All observers are responsible for:

- Understanding the requirements in the consultation and monitoring plan;
- Knowing the lines and method of communicating with the Lead Biologist and

boat operator (if an observer on the boat);

- Evaluating the sea conditions and visibility;
- Calibrating their ability to determine a 50 m distance at the beginning of each day. Calibration should be done using a range finder on a stationary object on the water; and
- Determining when conditions for monitoring are not met.

Monitoring will only occur when the sea state is at a Beaufort scale of 2 or less. The Beaufort scale is presented in Table 1 below. Observers should scan without a scope or binoculars; scopes and binoculars should only be used to verify species.

Observers will be positioned at land-based vantage points to scan for murrelets within the monitoring zone. The land-based vantage points must have an unobstructed view of the monitoring zone at all times. Each land-based observer can cover a 50 m area with a 180° arc. At least 2 full sweeps of the monitoring zone shall be conducted prior to pile driving to ensure that no murrelets are in the monitoring zone. Each boat observer is responsible for scanning from 0° (straight ahead of bow) to 90° left or right, depending upon which side of the boat they occupy. Observers should occasionally scan past 90°, looking for murrelets that may have surfaced behind the boat. Boat speed should be no less than 5 knots and no greater than 10 knots. Observer coverage should not be compromised; therefore, observer's ability to scan dictates the speed of the boat. Boat operators will not function as murrelet monitors while operating the boat.

If no murrelets are within the monitoring zone, the observers will notify the Lead Biologist who will communicate to the pile driver operator that pile driving may commence. During pile driving the observers on shore will continue scanning the area for murrelets. The observers in the boats will patrol and scan the monitoring area. All observers will have two-way radios with earpieces to allow for effective communication during pile driving. If murrelets are seen within the monitoring zone during pile driving, the observers will immediately notify the Lead Biologist who will communicate to the pile driver operator that he/she is to cease pile driving. Pile driving will not resume until the murrelets have left the monitoring area and at least 2 full sweeps of the monitoring area have confirmed murrelets are not present.

When a murrelet is detected within the monitoring area, it will be continuously observed until it leaves the monitoring area. If observers lose sight of the murrelet, searches for the murrelet will continue for at least 5 minutes. If the murrelet is still not found, then at least 2 full sweeps of the monitoring area to confirm no murrelets are present will be conducted prior to resumption of pile driving.

It is the observer's responsibility to determine if he/she is not able to see murrelets and inform the Lead Biologist that the monitoring needs to be terminated until conditions allow for accurate monitoring.

Murrelets are especially vulnerable to disturbance when they are molting and flightless. Molting occurs after nesting in late summer, typically July through October in Puget Sound populations. Extra precaution should be exercised during this period.

Table 1 – Beaufort Wind Scale develop in 1805 by Sir Francis Beaufort of England (0=calm to 12=hurricane)

Force	Wind (knots)	Classification	Appearance of wind effects on the water	Appearance of wind effects on land	Notes specific to on-water seabird observations
0	<1	Calm	Sea surface smooth and mirror like	Calm, smoke rises vertically	Excellent conditions, no wind, small or very smooth swell. You have the impression you could see anything.
1	1-3	Light air	Scaly ripples, no foam crests	Smoke drift indicates wind direction, still wind vanes	Very good conditions, surface could be glassy (Beaufort 0), but with some lumpy swell or reflection from forests, glare, etc.
2	4-6	Light breeze	Small wavelets, crests glassy, no breaking	Wind felt on face, leaves rustle, vanes begin to move	Good conditions, no whitecaps, texture/lighting contrast of water make murrelets hard to see. Surface could also be glassy or have small ripples, but with a short, lumpy swell, thick fog, etc.
3	7-10	Gentle breeze	Large wavelets, crests beginning to break, scattered whitecaps	Leaves and small twigs constantly moving, light flags extended	Surveys cease, scattered whitecaps present, detection of murrelets definitely compromised, a hit-or-miss chance of seeing them owing to water choppiness and high contrast. This could also occur at lesser wind with a very short wavelength, choppy swell.
4	11-16	Moderate breeze	Small waves 0.3 to 1.1m becoming longer, numerous whitecaps	Dust, leaves, and loose paper lifted, small tree branches move	Whitecaps abundant, sea chop bouncing the boat around, etc.
5	17-21	Fresh breeze	Moderate waves 1.1 to 2.0 m taking longer form, many whitecaps, some spray	Small trees begin to sway	

3.5 Limitations

No monitoring will be conducted during inclement weather that creates potentially hazardous conditions as determined by the Lead Biologist. Observers must have visibility to at least 50 meters. No monitoring will be conducted when visibility is significantly limited such as during heavy rain, fog, glare or in a Beaufort sea state greater than 2.

Glare can significantly limit an observer's ability to detect birds. Boat orientation may be adjusted to reduce glare (e.g. change direction or reduce width of transects to 50 meters with observers on only one side of boat). However, if visibility cannot be adjusted, monitoring and pile driving must cease until effective monitoring can be conducted.

Monitoring will not start until after sunrise and will cease prior to sunset. Specific timing restrictions may be in place per the consultation documents.

3.6 Documentation

The observers will document the number and general location of all murrelets in the monitoring area. Additional information on other seabirds and behaviors will be collected during documentation to improve general data knowledge on seabird presence and distribution as well as project impacts on various seabirds. Each observer will record information using the *Seabird Monitoring Data Collection Form* and reference completed *Seabird Monitoring Site/Transects Identification* and *Seabird Land-Based Monitoring Site Forms*. Forms are included in the Appendix.

Data Collection

All murrelets within transects or monitoring sites will be continuously documented during impacting activities. On the *Seabird Monitoring Data Collection Form*, document the time, number of birds, location, and observed behavior (See Example Dolphin Repair). Update the documentation when a murrelet changes behavior, changes location, or leaves the area. To the extent possible, the observers will also record each murrelet "take" incident observed, as defined in the final Biological Opinion. This may include obvious disturbance responses from pile driving or other construction activities, and injury or mortality that can be attributed to project-related activities.

Observers will also note all seabirds within the area that appear to be acting abnormally during any project activities. For example, if a seabird is listing, paddling in circles, shaking head, or suddenly flushing at the onset of activity, note the information on the *Seabird Monitoring Data Collection Form.* For all birds except murrelets, providing a genus level (grebe, loon, cormorant, scoter, gull, etc) of identification is sufficient.

General information on other seabird behavior and distribution within the monitoring area will be collected. Every two hours at minimum during pile driving activities, the observer will document other seabird presence, behavior, and distribution in the monitoring area. This information can be collected more frequently. Many seabirds may linger in an area for several hours. If this is the case, note the time, species, and in the

comments section identify that this is the same group from earlier and document any notable changes in behavior.

Under location, the data form indicates two separate options for documenting location. Land-based observers can fill out the land-based only or both land-based and boat sections. The land-based location will be based on the grid drawn out on the *Seabird Land-Based Monitoring Site Form* (See Example Dolphin Repair). For the boat transect locations, identify the distance in meters from the boat to the seabird and whether it is landward (toward activity) or seaward (away from activity).

Example Dolphin Repair

Seabird Monitoring Site/Transect Identification Form

Project Name

Dolphin repair

Monitoring Dates

November 8, 9, 10, 2012

Number of Monitoring Sites/Transects

4

Insert aerial photo of entire monitoring project area. Identify each monitoring site/station reflecting 50 meter zones for each observer. For example, if there are two observers on a boat transect, the box will be 100 meters wide. Some monitoring stations will overlap and should be indicated here.

Seabird Land-Based Monitoring Site Form

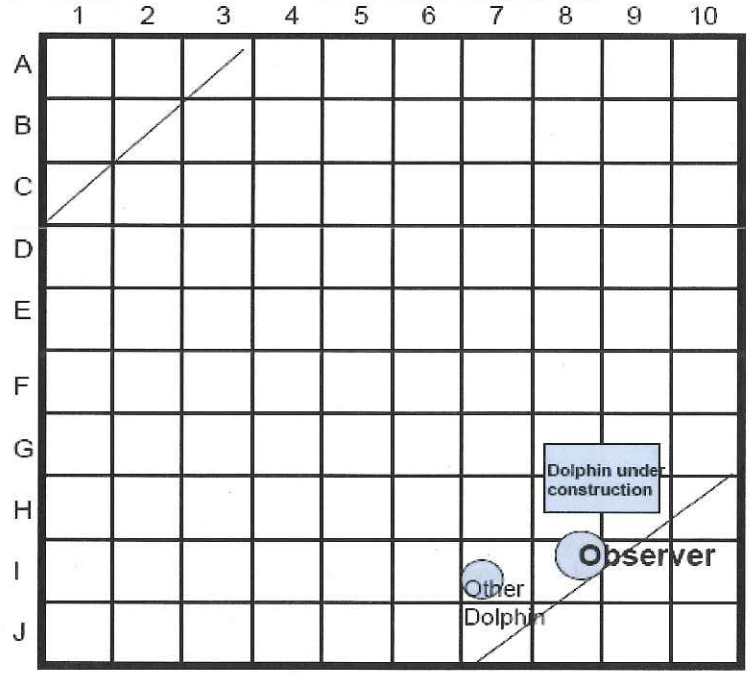
Project Name Dolphin Repair **Date** 11/10/12

Land Based Monitoring Site ID Station #4

For each monitoring station referenced in the main map grid, sketch the coastline using the 5 meter squares. Indicate the direction to where impacting activities are occurring.

Use space below to describe additional monitoring site details that may be pertinent such as other structures seabirds may use.

Observer located at end of terminal pier adjacent to construction activities. There is another dolphin to the west currently used by cormorants.



Seabird Monitoring Data Collection Form

Date _____

Project Name Dolphin Repair **Monitoring Site/Transect ID** Land Based Station #4

Observers Harry Downy

Activity Pile Driving **Time and Duration** 10:30 am to 4:00 pm

Time	Species	# of birds	Wind speed (Beaufort Marine scale)	Land Observer	Boat Observer		Observed Behavior*	Comments
				Grid Location	Distance	Land/Sea Ward		
10 am	scoters	10	2	C6			R	
10 am	cormorants	20	2	I8			R, P	Hanging out on adjacent dolphin
11.15 am	marbled murelet	1	1	B4			F	Pile driving ceased, MM left observation area at 11:20
12.00 pm	grebe	2	2	G6			P	
12.00 pm	cormorants	20	2	I8			R, P	Hanging out on adjacent dolphin
2:00	gulls	15	1	H10			F	Group attracted by fisherman dumping guts
2:00	cormorants	20	1	I8			R, P	Hanging out on adjacent dolphin
4.00	gulls	5	2	H10			F	Residuals from earlier
4.00	cormorants	20	2	I8			R, P	Hanging out on adjacent dolphin

* R=resting, F=feeding/diving, P=preening, Y=flying/flushing, T=transient, N=nesting, O=other

Seabird Monitoring Data Collection Form Date 11/10/12

Project Name Dolphin Repair Monitoring Site/Transect ID Land Based Station #4

Observers Jimmy Jones

Activity Pile Driving Time and Duration 10:30 am to 4:00 pm

Time	Species	# of birds	Wind speed (Beaufort Marine scale)	Land Observer	Boat Observer		Observed Behavior*	Comments
				Grid Location	Distance	Land/Sea Ward		
10 am	grebe	1	2		25	sea	T	
11:25	marbled murrelet	1	1		45	land	F	Pile driving ceased at 11:15, left monitoring area at 11:45
12:00	scoters, loon	8	1		15	land	R, P	Startled by pile driving re-start, flushed out of area
12:00	common murre	2	1		25	sea	T	Startled by pile driving re-start, flushed out of area
2:00	gulls	1	2		75	sea	T	
4:00	gulls	5	2		50	sea	T	

* R=resting, F=feeding/diving, P=preening, Y=flying/flushing, T=transient, N=nesting, O=other

3.7 Timing and Duration

Monitoring will commence at least 30 minutes before the initiation of pile driving (but not before daylight) and will continue until pile driving is completed each day (but not after nightfall). The monitoring set-up (i.e., number and location of observers) should allow for the entire monitoring are to be covered within five minutes.

3.8 Contingency

In the unlikely event that a murrelet is perceived to be injured by pile driving, all pile driving will cease and WFWO will be contacted as soon as possible.

The Lead Federal Action Agency will work with WFWO to make necessary changes to the monitoring plan as described in section 2.0 above. Pile driving cannot resume until the plan has been amended, unless the WFWO cannot be reached, then the Lead Biologist determines the course of action and continues to ensure consistency with the consultation.

4.0 Beach Surveys

Searches for diving seabird carcasses along nearby beaches will be conducted following pile driving activities. The biologist will walk accessible beaches within 0.5 mile of the pile driving location. Beach surveys will be conducted during low or receding tides, if

possible, to maximize the chances of finding beached carcasses. Beach surveys will be conducted each day following in-water impact pile driving (as is practical based on the timing of tide events and pile driving activities.) Beach surveys are of secondary priority and will not be conducted if such activities would interfere with the implementation of murrelet monitoring or if the timing of low/receding tides imposes unreasonable schedule demands on the biologist.

Any dead murrelets or other diving seabirds found during the beach surveys (or during monitoring activities) will be collected by monitoring staff and delivered, as soon as possible, to the WFWO in Lacey, Washington for examination. Collected carcasses will be put in plastic bags, and kept cool (but not frozen) until delivery to the WFWO. Surveyors will follow the chain-of-custody process included in the consultation documents.

5.0 FWS Communication

Prior to the initiation of monitoring the Lead Federal Action Agency and a representative from the WFWO will meet to review the proposed monitoring locations and any logistical concerns that may have developed during monitoring preparation. The Lead Federal Action Agency will keep the WFWO informed of the progress and effectiveness of the monitoring activities and of the number and disposition of murrelet take that is documented throughout the duration of the project.

The Lead Federal Action Agency will notify the WFWO of any problems and/or necessary modification to the monitoring plan. The Lead Federal Action Agency will coordinate with the WFWO in the development of a modified approach and will obtain WFWO approval for such modifications.

Primary points of contact at the WFWO are:

1. Consulting Biologist – phone:
2. Emily Teachout – phone: (360) 753-9583
3. Deanna Lynch – phone: (360) 753-9545

6.0 Personnel Qualifications and Training

All observers must be certified under the Marbled Murrelet Marine Protocol. Observers will have appropriate qualifications, including education or work experience in biology, ornithology, or a closely related field; at least one season (2-3 months) of work with bird identification being the primary objective (i.e. not incidental to other work). Observers must have experience identifying marine birds in the Pacific Northwest, as well as understanding and documenting bird behavior.

All observers will attend the marbled murrelet marine monitoring protocol training and pass the written and photo examination with 90% proficiency. Upon successful completion, observers will be certified. Certification is valid for one year.

Recertification is required annually, unless the observer can document that he/she implemented the monitoring protocol for at least 25 monitoring days in the previous year. Recertification can then be delayed for one year; however, recertification can only be delayed for one year.

Certifications will be considered expired after one year, unless the WFWO is notified by the biologist that greater than 25 days of survey were done within one year of their certificate date. If an observer does conduct greater than 25 days of survey the certificate will be valid for an additional year from the certificate date. To extend a certification the biologist sends an email to the attention of Emily Teachout (emily_teachout@fws.gov) with the dates of the surveys they conducted and the date of their original certificate. The WFWO will maintain a list a certified observers and it will be available on our website.

The Lead Federal Agency is expected to provide all observers with a copy of the consultation documents for the project. Observers must read and understand the contents of the consultation documents related to identifying, minimizing, and reporting "incidental take" of murrelets.

7.0 Reporting

At the completion of each in-water work window for which there has been impact pile driving, the Lead Federal Action Agency will forward a monitoring report to the WFWO within 30 days. Reports shall be sent to the attention of (WFWO Branch Manager). The report shall include:

- Observation dates, times, and conditions
- Description of the any "take" (as described in the final Biological Opinion) identified by the biologist
- Copies of field data sheets or logs

Note: Questions and comments regarding this protocol should be directed to Emily Teachout at the USFWS, Washington Fish and Wildlife Office (360-753-9583); emily_teachout@fws.gov

APPENDIX

Print Form

Seabird Monitoring Site/Transect Identification Form

Project Name

Monitoring Dates

Number of Monitoring Sites/Transects

Insert aerial photo of entire monitoring project area. Identify each monitoring site/transect. Each monitoring station will reflect the 50 meter zone for each observer. For example, if there are two observers on a boat transect, the box will be 100 meters wide. Some monitoring stations will overlap and should be indicated here.

Seabird Land-Based Monitoring Site Form

Project Name _____ **Date** _____

Land Based Monitoring Site ID _____

For each monitoring station referenced in the main map grid, sketch the coastline using the 5 meter squares. Indicate the direction to where impacting activities are occurring.

Use space below to describe additional monitoring site details that may be pertinent such as other structures seabirds may use.

	1	2	3	4	5	6	7	8	9	10
A										
B										
C										
D										
E										
F										
G										
H										
I										
J										

Seabird Monitoring Data Collection Form

Date_____

Project Name _____ **Monitoring Site/Transect ID** _____

Observers_____

Activity _____ **Time and Duration**_____

Time	Species	# of birds	Wind speed (Beaufort Marine scale)	Land Observer	Boat Observer		Observed Behavior*	Comments
				Grid Location	Distance	Land/Sea Ward		

* R=resting, F=feeding/diving, P=preening, Y=flying/flushing, T=transient, N=nesting, O=other

APPENDIX B

Sound Exposure Level Calculator Results

HERRERA

Sound Exposure Level Calculator for Marbled Murrelet and Bull Trout

This spreadsheet was developed as an in-house tool for USFWS staff to use when assessing the effects to marbled murrelets (MAMU) and/or bull trout from impact pile driving. The USFWS makes this spreadsheet available to other users, and assumes no responsibility for errors when this tool is used by non-USFWS staff. Use this spreadsheet to calculate the distance to various thresholds for both MAMU and bull trout. The calculations incorporate the concept of effective quiet (EQ) wherein we assume that the energy from pile strikes below a certain SEL does not accumulate to cause injury.

Please contact the following USFWS staff member to report errors or submit questions:
Lindsy Wright, USFWS, Washington Fish and Wildlife Office, Lacey, WA, 360-753-6037, lindsy_wright@fws.gov

Green cells = input. Input expected sound levels, distance, attenuation, and pile strikes
Blue cells = results. Results shown are based on the information in the green and yellow cells. DO NOT CHANGE
Yellow cells = threshold values and transmission loss constant. DO NOT CHANGE

	Peak	SEL	RMS	Single Strike SEL for Effective Quiet	Attenuation
Unattenuated single strike (dB)	200	175	187	150	10
Attenuated single strike (dB)	190	165	177		
Distance (m)	10	10	10		
Piles per day	4				
Estimated maximum # strikes per pile	675				
Estimated maximum # strikes per day	2700				
Cum SEL at measured distance	199.3	>>----------->>>	100	66	42
Transmission loss constant	15				

	Distance (m) to Bull Trout thresholds (SEL)		Distance (m) to MAMU thresholds				
	Fish ≤ 2g	Fish > 2g	Masking Zone Piles <36-inch	Masking Zone Piles ≥ 36-inch	Auditory Injury (SEL)	Barotrauma (SEL)	Distance to EQ
	183	187	202	208			
	168	7	3	100			

	Behavior
	dBrms
Potential Behavioral Response Zone	150
Distance (m)	631

*** Note:** If you have a project with different sized piles, you will run this analysis for each size of pile, and use the greater distance of the two to determine the distance to murrelet auditory injury threshold.

Version 3/3/14 L.Wright

Key:

Distance (m) [B12-D12]	This is the distance that the sound pressure levels you are entering were measured at. The hydrophones were placed at this distance from pile driving locations during sound measurements. This distance can vary, so be sure to verify the distance that the measurements were taken from.
Piles per day [B3]	Enter the maximum number of piles that would be installed in a day.
Attenuation [F10]	Enter the amount of attenuation that will be verified by hydroacoustic monitoring. If hydroacoustic monitoring would not occur, enter zero.
Masking Zone; piles <36-inch [F16]	For projects that entail impact-pile-driving steel piles that is more than intermittent proofing and the pile sizes are less than 36-inch diameter. Monitoring for marbled murrelets in the masking zone should only occur from land-based locations.
Masking Zone; piles ≥ 36-inch [G16]	For projects that entail impact-pile-driving steel piles that is more than intermittent proofing and pile sizes are 36-inch-diameter or larger. Monitoring for marbled murrelets in the masking zone should only occur from land-based locations.
Area of effect Auditory Injury (m) [H16]	This value represents the radius of the "area of effect" where we would anticipate auditory injury could occur. Monitoring for marbled murrelets in the area of auditory injury can be done from boats or land (see USFWS Marbled Murrelet Monitoring Protocol).
Distance to EQ [J16]	This is the distance with which the energy from pile driving would no longer be accumulating and harmful to fish. It is not ambient.
Distance (m) Potential Behavioral Response Zone [B22]	This is the distance that sound would travel underwater until the sound pressure levels drop below 150 dB RMS. This is only a guideline for when we would no longer expect potential behavioral effects to salmonids. We use it for bull trout and marbled murrelets. This is not the distance that sound would travel until attenuating to ambient conditions or when it would be undetectable (background is the sound in an area in the absence of your project noise).

Sound Exposure Level Calculator for Marbled Murrelet and Bull Trout

This spreadsheet was developed as an in-house tool for USFWS staff to use when assessing the effects to marbled murrelets (MAMU) and/or bull trout from impact pile driving. The USFWS makes this spreadsheet available to other users, and assumes no responsibility for errors when this tool is used by non-USFWS staff. Use this spreadsheet to calculate the distance to various thresholds for both MAMU and bull trout. The calculations incorporate the concept of effective quiet (EQ) wherein we assume that the energy from pile strikes below a certain SEL does not accumulate to cause injury.

Please contact the following USFWS staff member to report errors or submit questions:
Lindsy Wright, USFWS, Washington Fish and Wildlife Office, Lacey, WA, 360-753-6037, lindsy_wright@fws.gov

Green cells = input. Input expected sound levels, distance, attenuation, and pile strikes
Blue cells = results. Results shown are based on the information in the green and yellow cells. DO NOT CHANGE
Yellow cells = threshold values and transmission loss constant. DO NOT CHANGE

	Peak	SEL	RMS	Single Strike SEL for Effective Quiet	Attenuation
Unattenuated single strike (dB)	212	181	189	150	10
Attenuated single strike (dB)	202	171	179		
Distance (m)	10	10	10		
Piles per day	2				
Estimated maximum # strikes per pile	675				
Estimated maximum # strikes per day	1350				
Cum SEL at measured distance	202.3	>>----------->>>			
Transmission loss constant	15				

	Distance (m) to Bull Trout thresholds (SEL)		Distance (m) to MAMU thresholds				
	Fish ≤ 2g	Fish > 2g	Masking Zone	Masking Zone	Auditory Injury (SEL)	Barotrauma (SEL)	Distance to
	183	187	Piles <36-inch	Piles ≥ 36-inch	202	208	EQ
	194	105	42	168	10	4	251

	Behavior
	dBrms
Potential Behavioral Response Zone	150
Distance (m)	858

* **Note:** If you have a project with different sized piles, you will run this analysis for each size of pile, and use the greater distance of the two to determine the distance to murrelet auditory injury threshold.

Version 3/3/14 L.Wright

Key:

Distance (m) [B12-D12]	This is the distance that the sound pressure levels you are entering were measured at. The hydrophones were placed at this distance from pile driving locations during sound measurements. This distance can vary, so be sure to verify the distance that the measurements were taken from.
Piles per day [B3]	Enter the maximum number of piles that would be installed in a day.
Attenuation [F10]	Enter the amount of attenuation that will be verified by hydroacoustic monitoring. If hydroacoustic monitoring would not occur, enter zero.
Masking Zone; piles <36-inch [F16]	For projects that entail impact-pile-driving steel piles that is more than intermittent proofing and the pile sizes are less than 36-inch diameter. Monitoring for marbled murrelets in the masking zone should only occur from land-based locations.
Masking Zone; piles ≥ 36-inch [G16]	For projects that entail impact-pile-driving steel piles that is more than intermittent proofing and pile sizes are 36-inch-diameter or larger. Monitoring for marbled murrelets in the masking zone should only occur from land-based locations.
Area of effect Auditory Injury (m) [H16]	This value represents the radius of the "area of effect" where we would anticipate auditory injury could occur. Monitoring for marbled murrelets in the area of auditory injury can be done from boats or land (see USFWS Marbled Murrelet Monitoring Protocol).
Distance to EQ [J16]	This is the distance with which the energy from pile driving would no longer be accumulating and harmful to fish. It is not ambient.
Distance (m) Potential Behavioral Response Zone [B22]	This is the distance that sound would travel underwater until the sound pressure levels drop below 150 dB RMS. This is only a guideline for when we would no longer expect potential behavioral effects to salmonids. We use it for bull trout and marbled murrelets. This is not the distance that sound would travel until attenuating to ambient conditions or when it would be undetectable (background is the sound in an area in the absence of your project noise).

Sound Exposure Level Calculator for Marbled Murrelet and Bull Trout

This spreadsheet was developed as an in-house tool for USFWS staff to use when assessing the effects to marbled murrelets (MAMU) and/or bull trout from impact pile driving. The USFWS makes this spreadsheet available to other users, and assumes no responsibility for errors when this tool is used by non-USFWS staff. Use this spreadsheet to calculate the distance to various thresholds for both MAMU and bull trout. The calculations incorporate the concept of effective quiet (EQ) wherein we assume that the energy from pile strikes below a certain SEL does not accumulate to cause injury.

Please contact the following USFWS staff member to report errors or submit questions:
Lindsy Wright, USFWS, Washington Fish and Wildlife Office, Lacey, WA, 360-753-6037, lindsy_wright@fws.gov

Green cells = input. Input expected sound levels, distance, attenuation, and pile strikes
Blue cells = results. Results shown are based on the information in the green and yellow cells. DO NOT CHANGE
Yellow cells = threshold values and transmission loss constant. DO NOT CHANGE

	Peak	SEL	RMS	Single Strike SEL for Effective Quiet	Attenuation
Unattenuated single strike (dB)	214	186	201	150	10
Attenuated single strike (dB)	204	176	191		
Distance (m)	10	10	10		
Piles per day	1				
Estimated maximum # strikes per pile	675				
Estimated maximum # strikes per day	675				
Cum SEL at measured distance	204.3	>>----------->>>	263	142	42
Transmission loss constant	15				

Distance (m) to Bull Trout thresholds (SEL)		Distance (m) to MAMU thresholds				
Fish ≤ 2g	Fish > 2g	Masking Zone Piles <36-inch	Masking Zone Piles ≥ 36-inch	Auditory Injury (SEL)	Barotrauma (SEL)	Distance to EQ
183	187	202	208			
168	14	6	541			

	Behavior
	dBrms
Potential Behavioral Response Zone	150
Distance (m)	5412

*** Note:** If you have a project with different sized piles, you will run this analysis for each size of pile, and use the greater distance of the two to determine the distance to murrelet auditory injury threshold.

Version 3/3/14 L.Wright

Key:

Distance (m) [B12-D12]	This is the distance that the sound pressure levels you are entering were measured at. The hydrophones were placed at this distance from pile driving locations during sound measurements. This distance can vary, so be sure to verify the distance that the measurements were taken from.
Piles per day [B3]	Enter the maximum number of piles that would be installed in a day.
Attenuation [F10]	Enter the amount of attenuation that will be verified by hydroacoustic monitoring. If hydroacoustic monitoring would not occur, enter zero.
Masking Zone; piles <36-inch [F16]	For projects that entail impact-pile-driving steel piles that is more than intermittent proofing and the pile sizes are less than 36-inch diameter. Monitoring for marbled murrelets in the masking zone should only occur from land-based locations.
Masking Zone; piles ≥ 36-inch [G16]	For projects that entail impact-pile-driving steel piles that is more than intermittent proofing and pile sizes are 36-inch-diameter or larger. Monitoring for marbled murrelets in the masking zone should only occur from land-based locations.
Area of effect Auditory Injury (m) [H16]	This value represents the radius of the "area of effect" where we would anticipate auditory injury could occur. Monitoring for marbled murrelets in the area of auditory injury can be done from boats or land (see USFWS Marbled Murrelet Monitoring Protocol).
Distance to EQ [J16]	This is the distance with which the energy from pile driving would no longer be accumulating and harmful to fish. It is not ambient.
Distance (m) Potential Behavioral Response Zone [B22]	This is the distance that sound would travel underwater until the sound pressure levels drop below 150 dB RMS. This is only a guideline for when we would no longer expect potential behavioral effects to salmonids. We use it for bull trout and marbled murrelets. This is not the distance that sound would travel until attenuating to ambient conditions or when it would be undetectable (background is the sound in an area in the absence of your project noise).

Sound Exposure Level Calculator for Marbled Murrelet and Bull Trout

This spreadsheet was developed as an in-house tool for USFWS staff to use when assessing the effects to marbled murrelets (MAMU) and/or bull trout from impact pile driving. The USFWS makes this spreadsheet available to other users, and assumes no responsibility for errors when this tool is used by non-USFWS staff. Use this spreadsheet to calculate the distance to various thresholds for both MAMU and bull trout. The calculations incorporate the concept of effective quiet (EQ) wherein we assume that the energy from pile strikes below a certain SEL does not accumulate to cause injury.

Please contact the following USFWS staff member to report errors or submit questions:
Lindsy Wright, USFWS, Washington Fish and Wildlife Office, Lacey, WA, 360-753-6037, lindsy_wright@fws.gov

Green cells = input. Input expected sound levels, distance, attenuation, and pile strikes
Blue cells = results. Results shown are based on the information in the green and yellow cells. DO NOT CHANGE
Yellow cells = threshold values and transmission loss constant. DO NOT CHANGE

	Peak	SEL	RMS	Single Strike SEL for Effective Quiet	Attenuation
Unattenuated single strike (dB)	214	186	201	150	0
Attenuated single strike (dB)	214	186	201		
Distance (m)	10	10	10		
Piles per day	1				
Estimated maximum # strikes per pile	150				
Estimated maximum # strikes per day	150				
Cum SEL at measured distance	207.8	>>----------->>>	447	242	42
Transmission loss constant	15				

Distance (m) to Bull Trout thresholds (SEL)		Distance (m) to MAMU thresholds				
Fish ≤ 2g	Fish > 2g	Masking Zone Piles <36-inch	Masking Zone Piles ≥ 36-inch	Auditory Injury (SEL)	Barotrauma (SEL)	Distance to EQ
183	187			202	208	
447	242	42	168	24	10	2512

	Behavior
	dBrms
Potential Behavioral Response Zone	150
Distance (m)	25119

* **Note:** If you have a project with different sized piles, you will run this analysis for each size of pile, and use the greater distance of the two to determine the distance to murrelet auditory injury threshold.

Version 3/3/14 L.Wright

Key:

Distance (m) [B12-D12]	This is the distance that the sound pressure levels you are entering were measured at. The hydrophones were placed at this distance from pile driving locations during sound measurements. This distance can vary, so be sure to verify the distance that the measurements were taken from.
Piles per day [B3]	Enter the maximum number of piles that would be installed in a day.
Attenuation [F10]	Enter the amount of attenuation that will be verified by hydroacoustic monitoring. If hydroacoustic monitoring would not occur, enter zero.
Masking Zone; piles <36-inch [F16]	For projects that entail impact-pile-driving steel piles that is more than intermittent proofing and the pile sizes are less than 36-inch diameter. Monitoring for marbled murrelets in the masking zone should only occur from land-based locations.
Masking Zone; piles ≥ 36-inch [G16]	For projects that entail impact-pile-driving steel piles that is more than intermittent proofing and pile sizes are 36-inch-diameter or larger. Monitoring for marbled murrelets in the masking zone should only occur from land-based locations.
Area of effect Auditory Injury (m) [H16]	This value represents the radius of the "area of effect" where we would anticipate auditory injury could occur. Monitoring for marbled murrelets in the area of auditory injury can be done from boats or land (see USFWS Marbled Murrelet Monitoring Protocol).
Distance to EQ [J16]	This is the distance with which the energy from pile driving would no longer be accumulating and harmful to fish. It is not ambient.
Distance (m) Potential Behavioral Response Zone [B22]	This is the distance that sound would travel underwater until the sound pressure levels drop below 150 dB RMS. This is only a guideline for when we would no longer expect potential behavioral effects to salmonids. We use it for bull trout and marbled murrelets. This is not the distance that sound would travel until attenuating to ambient conditions or when it would be undetectable (background is the sound in an area in the absence of your project noise).

APPENDIX C

Species Lists

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Washington Fish and Wildlife Office
510 DESMOND DRIVE SE, SUITE 102
LACEY, WA 98503
PHONE: (360)753-9440 FAX: (360)753-9405
URL: www.fws.gov/wafwo/

Consultation Tracking Number: 01EWFW00-2014-SLI-0426 May 20, 2014
Project Name: Steilacoom Ferry Landing Improvement

Subject: List of threatened and endangered species that may occur in your proposed project location, and/or may be affected by your proposed project.

To Whom It May Concern:

The enclosed species list identifies threatened, endangered, and proposed species, designated and proposed critical habitat, and candidate species that may occur within the boundary of your proposed project and/or may be affected by your proposed project. The species list fulfills the requirements of the U.S. Fish and Wildlife Service (Service) under section 7(c) of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 et seq.).

New information based on updated surveys, changes in the abundance and distribution of species, changed habitat conditions, or other factors could change this list. The species list is currently compiled at the county level. Additional information is available from the Washington Department of Fish and Wildlife, Priority Habitats and Species website: http://wdfw.wa.gov/mapping/phs/ or at our office website: http://www.fws.gov/wafwo/species_new.html. Please note that under 50 CFR 402.12(e) of the regulations implementing section 7 of the Act, the accuracy of this species list should be verified after 90 days. This verification can be completed formally or informally as desired. The Service recommends that verification be completed by visiting the ECOS-IPaC website at regular intervals during project planning and implementation for updates to species lists and information. An updated list may be requested through the ECOS-IPaC system by completing the same process used to receive the enclosed list.

The purpose of the Act is to provide a means whereby threatened and endangered species and the ecosystems upon which they depend may be conserved. Under sections 7(a)(1) and 7(a)(2) of the Act and its implementing regulations (50 CFR 402 et seq.), Federal agencies are required to utilize their authorities to carry out programs for the conservation of threatened and endangered species and to determine whether projects may affect threatened and endangered species and/or designated critical habitat.

A Biological Assessment is required for construction projects (or other undertakings having similar physical impacts) that are major Federal actions significantly affecting the quality of the human environment as defined in the National Environmental Policy Act (42 U.S.C. 4332(2)(c)). For projects other than major construction activities, the Service suggests that a biological evaluation similar to a Biological Assessment be prepared to determine whether or not the project may affect listed or proposed species and/or designated or proposed critical habitat. Recommended contents of a Biological Assessment are described at 50 CFR 402.12.

If a Federal agency determines, based on the Biological Assessment or biological evaluation, that listed species and/or designated critical habitat may be affected by the proposed project, the agency is required to consult with the Service pursuant to 50 CFR 402. In addition, the Service recommends that candidate species, proposed species, and proposed critical habitat be addressed within the consultation. More information on the regulations and procedures for section 7 consultation, including the role of permit or license applicants, can be found in the "Endangered Species Consultation Handbook" at:
http://www.fws.gov/endangered/esa-library/pdf/TOC-GLOS.PDF

Please be aware that bald and golden eagles are protected under the Bald and Golden Eagle Protection Act (16 U.S.C. 668 et seq.). You may visit our website at http://www.fws.gov/pacific/eagle/for information on disturbance or take of the species and information on how to get a permit and what current guidelines and regulations are. Some projects affecting these species may require development of an eagle conservation plan: (http://www.fws.gov/windenergy/eagle_guidance.html). Additionally, wind energy projects should follow the wind energy guidelines (http://www.fws.gov/windenergy/) for minimizing impacts to migratory birds and bats.

Also be aware that all marine mammals are protected under the Marine Mammal Protection Act (MMPA). The MMPA prohibits, with certain exceptions, the "take" of marine mammals in U.S. waters and by U.S. citizens on the high seas. The importation of marine mammals and marine mammal products into the U.S. is also prohibited. More information can be found on the MMPA website: http://www.nmfs.noaa.gov/pr/laws/mmpa/.

We appreciate your concern for threatened and endangered species. The Service encourages Federal agencies to include conservation of threatened and endangered species into their project planning to further the purposes of the Act. Please include the Consultation Tracking Number in the header of this letter with any request for consultation or correspondence about your project that you submit to our office.

Related website:
National Marine Fisheries Service:
http://www.nwr.noaa.gov/protected_species/species_list/species_lists.html

Attachment

United States Department of Interior
Fish and Wildlife Service

Project name: Steilacoom Ferry Landing Improvement

Official Species List

Provided by:

Washington Fish and Wildlife Office
510 DESMOND DRIVE SE, SUITE 102
LACEY, WA 98503
(360) 753-9440
http://www.fws.gov/wafwo/

Consultation Tracking Number: 01EWFW00-2014-SLI-0426
Project Type: Bridge Construction / Maintenance
Project Description: The Steilacoom Ferry Landing, Pierce County Bridge #31202 A, will be improved by upgrading an existing second slip. The upgrade will include a new approach trestle, pedestrian trestle and transfer span, wingwalls, dolphins; and associated mechanical and utility systems including electrical, water, and sewer work. A new 6-foot wide pedestrian access trestle and span will be constructed and an existing pedestrian span will be removed.

United States Department of Interior
Fish and Wildlife Service

Project name: Steilacoom Ferry Landing Improvement

Project Location Map:

Project Coordinates: MULTIPOLYGON (((-122.6052699 47.1725594, -122.6052766 47.1725623, -122.6052819 47.1725673, -122.6057647 47.1732383, -122.6057678 47.1732448, -122.6057684 47.1732519, -122.6057665 47.1732588, -122.6057622 47.1732645, -122.6048604 47.1741174, -122.6048535 47.1741217, -122.6048454 47.1741229, -122.6028504 47.173992, -122.6028434 47.1739902, -122.6028374 47.173986, -122.6028334 47.17398, -122.6023608 47.1728929, -122.6023591 47.1728841, -122.6023615 47.1728755, -122.6023673 47.1728688, -122.6033307 47.172165, -122.6033378 47.1721617, -122.6033456 47.1721613, -122.6033529 47.172164, -122.6033586 47.1721693, -122.6033592 47.1721705, -122.6033609 47.1721665, -122.6033665 47.172161, -122.6033738 47.1721581, -122.6033816 47.1721582, -122.6052699 47.1725594), (-122.6033606 47.1721887, -122.6033596 47.1721915, -122.6033543 47.1721972, -122.6024038 47.1728916, -122.6028652 47.1739528, -122.6048393 47.1740824, -122.6057221 47.1732475, -122.605254 47.172597, -122.6033732 47.1721974, -122.6033661 47.1721943, -122.6033606 47.1721887)))

United States Department of Interior
Fish and Wildlife Service

Project name: Steilacoom Ferry Landing Improvement

Project Counties: Pierce, WA

United States Department of Interior
Fish and Wildlife Service

Project name: Steilacoom Ferry Landing Improvement

Endangered Species Act Species List

There are a total of 16 threatened, endangered, or candidate species on your species list. Species on this list should be considered in an effects analysis for your project and could include species that exist in another geographic area. For example, certain fish may appear on the species list because a project could affect downstream species. Critical habitats listed on the **Has Critical Habitat** lines may or may not lie within your project area. See the **Critical habitats within your project area** section further below for critical habitat that lies within your project. Please contact the designated FWS office if you have questions.

Bull Trout *(Salvelinus confluentus)*

Population: U.S.A., conterminous, lower 48 states

Listing Status: Threatened

Has Critical Habitat: Final designated

Canada Lynx *(Lynx canadensis)*

Population: (Contiguous U.S. DPS)

Listing Status: Threatened

Has Critical Habitat: Final designated, Proposed

Golden Paintbrush *(Castilleja levisecta)*

Listing Status: Threatened

Gray wolf *(Canis lupus)*

Population: U.S.A.: All of AL, AR, CA, CO, CT, DE, FL, GA, KS, KY, LA, MA, MD, ME, MO, MS, NC, NE, NH, NJ, NV, NY, OK, PA, RI, SC, TN, VA, VT and WV; those portions of AZ, NM, and TX not included in an experimental population; and portions of IA, IN, IL, ND, OH, OR, SD, UT, and WA. Mexico.

Listing Status: Endangered

Grizzly bear *(Ursus arctos horribilis)*

Population: lower 48 States, except where listed as an experimental population or delisted

Listing Status: Threatened

Marbled murrelet *(Brachyramphus marmoratus)*

Population: CA, OR, WA

Listing Status: Threatened
Has Critical Habitat: Final designated

Marsh Sandwort *(Arenaria paludicola)*
Listing Status: Endangered

North American wolverine *(Gulo gulo luscus)*
Listing Status: Proposed Threatened

Northern Spotted owl *(Strix occidentalis caurina)*
Population: Entire
Listing Status: Threatened
Has Critical Habitat: Final designated

Oregon Spotted frog *(Rana pretiosa)*
Listing Status: Proposed Threatened
Has Critical Habitat: Proposed

Roy Prairie pocket gopher *(Thomomys mazama glacialis)*
Listing Status: Threatened

Streaked Horned lark *(Eremophila alpestris strigata)*
Listing Status: Threatened
Has Critical Habitat: Final designated

Taylor's Checkerspot *(Euphydryas editha taylori)*
Listing Status: Endangered
Has Critical Habitat: Final designated

Water howellia *(Howellia aquatilis)*
Listing Status: Threatened

Whitebark pine *(Pinus albicaulis)*
Listing Status: Candidate

United States Department of Interior
Fish and Wildlife Service

Project name: Steilacoom Ferry Landing Improvement

Yellow-Billed Cuckoo *(Coccyzus americanus)*

Population: Western U.S. DPS

Listing Status: Proposed Threatened

United States Department of Interior
Fish and Wildlife Service

Project name: Steilacoom Ferry Landing Improvement

Critical habitats that lie within your project area

The following critical habitats lie fully or partially within your project area.

Species	Critical Habitat Type
Bull Trout *(Salvelinus confluentus)* Population: U.S.A., conterminous, lower 48 states	Final designated

APPENDIX D

Biology of Selected Listed Species

Biology of Selected Listed Species

Bull Trout (*Salvelinus confluentus*)

Status

Bull trout were listed as threatened on November 1, 1999 (64 FR 58909-58933).

Critical Habitat

On September 26, 2005, USFWS published the Final Rule for designating critical habitat for the Coastal-Puget Sound DPS of bull trout in the Federal Register (70 FR 56212). The rule became effective on October 26, 2005 (50 CFR Part 17).

Critical habitat designates areas that contain the physical and biological habitat features (called PCEs) essential for the conservation of a threatened or endangered species and that may require special management considerations. Areas providing at least one of the following nine PCEs are designated as critical habitat:

1. Water temperatures that support bull trout use. Bull trout have been documented in streams with temperatures from 32 to 72°F (0 to 22°C) but are found more frequently in temperatures ranging from 36 to 59°F (2 to 15°C). These temperature ranges may vary depending on bull trout life history stage and form, geography, elevation, diurnal and seasonal variation, shade (such as that provided by riparian habitat), and local groundwater influence. Stream reaches with temperatures that preclude any bull trout use are specifically excluded from designation.

2. Complex stream channels with features such as woody debris, side channels, pools, and undercut banks to provide a variety of depths, velocities, and instream structures.

3. Substrates of sufficient amount, size, and composition to ensure success of egg and embryo overwinter survival, fry emergence, and young-of-the-year and juvenile survival. This should include a minimal amount of fine substrate less than 0.25 inch (0.63 centimeter) in diameter.

4. A natural hydrograph including peak, high, low, and base flows within historic ranges or, if regulated, currently operate under a biological opinion that addresses bull trout, or a hydrograph that demonstrates the ability to support bull trout populations by minimizing daily and day-to-day fluctuations and minimizing departures from the natural cycle of flow levels corresponding with seasonal variation.

5. Springs, seeps, groundwater sources, and subsurface water to contribute to water quality and quantity as a cold water source.

6. Migratory corridors with minimal physical, biological, or water quality impediments between spawning, rearing, overwintering, and foraging habitats, including intermittent or seasonal barriers induced by high water temperatures or low flows.

7. An abundant food base including terrestrial organisms of riparian origin, aquatic macroinvertebrates, and forage fish.

8. Permanent water of sufficient quantity and quality such that normal reproduction, growth, and survival are not inhibited.

In marine nearshore areas, the inshore extent of critical habitat is the mean higher high water line (MHHW; average of all the higher high-water heights of the two daily tidal levels), including tidally influenced freshwater heads of estuaries. Adjacent shoreline riparian areas, bluffs, and uplands are not included in the critical habitat designation. The offshore extent of critical habitat for marine nearshore areas is to the depth of 33 feet (10 meters) relative to MLLW (average of all the lower low water heights of the two daily tidal levels), which is the average depth of the photic zone.

Biology and Distribution

Bull trout are members of the char subgroup of the salmon family. Bull trout feed on terrestrial and aquatic insects and, as they grow in size, their diets include whitefish, sculpins, and other trout. Bull trout spawn from August through November when they reach maturity (between 4 and 7 years) and when temperatures begin to drop, in cold, clear streams. Bull trout can spawn repeatedly, and can live over 20 years. Resident forms of bull trout spend their entire lives in freshwater, while anadromous forms live in tributary streams for 2 or 3 years before migrating to estuaries as smolts. Char species are generally longer-lived than salmon; bull trout up to 12 years old have been identified in Washington (Brown 1992).

In northern Puget Sound, bull trout occur in the Nooksack, Skagit, Stillaguamish, and Snohomish basins. Sub-adult and adult bull trout feed mostly on fish in marine/estuarine areas of northern Puget Sound (i.e., smelt, herring and juvenile salmonids). They are also believed to return to overwinter in lower mainstem rivers following their first summer in saltwater, before returning to saltwater the following spring (Kraemer 1994).

Marbled Murrelet (*Brachyramphus marmoratus marmoratus*)

Status

The marbled murrelet was listed as threatened on October 1, 1992 (57 FR 45328-45337).

Critical Habitat

The USFWS designated critical habitat for the marbled murrelet in 1996. Designated critical habitat includes old growth stands and other suitable nesting areas. No critical habitat has been designated near WSF ferry terminal areas (61 FR 26258).

Biology and Distribution

Marbled murrelets are small seabirds that occur along the Pacific Coast from the Bering Sea to central California, with the largest population occurring in southeastern Alaska and northern British Columbia. Marbled murrelets feed in the nearshore marine environment, usually up to 350 to 2,000 feet off the shoreline. They forage year-round in waters generally less than 90 feet deep and are most frequently within 1,500 feet of protected shoreline waters. Marbled murrelets generally do not forage in shallow waters less than 30 feet deep.

In the Pacific Northwest, marbled murrelets live near shore, feeding on fish, small crustaceans, and invertebrates. Marbled murrelets prefer to forage near kelp beds and at stream mouths, and feed on a variety of prey including sand lance, Pacific herring, and northern anchovy.

Although marbled murrelets feed primarily on fish and invertebrates in nearshore marine waters, they fly inland to nest on large limbs of mature conifers. Most nesting habitat likely occurs within 50 miles of the marine environment (USFWS 1997). The nesting period is between April 1 and September 15, with peak activity occurring between July and August when adults are increasing foraging trips to feed their young. Old-growth or mature forest stands appear to be crucial for breeding and foraging, and most nests are in conifers over 150 years old, and in trees greater than 55 inches diameter at breast height (dBH). Most nests have been found on large flat conifer branches that are covered with thick moss (WDW 1991).

Murrelets undergo two periods of molting: one preceding (prealternate) and one following (prebasic) the molting season. The prealternate molt is incomplete and the birds retain their ability to fly, while the prebasic molt is comlete and renders them unable to fly for up to 2 months (Nelson 1997). Timing of molts varies year-to-year and by location, but in general, the prealternate molt occurs from late February to mid-May and the prebasic molt from mid-July through December (Carter and Stein 1995). In Washington, there is some evidence that the prebasic molt extends from mid-July through late August or as late as September (USFWS 2004).

APPENDIX E

Eelgrass and Macroalgae Habitat Preliminary Survey

HERRERA

EELGRASS AND MACROALGAE HABITAT PRELIMINARY SURVEY

Steilacoom Ferry Terminal Improvements Steilacoom, Washington

Prepared for

Pierce County Public Works and Utilities
Office of the County Engineer

January 2009

EELGRASS AND MACROALGAE HABITAT PRELIMINARY SURVEY

Steilacoom Ferry Terminal Improvements Steilacoom, Washington

Prepared for

Pierce County Public Works and Utilities
Office of the County Engineer
2702 South 42nd Street, Suite 201
Tacoma, WA 98409-7322

Prepared by

Herrera Environmental Consultants
2200 Sixth Avenue, Suite 1100
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January 5, 2009

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Introduction

Pierce County Department of Public Works and Utilities proposes to add a second ferry slip and a new access trestle at the Steilacoom Ferry Landing. These changes are intended to improve security at this facility, which is also used by the Washington Department of Corrections to transport prisoners, staff, and materials to and from McNeil Island Penitentiary. By adding a second ferry slip and an access trestle to access moored ferries, Department of Corrections traffic can be more effectively isolated from Pierce County public ferry access and traffic.

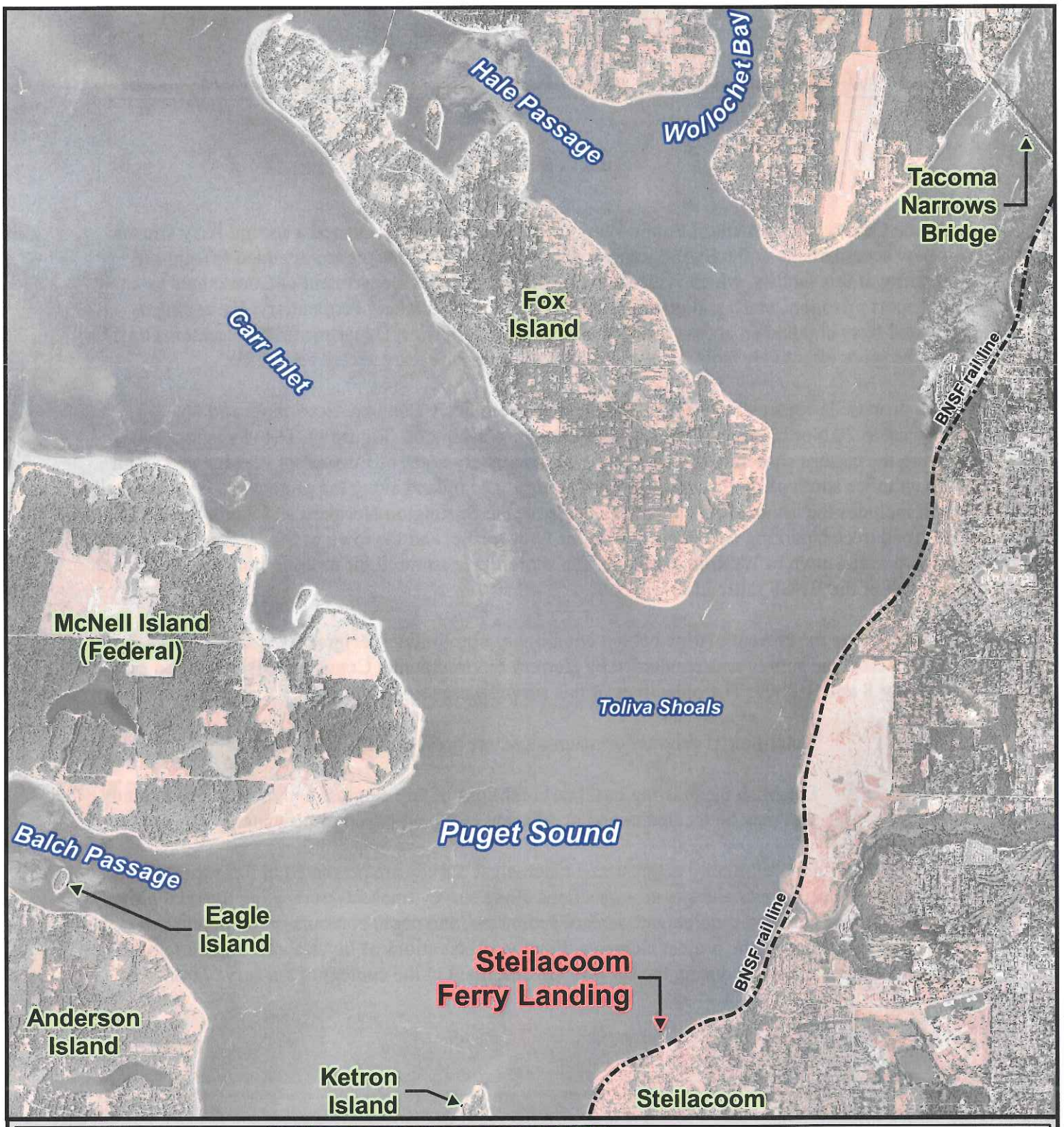
The proposed project site is located at the Steilacoom Ferry Landing, Section 45 and 46, Township 20 North, Range 1 East, in Steilacoom, Washington (Figure 1). The site is located along the eastern shoreline of Puget Sound, immediately north of Cormorant Passage and about seven miles south of the Tacoma Narrows Bridge. The upland along the project site is developed, and includes the armored revetments that support the Burlington Northern and Santa Fe (BNSF) railroad tracks, parking and staging areas for ferry traffic, and the town of Steilacoom, the oldest incorporated town in Washington State. The shoreline is armored for miles in both directions, as a result of the BNSF railroad revetments.

To determine the current marine habitat conditions, a preliminary eelgrass (*Zostera maritima*) and macroalgae survey was conducted by Herrera Environmental Consultants (Herrera) on October 8 and 9, 2009. The objectives of this survey were to:

1. Determine if eelgrass or macroalgae are present at the project site, and

2. Establish the existing baseline conditions of any eelgrass and macroalgae habitats that may be located in and/or adjacent to the proposed project site.

The results of the preliminary eelgrass and macroalgae survey are presented in this report. Also presented are a site map and site cross-sections along survey transects, indicating the qualitative distribution of eelgrass, macroalgae, surface sediments, and depth contours in relation to the proposed locations of the project elements. Finally, observations of invertebrate and vertebrate animal species observed during the surveys are described in the context of the survey transects.



Legend

BNSF rail line

Figure 1. Project vicinity map for the Steilacoom Ferry Terminal Improvements.

N

0 2,500 5,000 10,000 Feet

HERRERA ENVIRONMENTAL CONSULTANTS

Aerial photograph: USDA 2006

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Survey Methods

The survey was performed in accordance with the Preliminary Survey protocols described in the *Eelgrass and Macroalgae Habitat Survey Guidelines* (WDFW 2008). The survey included spatial delineation of eelgrass and macroalgae habitats extents, as well as substrate characterizations and observations of vertebrate and invertebrate animals along the survey transects. Habitat characterization followed the Denthier marine and estuarine habitat classification system (Denthier 1990).

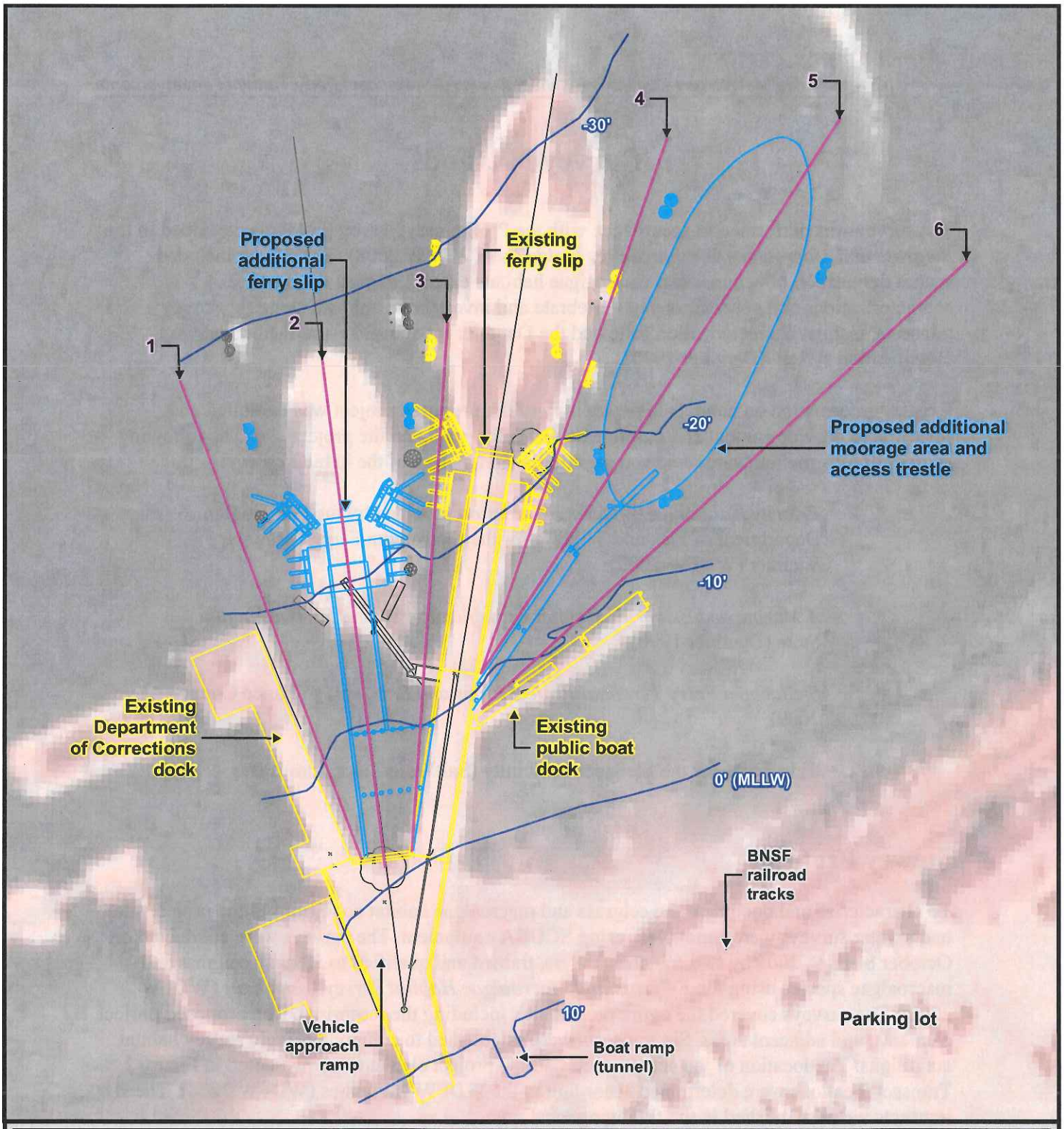
Existing information on habitats in the vicinity of the proposed project was compiled and reviewed to provide context and baseline habitat information on the project site. The following sources of information were reviewed prior to the completion of the habitat survey:

- *Priority Habitat and Species Information* provided by the Washington Department of Fish and Wildlife for the Steilacoom Ferry Terminal Vicinity (WDFW 2009).
- *A Marine and Estuarine Habitat Classification System for Washington State* (Denthier 1990).
- *Steilacoom Ferry Terminal Project Plans and Bathymetry* (Pierce County 2009).
- Tide tables for the Steilacoom vicinity (SaltWaterTides.com 2009).

Survey Protocol

To characterize and document the eelgrass and macroalgae habitat conditions at the project site, underwater surveys were conducted, using SCUBA equipment. The surveys were conducted on October 8 and 9, 2009 by two scientific divers, trained and qualified to identify eelgrass and macroalgae species using the *Eelgrass and Macroalgae Habitat Survey Guidelines* (WDFW 2008). The surveys covered the entire project site, including the footprint of the proposed project elements, and adjacent areas. Six transects were established to comprehensively survey habitat conditions. The location of the six transects and the project elements are presented in Figure 2. Transect locations were determined according to the WDFW guidelines (WDFW 2008). The six transects were established in the following locations:

- At the proposed ferry slip centerline, extending 70 feet waterward from the outer extent of its footprint.
- 10-25 feet outside of and parallel to each side of the proposed ferry slip footprint and extending 50 to 70 feet waterward of the proposed footprint.



Legend

- Eelgrass and macroalgae survey transect
- Existing infrastructure
- Proposed ferry slip and moorage structures
- 10-foot contour

Note: All elevations are based on NAVD88 coordinates.

Figure 2. Map of survey transects for the Steilacoom Ferry Terminal Improvements.

N

0 35 70 140 Feet

HERRERA ENVIRONMENTAL CONSULTANTS

Aerial photograph: USDA 2006

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- At the proposed ferry moorage site and access trestle centerline, extending 75 feet waterward from the outer extent of the footprint.
- 10-25 feet outside of and parallel to each side of the proposed ferry moorage site and access trestle centerline and extending 75 feet waterward of the proposed footprint.

The survey transects were established by attaching a 300-foot measuring tape to an existing pile and using a boat to pull the other end of the tape out to the specified transect length. At the outer (waterward) limit of the survey transect, an anchor was set, attached to the tape end and a buoy. Transect locations were mapped using a global positioning system by collecting position data at transect start and stop locations.

Divers entered the water at the outer limit of each transect and descended the buoy line to the anchor. Prior to initiating each transect survey, habitat conditions were characterized at the anchor location, and in its vicinity (approximately 50 feet). The divers then began the transect-based survey, collecting data at the transect beginning and transect end, as well as at locations where there was a change in either substrate or vegetation, as they moved landward. Turbidity was measured during each survey by collecting water samples at depth and analyzing the samples using a Hach turbidity meter.

Along each of the six transects, habitat conditions, including sediment type, presence of eelgrass, presence of macroalgae, and observation of vertebrate and invertebrate animals were recorded. In addition, underwater video and still photography were collected to document conditions and for species verification after the survey.

In addition to the survey transects, the shallow areas landward of the project site were surveyed by foot during moderate tides. This included areas higher than mean lower low water (MLLW; established at 0 feet elevation, NAVD88), up to the mean higher high water (MHHW) (13.48 feet, NAVD88). This survey area included the upper portions of the beach, the riprap revetments supporting the railroad tracks, the boat ramp, and portions of the parking lot located below the MHHW.

Survey Results

Weather conditions during the survey preformed on October 8 and 9, 2009 were good, with clear skies and low wind on both days. Tides fluctuated from +13.0 to +8.0 feet above MLLW. Underwater visibility was good. Turbidity readings ranged from 1.68 to 2.09 nephelometric turbidity units (NTU). Observations during the survey indicated that visibility ranged from 12 to 18 lineal feet (See typical visibility in Photo 1, Appendix A).

The results of the survey include the characterization of the physical habitat (i.e., substrate and slope) and the biological habitat (i.e., plant and animal species). Written descriptions are provided in the following sections. In this report, all discussion and figures are provided on two base elevations: the MHHW, an elevation of 13.48 feet, and the MLLW, an elevation of 0 feet, in the NAVD 88 coordinate system. The cross sections of the project site showing survey results are presented in Figure 3 and 4. A plan view of the results of the survey is presented in Figure 5.

Kelp beds and potential eelgrass habitats have been mapped in the study area as part of the priority habitat and species data prepared by WDFW (WDFW 2009). These habitat areas extend from Gordon Point, about one half mile southwest of the project site, along the shoreline northward for miles beyond the project site.

However, no eelgrass was observed during the on-site survey. The entire project site and the surrounding vicinity are thoroughly vegetated with a diverse community of macroalgae species. More detailed information is provided in the following sections.

Physical Habitat

The project site is characterized by having intertidal and shallow sub-tidal zones (habitat types), which is a characteristic common to beaches in the Puget Sound region (Dethier 1990). In this report the intertidal zone includes the upper shoreline that is located up to the MHHW. The project site is considered *open* according to the Dethier (1990) classification system, as the site's hydrology is not confined by a bay or inlet. The entire survey area is above -45 feet, and so is considered *shallow* according to this classification system.

The following sections describe the substrate characteristics of the intertidal zone, shallow sub-tidal zone, and bathymetric features in the study area.

Intertidal Zone Substrate

For the purposes of this report, the intertidal zone begins at the MHHW (13.48 feet) and extends to the MLLW elevation (0 feet). Above an elevation 10 feet, the intertidal habitat is composed of the riprap revetments that protect the railroad tracks, a boat ramp (located within a tunnel, under the railroad tracks), and an associated parking lot (See Figure 2). No natural substrate occurs

above this elevation. This area is considered *intertidal bedrock*, based on the Dethier (1990) classification system, although the substrate is anthropogenic (riprap revetment).

From an elevation of 10 feet down to the lower limit of the intertidal zone (MLLW, elevation 0 feet, NAVD 88), the substrate is composed of a hardened surface of rock, cobbles and gravel. According to the Dethier (1990) classification system, this area is considered *intertidal mixed-coarse.* The railroad revetment, composed of riprap, prevents recruitment of sediment from the uplands and also increases erosion forces in the intertidal zone. The revetment also unnaturally reduces the roughness of the shoreline (by eliminating vegetation and woody debris) thereby locally increasing the strength of alongshore currents in the nearshore. As there are no sediment sources nearby, the result has been the stripping away of all mobile sediments, leaving only the largest sediment sizes.

Shallow Sub-tidal Zone Substrate

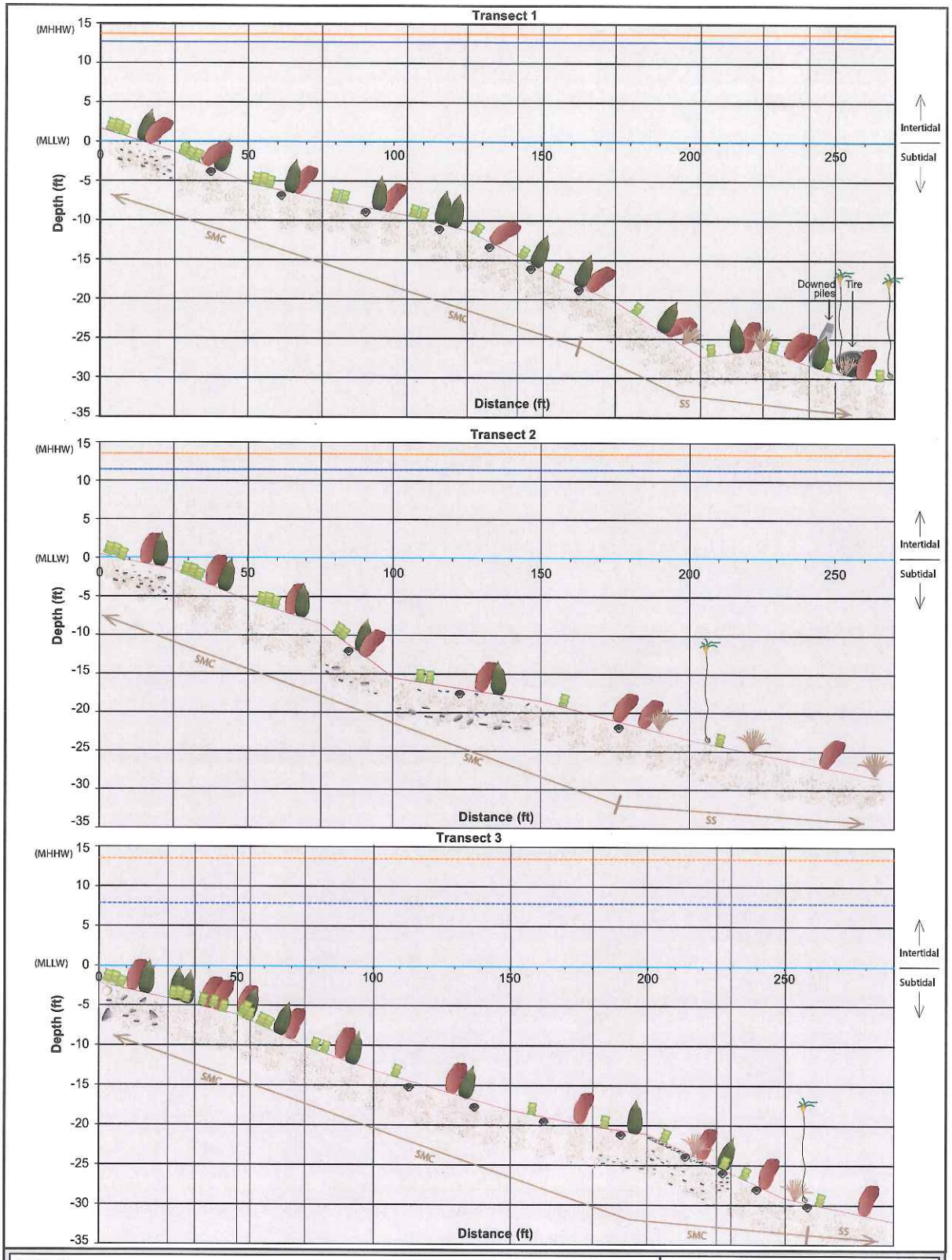
The sub-tidal zone begins at the MLLW elevation (0 feet, NAVD 88) and extends down to the lower limit of the survey area (-35 feet, NAVD 88). Several substrate types occur in this zone. In general, the sediments became finer (smaller particle size) with increasing depth. At MLLW, the substrate is considered *sub-tidal mixed-coarse* based on the Dethier (1990) classification system. At 3 feet below MLLW, the sediments are increasingly dominated by sand. Shells are a significant portion of the sediment, particularly in a depth range of -7 to -15 feet.

Shoreline Geomorphic Conditions and Processes

Geomorphic conditions and processes within the action area are strongly influenced by the naturally steep shoreline bathymetry and extensive shoreline armoring protecting the BNSF railroad corridor. Shoreline armoring has effectively interrupted the majority of sediment supply to the nearshore environment for several miles in each direction from the project site. Wave action reflecting off of this hard surface has contributed to erosion of the beach and the adjacent intertidal bench. The beach has eroded down to hardpan in many areas, and fine substrates capable of supporting intertidal vegetation like eelgrass are generally lacking. In addition to the direct loss of suitable habitats for juvenile salmonids, this has also degraded and potentially eliminated forage fish spawning habitat, reducing the forage base available for subadult and adult salmon and bull trout. This form of degradation is pervasive and persistent in Puget Sound (Downing 1983). Shoreline modification and natural geomorphic conditions (naturally steep offshore bathymetry) have strongly influenced intertidal and subtidal habitat conditions in the project vicinity.

Biological Habitat

The following sections describe the habitat conditions and organisms observed during the survey. All of Puget Sound is considered *estuarine* according to the Dethier (1990) classification



Legend

- Turkish towel (red kelp) (Chondracanthus sp.)
- Ulva
- Shell
- Sand
- Course mix
- Sugar kelp (brown kelp) (Laminaria sp.)
- Sacrodiotheca sp.
- Bull kelp (Nereocystis sp.)
- Water surface elevation adjusted for tide height
- Mean higher high water (MHHW)
- Mean lower low water (MLLW)
- SMC Subtidal mixed coarse
- SS Subtidal sand

Note: Qualitative kelp density indicated by the number of kelp icons per unit distance. No quantitative distribution data was collected.

Figure 3. Results of the eelgrass and macroalgae survey transects 1-3, for the Steilacoom Dock Ferry Improvements.

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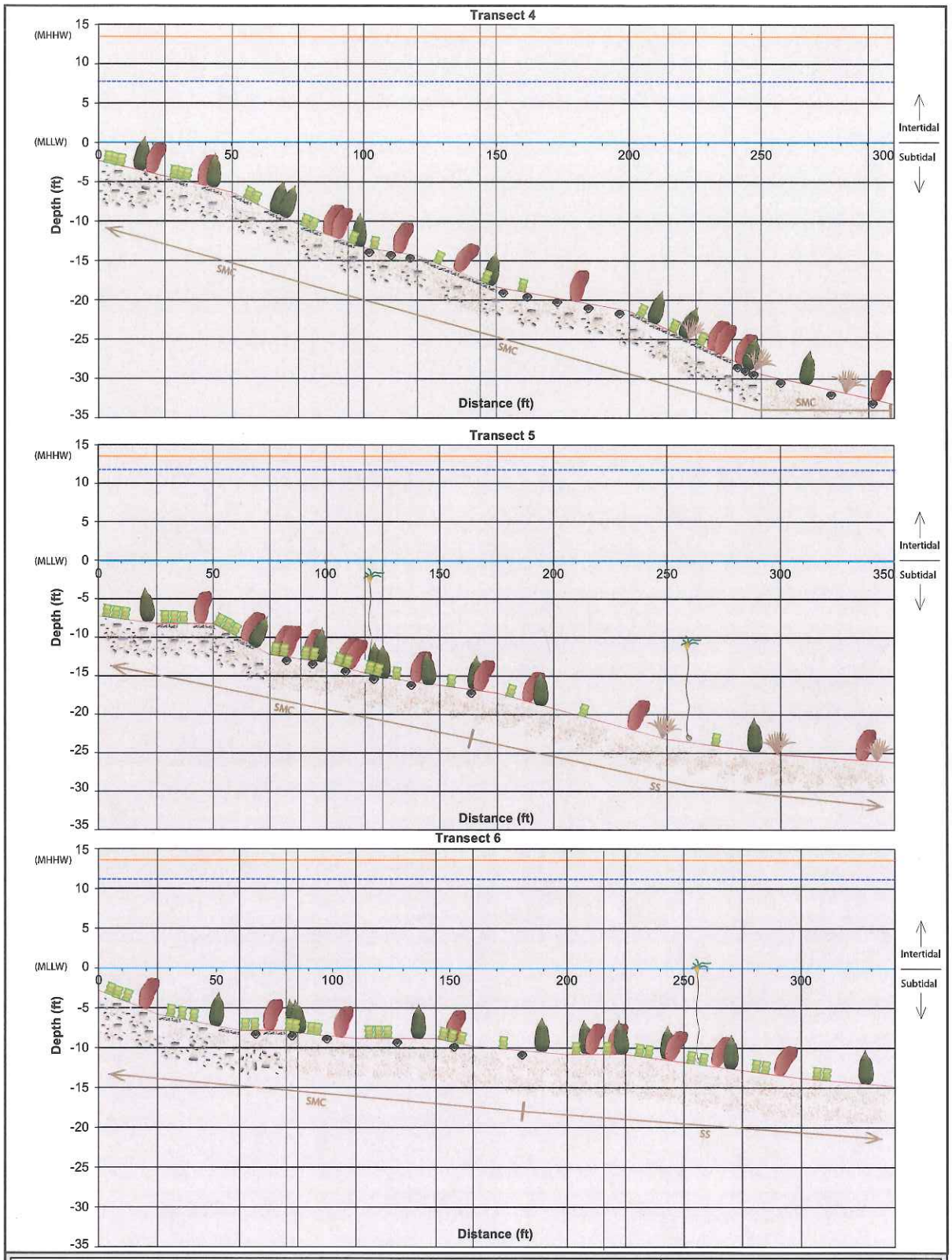

Legend

- Turkish towel (red kelp) (Chondracanthus sp.)
- Ulva
- Shell
- Sand
- Course mix
- Sugar kelp (brown kelp) (Laminaria sp.)
- Sacrodiotheca sp.
- Bull kelp (Nereocystis sp.)
- Water surface elevation adjusted for tide height
- Mean higher high water (MHHW)
- Mean lower low water (MLLW)
- SMC Subtidal mixed coarse
- SS Subtidal sand

Note: Qualitative kelp density indicated by the number of kelp icons per unit distance. No quantitative distribution data was collected.

Figure 4. Results of the eelgrass and macroalgae survey transects 4-6, for the Steilacoom Dock Ferry Improvements.

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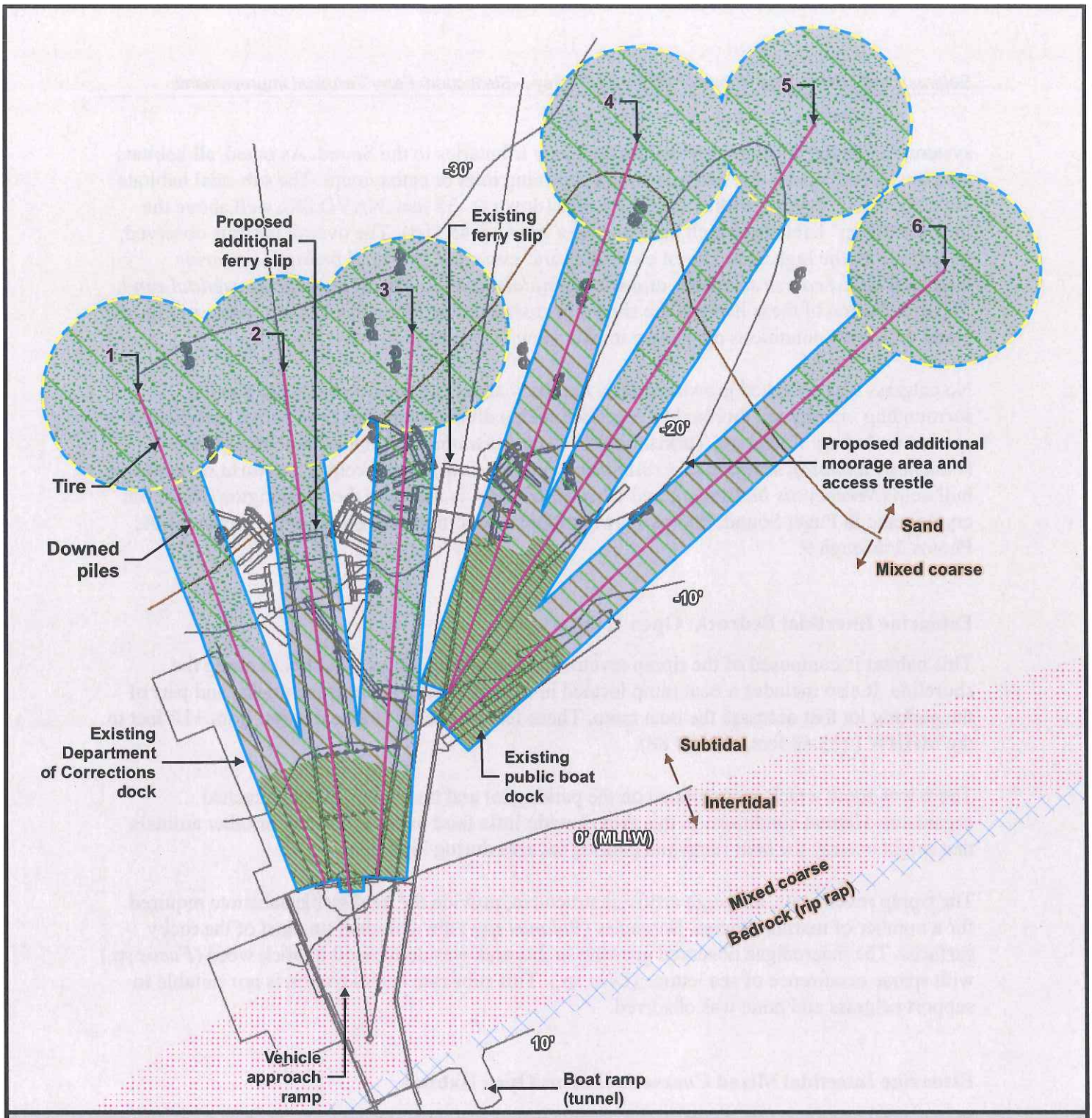

Legend

- Eelgrass and macroalgae survey transect
- Additional search area
- Range of visibility
- Project plans

Ground survey extent

- No eelgrass or macroalgae
- Fucus sp. and sparse ulva growing on rip rap
- Dense Ulva and moderate red and brown algae
- Sparse Ulva and dense red and brown algae
- Sparse Ulva and red and brown algae, with sparse Enteromorpha sp.

Note: All elevations are based on NAVD88 coordinates.

Figure 5. Results of the eelgrass and macroalgae survey, plan view for the Steilacoom Ferry Terminal Improvements.

N

0 35 70 140 Feet

HERRERA ENVIRONMENTAL CONSULTANTS

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system, due to the dilution provided by the many tributaries to the Sound. As noted, all habitats are considered "open" due to the lack of a confining inlet or embayment. The sub-tidal habitats are considered shallow, within the survey area (down to -35 feet, NAVD 88), well above the limit for "deep" habitats (which have an upper limit of -45 feet). The overall habitats observed, in order from the highest to lowest elevations are: *estuarine intertidal bedrock, estuarine intertidal mixed coarse sediment, estuarine subtidal mixed coarse,* and *estuarine subtidal sand.* The distribution of these habitats are shown in cross-section, along the transect routes in Figures 3 and 4. Habitat conditions are shown in plan view in Figure 5.

No eelgrass was observed growing within the study area. The entire project site and the surrounding vicinity are thoroughly vegetated with a diverse community of native macroalgae species including: *Fucus* sp., Turkish towel (*Chondracanthus* sp.), blue-branching seaweed (*Fauchea laciniata*), seaweed (*Sacrodiotheca gaudichaudii*), sugar kelp (*Laminaria saccharina*), bull kelp (*Nereocystis luetkeana*); and *Ulva* sp. *Ulva* sp. is native to the Washington Coast, but cryptogenic in Puget Sound. Photos showing typical conditions are found in the Appendix A, Photos 2 through 9.

Estuarine Intertidal Bedrock: Open Habitat

This habitat is composed of the riprap revetments supporting the railroad tracks along the shoreline. It also includes a boat ramp located in a tunnel under the railroad tracks, and part of the parking lot that accesses the boat ramp. These features occur at an elevation from +10 feet to the MHHW (+13.48 feet, NAVD 88).

There was some wrack accumulated on the parking lot and boat ramp, but no attached organisms. Habitat conditions in this area provide little food or cover for fish or other animals that might occupy the boat ramp and parking lot area during high tides.

The riprap revetments, although artificial structures, provide the hard stable substrate required for a number of marine species. Barnacles (*Balanus spp.)* are abundant on most of the rocky surfaces. The macroalgae observed growing in this area was dominated by rock weed (*Fucus* sp.) with sparse occurrence of sea lettuce (*Ulva* sp.). This substrate and elevation is not suitable to support eelgrass and none was observed.

Estuarine Intertidal Mixed Coarse Sediment: Open Habitat

This habitat is composed of areas below the riprap revetment and boat ramp, down to an elevation of 0 feet (MLLW, NAVD 88). As described before, the substrate is dominated by rock, cobbles and gravels, tightly packed together such that individual pieces rarely moved due to water movements or foot traffic (i.e., the beach substrate is armored). This is likely the result of strong wave energy and long-shore currents that result from the revetments. These forces have removed all mobile sediment, leaving behind only the most durable features. The extensive revetment (miles in both directions), also limits the recruitment of sediment from the upland, and

as such, no new sediment is transported into the site to replenish the sediments that are removed by scour.

The lower portions of this habitat supported growth of sea lettuce (*Ulva* sp.), growing attached to gravels. Macroalgae coverage in the upper portions of this habitat was very sparse. The substrate and elevation of this area is not suitable to support eelgrass and none was observed.

Estuarine Sub-tidal Mixed-Coarse: Open Shallow Habitat

This habitat type is the most common and widely distributed habitat observed during the underwater/transect-based surveys. This habitat occurs from an elevation of 0 feet (MLLW, NAVD 88) down to an elevation of -35 feet. The substrate is composed of sand mixed with gravels and shells. It is intermixed with areas predominantly composed of sand (see description in the section below).

The upper portions of this habitat supported abundant growth of sea lettuce (*Ulva* sp.) attached to gravels, with more occasional occurrence of Turkish towel (*Chondracanthus* sp.), blue-branching seaweed (*Fauchea laciniata*), and occasional sugar kelp (*Laminaria saccharina*). Animals observed in this area include: hermit crab (*Pagurus beringanus*), kelp crab (*Pugettia gracilis*), and stars (*Piaster* sp.).

As expected, with increasing depth, the abundance of sea lettuce decreased and the abundance of brown and red algae increased. Sugar kelp is abundant between a depth of -5 feet to -20 feet, and less abundant, but still common out to the lower limits of the survey area (-35 feet). In the area between -5 to -20 feet, sugar kelp is mixed with low density of sea lettuce and low to medium density of Turkish towel, succulent seaweed (*Sacrodiotheca gaudichaudii*), and occasional bull kelp (*Nereocystis luetkeana*). Animal species observed in this area include: sea pens (*Ptilosarcus gurneyi*), alabaster nudibranch (*Dirona albolineata*), Lewis' moon snail (*Polynices lewisii*), rough piddock (*Zirfaea pilsbryi*), hermit crab, and slender cancer crab (*Cancer gracilis*).

Estuarine Subtidal Sand: Open Shallow Habitat

This habitat occurs from the lower limits of the survey transects (-35 feet) up to an elevation of -12 feet, above which the *mixed coarse* habitat type is dominant. It is most common in the vicinity of transects 4 through 6. The *subtidal sand* habitat type extends 50 feet or more off-shore from the outer extent of the survey transects, based on reconnaissance surveys conducted in the vicinity of the deep ends of the survey transects (See Figure 5). Some *subtidal mixed coarse* habitat is found intermittently within the predominantly *subtidal sand* habitat type.

The lower portions of this habitat support sparse growth of sea lettuce, succulent seaweed, and occasional patches of bull kelp, Turkish towel, and sugar kelp. Animals observed in these areas include: sea cucumber (*Parastichopus* sp.), sunflower star (*Pycnopodia helianthoides*), leather star (*Dermasterias imbricate*), and tube anemone (*Pachycerianthus fimbriatus*).

Pilings and Other Submerged Hard Structures

The piles which support the existing piers, docks, and other ferry-slip structures provide the stable artificial substrate used by many marine animals. These structures had the highest concentrations of invertebrates and vertebrate fish species within the survey area. Typical invertebrate species observed during the survey include: acorn barnacles (*Balanus nubilis*), kelp crab, Pacific blue mussel (*Mytilus trossulus*), and plumose anemone (*Metridium giganteum*). The vertebrate animals observed include: pile perch (*Phacochilus vacca*), shiner perch (*Cymatogaster aggregata*), and tube-snout (*Auluorynchus flavidus*).

Most of the piles occur in a vertical/structurally functional configuration. In a few locations (i.e., at a depth of 28 feet on transect 1), abandoned piles are lying on the seabed, providing artificial habitat for a similar high density and diversity of animal life. Other debris (tires, concrete debris) that was encountered during the surveys was similarly colonized. Macroalgae was both attached to these structures, pilings, and also accumulated along the margins of the pilings, presumably due to the piles acting as wracks for drifting algae.

Survey Conclusions and Recommendations.

No eelgrass was observed growing within the study area. The entire project site and the surrounding vicinity are thoroughly vegetated with a diverse community of macroalgae species, primarily *Ulva* sp.

Macroalgae species provide habitat for a wide number of marine fish and invertebrates. Habitat features include food, cover and shelter, and substrate for the attachment and protection of eggs and juveniles.

The macroalgae communities observed during the surveys are composed of relatively common and wide-spread species, both in the vicinity of the project site, as well as in Puget Sound at large.

Based on the WDFW survey protocols, the subsequent steps in determining appropriate habitat protections are:

- Contact WDFW to describe habitat conditions and proposed project elements, as well as avoidance and minimization measures, to determine whether mitigation and/or additional surveys are required,
- If required by WDFW, conduct additional surveys (advanced surveys) to determine quantitative distribution of macroalgae species.
- Adjust project plans and/or implement appropriate mitigation based on discussions with WDFW.

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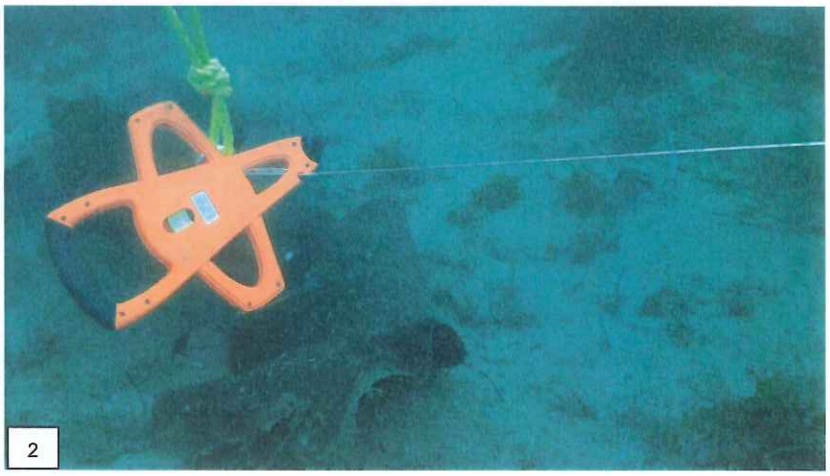
APPENDIX A

Photographic Documentation

Steilacoom Ferry Terminal Improvements
Photographic Log

Photo Number	Photo Description
1	Typical visibility, Secchi at 10 feet
2	Deep end of transect 2, showing sand substrate and typical vegetation
3	Gravels and shells dominate mixed coarse sediment type
4	Shell substrate
5	Dense *Ulva* sp. near shallow end of transect 6
6	Mixed kelp species (*Ulva sp., Laminaria sp., Chondracanthus, sp.*), mid transect 5
7	*Ulva* sp. on broken shells
8	Pile Perch, sunflower star, plumose anemone, near piers.
9	Blue Branching Seaweed, occurs infrequently in shallow ends of transects

1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